SPORTS & EXERCISE MASSAGE

2nd EDITION

Sandy Fritz

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2nd EDITION

COMPREHENSIVE CARE IN ATHLETICS, FITNESS & REHABILITATION

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With more than 600 illustrations

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This textbook is dedicated to Charlie Batch.

Charlie has been my client since he began his career as a quarterback in the National Football League. He has taught me many things–many related to working with athletes; but more importantly, he has taught me to believe in the power of commitment. I have taught him many things as well, such as taking care of himself, the importance of massage for prolonging an athletic career, but more importantly, about persistence, commitment, and loyalty. He has opened doors for many massage therapists through his relationship with me. Fifteen years ago I told him I would do my best to follow him through his career, and partly due to massage, he is still playing professional football. He is committed to giving back to kids where he grew up and works tirelessly to provide an example to them about what you can be if you are educated and determined to succeed. I am proud of him and all he has accomplished in the past and as his future unfolds.

Preface

I am excited to present the second edition of this comprehensive textbook, which targets therapeutic massage for the sports and exercise community. As massage therapy evolves, there is a trend toward specialization based on career interests and specific populations. The three main career tracks in massage are wellness/spa, medical/clinical, and sports and fitness. The sports and fitness population is increasing its demand for highly trained massage therapists to address the specific needs of exercise and training protocols, including recovery and injury prevention. Massage is quickly becoming a supportive approach for addressing sports injuries. The information and skills involved in achieving these outcomes is over and above entry level training and conforms with the concept of a massage therapy specialty.

This textbook responds to the specific massage needs of professional, amateur, recreational, and rehabilitative sports and exercise participants. This is a broad scope of people with a variety of outcomes for massage, but they are all connected by their desire for efficient movement. Western society is currently overwhelmed with lifestyle-related health concerns, such as weight management and cardiovascular disease. Exercise in not an option but a necessity in regaining and maintaining one's health. Physical exercise places demands on the body that, although beneficial, can result in discomfort. Delayed onset muscle soreness, which occurs when a new activity is undertaken or the intensity in the existing program is increased, is an example. As I write this Preface in the spring of 2012, I am stiff and sore from raking the yard and getting my gardens ready. Massage can help with this aching and stiffness, making compliance with the exercise programs more likely. This is very important.

Providing massage to the competing athlete–professional, amateur, or recreational–is an entirely different process than working with those striving to achieve fitness and to support healthy lifestyles. Athletes are all about performance, which places many more demands on the body than exercise for fitness. Recovery and injury prevention in this population is essential, as is knowing how to provide massage as part of injury treatment. With competitive athletes, it is not *if* they will get injured, but rather *when* and *how severely.*

Physical rehabilitation involves movement-related activity. General aerobic conditioning is necessary for cardiac rehabilitation. Rehabilitation is required for surgical procedures for joint injury or replacement. If surgery is involved, scar tissue management is important. Advancements in medical treatment are allowing athletes to compete longer at a higher level and letting the rest of us age while remaining active and productive without the pain and limitation of arthritic joints. If a person has experienced physical trauma, such as a car accident or a football injury, the healing process in general, as well as the specifically targeted rehabilitation by the medical team, can be supported by the well-trained massage therapist.

That's what this book is about.

The textbook is divided into four units. Unit One is about the world of the athlete and the background information needed to understand movement and fitness. Unit Two is a review of massage in relationship to this population, specific skills needed to address the conditions these people experience, and a comprehensive and detailed protocol as a foundation for working with this population. Unit Three is about injury and treatment regimens, including specific massage protocols. There are detailed video demonstrations of methods on the Evolve site that accompany this. Unit Four is unique in that it provides detailed Case Studies for understanding how all information in the book fits together in a goal-oriented treatment process.

The Workbook sections at the end of each chapter are not your typical fill-in-the-blank or labeling activities. The premise is that this is an advanced-level study, and therefore the questions require the reader to manipulate the information from the chapter as well as integrate that information with the content of the entire book. It would be prudent to spend adequate time completing these activities. They are not easy, and that's appropriate for this level of study.

Real-life stories are spread throughout the text to maintain a focus on the people, and not just the sport they play or the condition they have. These stories help reinforce this broader base of understanding. I personally have lived these stories and have learned from every one of them. They are called *In My Experience* boxes.

In addition to the video demonstrations, there is great additional support on the Evolve website that accompanies this book, such as news articles relating to hot topics in the sports industry and further resources to help in a sports massage practice or with clients.

The textbook, the Evolve site, and the instructor support material (Instructor's Manual and Test Bank) make this package the most comprehensive educational resource available for massage application, targeting athletes and those in fitness and rehabilitation exercise programs.

The textbook is meant to be a teaching tool. In this advanced book, I took a little liberty in writing it in the style in which I teach my own students. It is possible to self-study the text and increase your skills and understanding of how massage supports the sports and fitness communities. The text is designed to be used in a formal classroom study with a skilled instructing staff. Chapter 1 talks about this in regard to how such a course would be presented. Those that teach (like me) need to go the extra mile to understand the content and admit when they don't. It is impossible to know it all. It is true that some of the content in the text is based on my experience working with this population. I would expect that those teaching this material would respect that experience and then expand on the content of the textbook based on their own expertise with this population. The book does not have all the answers and requires the development of clinical reasoning skills. This means that the information can be challenged (make sure to justify the position taken) and even more importantly, it can evolve into more effective massage application.

Finally, on a personal note, I love the massage profession. It has been my career path since the late 1970s. I have worked with thousands of clients (a lot of them athletes), taught massage since 1984, and raised three children with massage-related activity as my sole source of income. It has been a long, sometimes hard, but worthwhile journey. There are not many massage therapists that have endured this long, and I intend to stick around for many more years and believe I owe it to the profession to give back a measure of what I have received. But I am 60 years old and believe that it will take up to 10 years to prepare the next generation of massage therapists to take over. It just takes that much time to develop the necessary experience to be proficient in anything, including massage therapy. My youngest son, Luke, who appears in some of the photos in the textbook, is now a massage therapist working with professional athletes and is becoming part of the next generation of massage educators and leaders.

Massage in general, and this population specifically, has been a blessing for me. I did not seek out professional athletes as clients but ended up with a bunch of them. They are a demanding group, and I love it. I have been privileged to work with some of the greatest athletes of our time, and their support for massage will make an impact on future generations. It is important to return those blessings to those who will carry on–the future athletes, those striving to regain their physical fitness, and the massage therapists dedicated enough to take care of them. My contribution is this textbook, the students that I am able to personally teach, and the hope that there will be those who commit to excellence and evolve beyond me in skill, knowledge, and understanding.

Sandy Fritz
April 2012

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Writing a textbook is a team effort. Many thanks to my team:

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Contents

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UNIT ONE

Theory and Application of Exercise and Athletic Performance

CHAPTER

1 The World of Sports and Exercise Massage

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1 Identify personal motivation for wanting to work with this population.
2 List previous knowledge and experience needed to apply the information in the textbook.
3 Identify teachers, mentors, and resources for self-study in this career area.
4 Use this textbook for self- and classroom study.
5 Explain realistic career expectations.
6 List the complexities of working with this population.
7 Explain and list challenges and rewards for working with this population.

KEY TERMS

Mentor
Physiologic
Structural
Outcome-Based
Psychological
Teacher

OUTLINE

DETERMINING CAREER MOTIVATION

Objective

1. Identify personal motivation for wanting to work with this population.

This text is written with many objectives. It should provide information to answer some of the questions listed in Box 1-1, at least those about exercise, athletes, and what it takes to work with this group of clients. However, it cannot explain why you want to work in this realm. No textbook or teacher can answer that question for you. I am still figuring it out for myself. Many years of working with hundreds of athletes (for real), as well as with thousands of "ordinary" people, have blessed me with accumulated therapeutic massage experience, most of which has been learned independently of formal classroom training. One of the main purposes of this text is to consolidate this experience so that it won't take others over 30 years to become proficient at this type of massage application.

This text targets the sports/fitness/physical rehabilitation client. These clients range from individuals involved in physical rehabilitation requiring exercise programs, including cardiovascular and cardiorespiratory rehabilitation, and physical therapy for orthopedic injury; persons incorporating exercise as part of a comprehensive fitness and wellness program, including weight management; and recreational and competitive athletes, both amateur and professional. Return to the questions in Box 1-1 and really look at them. What is your motivation for wanting to learn how to use therapeutic massage to serve this population?

The sports, fitness, and rehabilitation communities are using massage at an increased rate; however, many misconceptions, much inaccurate information, and even dangerous methods such as extreme stretching and invasive inflammatory "deep tissue" massage are being taught and practiced as sports massage. Complaints from those who have received ineffective massage that was not worth the time and money are common. This is unacceptable. Members of the profession have the responsibility to provide safe and effective massage care for all populations.

WHAT YOU NEED TO KNOW

Objective

2. List previous knowledge and experience needed to apply the information in the textbook.

BOX 1-1 Determining Motivation

- What is it about working with sports and fitness issues that requires more learning and topic-specific textbooks?
- What do I need to know to effectively work with athletes?
- Why do I want to work with athletes?
- Am I committed to putting as much time into my training and skills as athletes put into their training and skills?

These interesting questions are relevant for any massage therapist wishing to specialize and target his or her career toward a specific population. Substitute chronic illness, hospice, prenatal and postnatal, elderly, infants, and so on, and the questions would be the same. It is important to identify the motivation for any course of study, especially at an advanced level.

Since the first edition of this book was published in 2005, advances have been made in our understanding of the effects of massage, the importance of exercise, and the physical and physiologic demands on athletes. Research has exposed many myths about massage and components of sports training. These myths will be discussed and more current and accurate information presented. As a massage therapist, especially when working with clients who place excessive demands on their bodies, it is absolutely essential that lifelong learning is a priority, as is remaining current with research evidence.

It is assumed that the reader is proficient in the following areas of knowledge:

- Anatomy
- Physiology
- Pathology
- Biomechanics
- Kinesiology

In the first edition of this textbook, review content for these areas was included because it was difficult to determine the baseline education of the reader. Now, as massage therapy entry level education has begun to be standardized and more resource material is available for your review, this content has been reduced but does appear on the Evolve website that accompanies this book. You should already know about anatomy and physiology, sanitation, draping, massage manipulations, and techniques such as body mechanics, assessment, charting, and treatment plan development, as well as ethics and professionalism. These foundational skills and knowledge are even more important when specializing in a target population.

This information should have been presented in your initial massage therapy education. However, we all need ongoing review and updates. It is strongly suggested that you obtain the most current edition of the following books and online courses, which provide the foundation necessary to learn the material in this book:

Fritz S: *Mosby's fundamentals of therapeutic massage*, ed 5, St Louis, 2012, Mosby.

Fritz S: *Mosby's essential science for therapeutic massage: anatomy, physiology, biomechanics, and pathology*, ed 4, St Louis, 2012, Mosby.

Mosby's online course to accompany *Mosby's essential science for therapeutic massage: anatomy, physiology, biomechanics, and pathology*, ed 4, St Louis, 2012, Mosby.

These two textbooks and the online course will provide you with the most current information about massage therapy and an excellent review of all the necessary sciences. The online course that accompanies the *Essential Sciences* text is interactive, comprehensive, and fun.

For further study on bones, joints, and muscles and how they function together, take advantage of Joe Muscolino's texts:

Muscolino JE: *Know the body: muscle, bone, and palpation essentials*, St Louis, 2012, Mosby.

Muscolino JE: *The muscular system manual: the skeletal muscles of the human body*, St Louis, 2010, Mosby.

Muscolino JE: *The muscle and bone palpation manual with trigger points, referral patterns and stretching*, St Louis, 2009, Mosby.

Muscolino JE: *Kinesiology: the skeletal system and muscle function*, St Louis, 2011, Mosby.

This textbook is an excellent resource:

Neumann D: *Kinesiology of the musculoskeletal system: foundations for physical rehabilitation*, ed 2, St Louis, 2010, Mosby.

The following two books are comprehensive and will provide the opportunity to expand on the information in this textbook:

Chaitow L, DeLany J: *Clinical application of neuromuscular techniques*, vol 1, the upper body, ed 2, Edinburgh, 2008, Churchill Livingstone.

Chaitow L, DeLany J: *Clinical application of neuromuscular techniques*, vol 2, the lower body, ed 2, Edinburgh, 2011, Churchill Livingstone.

For updated information on the importance of fascia, read the following:

Myers T: *Anatomy trains: myofascial meridians for manual and movement therapists*, ed 2, St Louis, 2009, Churchill Livingstone.

Schleip R, Findley TW, Chaitow L, et al: *Fascia: the tensional network of the human body: the science and clinical applications in manual and movement therapy*, St Louis, 2013, Churchill Livingstone.

TEACHERS AND MENTORS

Objective

3. Identify teachers, mentors, and resources for self-study in this career area.

This textbook is designed to be a teacher, and I hope that it can be somewhat like a mentor. A **teacher** presents new information and skills and refines and targets previous learning. A **mentor** has professional experience, has achieved individual excellence, and wants to help others achieve their own success.

It is important for you to confirm that your teachers and mentors provide you with information and skills for you to excel, and that they are qualified to teach you. I have been a massage therapist for over 30 years and a school owner and educator for over 25 years, teaching more than 4000 students. I have written many textbooks and have created an online science course. My experience with professional athletes is extensive, including an educational partnership with the Detroit Lions organization for 14 years, as well as with individual players from multiple NFL teams, NBA players. and PGA golfers. I have worked with famous athletes and amateurs. I still work with professional athletes, and some of them have been my clients for over 15 years (Box 1-2).

I present these qualifications to support my role for you as a teacher and a mentor.

I have been fortunate in my career to have great teachers and mentors. One of these was Dr. David Gurevich—Russian physician, physical medicine specialist, soccer player, and tango dancer. It was an honor to learn from him for 8 years. He taught me a practical and innovative application of massage, which he learned as a battlefield surgeon and a long-time specialist in physical and rehabilitative medicine in Russia.

Dr. Leon Chaitow is also my teacher and mentor. His review and consolidation of research supporting soft tissue methods provide much of the foundation material for this book. And of course, every client I have worked with and every student I have taught has served as both a teacher and a mentor (Box 1-3).

Athletes provide great learning experiences because, as a group, they present many different and complex problems that must be solved to help them reach and maintain their desired goals.

The world of athletics is culturally diverse and rich in cultural experience and has no room for prejudice. Other than the military, I don't think that multicultural interaction toward a common goal is displayed any better than in team sports. Most competing amateur and professional athletes are young, ranging from adolescence to 40 years of age. Advances in medical care have extended the playing age. As a 60 year–plus Mom-type person, I have stayed current and tolerant through these interactions.

The hard part of this work is learning how to be a professional in the sports/fitness/rehabilitation environment. You cannot be a groupie—no asking for autographs and no type of interaction with the athletes other than ultimate professionalism. A professional gender-neutral appearance is essential. Ethical conduct, especially as related to confidentiality, is mandatory. For example, I have worked with athletes for whom a specific injury was not disclosed or completely explained by the team to protect the athlete from being targeted by the opposing team during play. Most professional athletes have competed with injuries, and if the opposition knows the details, it is possible that they will target the defensive play to take advantage of the vulnerable area of the player. Although athletes do not typically intend to harm each other, it is common for reinjury to occur as part of the defensive play. Also, there is a distinct difference between an athlete's professional life and his or her personal life. Most have families and are in committed relationships. Spouses have to constantly put up with groupies, and their private life is often invaded by fans asking for autographs. Athletes and their families should not endure the same demands from their massage therapist.

An ongoing question I ask myself as a teacher and a mentor is how I can instill the desire for excellence and awareness and acceptance of the time, practice, and persistence required to work with these types of issues and clients. I hope this textbook becomes part of the answer to my question. It is necessary for all massage therapists to conduct themselves with integrity, and those in a position of authority need to remember that they must be a quality example of ethical behavior and professional conduct.

So, here is the reality: There is no such thing as "sports massage"—only appropriate massage as applied for each client. Whether your client is a runner, bowler, swimmer, surfer, or golfer; is a baseball, basketball, football, or soccer player; or has just completed a treadmill stress test—this is an important factor to consider as part of the treatment plan. This text also provides skill development for treating the general population: any client can sprain an ankle, develop post-exercise soreness, or have a headache or backache. Do not limit use of this text just to those considered athletes. We are all athletes in some form anyway.

HOW THIS TEXTBOOK IS DESIGNED

Objective

4. Use this textbook for self- and classroom study.

This text is presented as an integrated **outcome-based** approach to massage. It is not based on specific massage and bodywork types (Swedish massage, reflexology, shiatsu, deep tissue massage, and the seemingly never-ending list of others), because specific styles of massage do not support individual applications based on client goals. Instead, we will discuss the application of mechanical force to stimulate the neuroendocrine/neuromuscular systems, to affect myofascial structure and function, to assist fluid movement, and to support homeostasis. The content should prepare the massage professional to interact effectively with various treatment, training, and rehabilitation protocols of the sports and fitness world. General lifestyle requirements such as sleep, nutrition, and stress management are an important part of the athlete's world. These will be addressed as part of the knowledge foundation

BOX 1-2 Stories from the Field

The stories I have chosen to tell are about those with whom I have spent the most time and therefore know the best. The stories are written from my point of view and with their permission.

I first met Charlie at the start of the educational programs with the Detroit Lions that began in 1998/99. He had been drafted that previous year, and through various circumstances, he had been the starting quarterback as a rookie. I soon learned that rookies are just kids, and being the quarterback on an NFL team put this kid in the spotlight. During his rookie year, he had performed extremely well. He had the opportunity to play with Hall of Fame running back Barry Sanders and is the first to acknowledge that part of his rookie success can be attributed to having Barry on the team. I met Charlie the next year, when the team was in transition, because this was the year that Barry Sanders retired. Especially with team sports, a change like this is especially difficult for a young player.

The first time I worked with Charlie, he had a kink in his neck. I had no idea who he was, and I was swamped with a bunch of other players with aches and pains. I do remember thinking how young he looked as I applied compression to the scalenes. This was the beginning of a long, involved professional relationship that has spanned many years.

Various circumstances over the years resulted in Charlie playing with a series of painful injuries, and massage was an ongoing part of how he continued to play. At the same time, the team was undergoing many organizational changes. Stress levels were high for everyone, which added to the typical strain of the ongoing football seasons. Accumulated injuries affected his ability to perform at his peak. In 2002, he undertook a major commitment to rehabilitation and spent months at the IMG training facility in Bradenton, Florida. I have experienced only a few persons in my long massage career who worked so hard to rebuild their bodies. In 2002, Charlie left the Detroit Lions and joined the Pittsburgh Steelers. He was in the best physical condition I had ever seen him, and he had matured from a kid to a man. For a major part of his career in Detroit, he had been the starting quarterback. In Pittsburgh, his initial role on the team was third quarterback. He had to adjust professionally and personally to the status change, knowing that he was in the best playing shape of his life but likely would not see playing time, and in fact was last in line. He made the adjustment from top dog to background support with grace and maturity.

An old knee injury, likely from when he was in high school or college, resulted in a loose body in his knee, and arthroscopic surgery was performed less than 3 weeks before the beginning of training camp with his new team. After excellent medical care and 24-hour-a-day massage care, he reported to camp and never missed a practice. That was a long and intense 2 weeks. I performed lymph drainage on his knee and managed compensation hour after hour. He participated and at times endured (with only a bit of grumping) scar tissue management, ice application, and range-of-motion methods. Many funny stories resulted from that intense 2-week period because circumstances were just not typical. We got tired of each other but persisted anyway.

Massage was provided on the massage table but also on the floor, on the sofa, at the computer, and so on. The effort put forth by both of us was incredible.

I wonder what motivates or drives these athletes, so in brief here is the rest of his story.

Charlie grew up with a committed single mom in a tough neighborhood. Charlie excelled in sports and was awarded a scholarship to Eastern Michigan University. He survived a life-threatening illness from toxic chemical exposure at a summer job and managed to return to football, breaking almost every quarterback record at the school. Even more devastating was the tragedy that hit his family next.

In 1996, when Charlie's sister, whom he adored, was walking along his hometown sidewalk with a friend, a gunshot intended for her companion struck her in the head and killed her. She was 17 years old. The shooter never has been brought to justice.

Charlie had left the neighborhood he grew up in for college, before the neighborhood was torn apart by guns, drugs, and a feeling of hopelessness.

When his sister was killed, Charlie told his mother that he was leaving college to come home and provide for the family, but she would not permit it, reminding him that his sister was so proud that he had made it to college and never thought he was a quitter. So he found another way not only to support his family but also the community that he loves. Grief for his sister motivated him to wonder how he could make things better.

Charlie started the Best of the Batch Foundation, which targets low-income families and youth in the Homestead area, where idle hands often can get in trouble. The Foundation has started after-school programs that promote literacy by conducting registration for library cards. But that is only a small part of it. The Foundation also provides scholarships, restores playgrounds, takes kids to the movies, and conducts a popular summer basketball league for boys and girls between the ages of 7 and 18. The league is run through an arm of the Foundation called Project C.H.U.C.K. (Constantly Helping Uplift Community Kids).

I know Charlie shows up at the playground almost every night to talk to the kids or just shoot baskets with them. He also mentors students in one-on-one sessions at Steel Valley High School, reads to them at the library, and simply hangs out with them at the park. I have seen him go from kid to kid asking for a report on grades and conduct. He is tough. If they do not follow the rules, they have to answer to him, but because he is there, the kids know he cares.

I was there when he took 50 elementary students to the circus, and again when he took 50 more students to the movies. The kids who went had made the grades and attendance requirements at school.

By nature, Charlie is quiet and is not one to talk much, including about himself, but he did say during an interview, "If you can save one person, that changes somebody's life. If you can make an impact on somebody's life forever, that's something I want to do."

As of this writing, Charlie is still playing for the Steelers and wants to play football a few more years and is beginning to plan for the next stage of his life—not being a football player. He has role models to whom he looks for guidance, just as he is a role model to the kids with whom he interacts. Because of an unusual set of circumstances, he ended up starting games during the 2010 and 2011 football seasons and, as heard from other players, "the old man has still got it." How did my kid quarterback become the grizzled old veteran? 15+ years in the league, that's how. And massage helped him do that!

BOX 1-3 The Learning Journey

Because this text is not for the beginner, it is valuable to review and reflect on your therapeutic massage learning journey thus far, and to take a realistic inventory of your skills, strengths, and weaknesses as you advance your educational experience. Who are your teachers and mentors? What authors, lecturers, and experts do you admire? What textbooks and reference texts have been beneficial learning tools for you?

needed to be an effective massage practitioner with this type of client.

Although this text is based on theory, it is more focused on practice. It is more about how than why. Practical application comes from years of working in the real world.

Out of necessity—the mother of invention—my students, fellow instructors, and I have figured out applications that you may not have considered but that we have found worked well. Examples related to body mechanics, positioning of the client, and ways of adapting massage applications are provided throughout the textbook. So, please keep an open mind and give these things a try before you judge. I share all of this with you in this first chapter not to brag but to establish that I have been there, done that, made mistakes, and learned something from most of them, and that I will not try to candy-coat this career track.

REALISTIC CAREER EXPECTATIONS

Objectives

5. Explain realistic career expectations.
6. List the complexities of working with this population.
7. Explain and list challenges and rewards for working with this population.

The reality check of building a professional practice with professional athletes is a wake-up call. The truth is that it does not happen very often, and if it does, working with the professional athlete takes a lot of time, travel, and flexibility. The professional sports community is very mobile. You seldom work with this level of athlete for more than a season or two. Boundaries are a big deal. This population can be needy and demanding because of the pressures of performance.

There are not that many professional or Olympic athletes around—fewer than 400 NBA basketball players and fewer than 2500 NFL football players. The numbers for other team sports are somewhere in between. Individual professional athletes such as tennis players, golfers, and bowlers also make up small communities.

Most massage therapists will serve the high school, collegiate, amateur, or semiprofessional athlete and those in rehab or striving to achieve, or maintain, fitness.

A common misconception is that professional athletes make millions and millions of dollars. Only a few are in that category. Most make far less, and amateurs generate no athletic income at all. For those athletes who have limited income, justifying the cost versus the benefit of therapeutic massage is an ongoing issue, or the athlete knows the benefit but cannot afford the cost. Participation in sports, fitness, and rehabilitation costs money, and often lots of it. If a person is going to use massage on a regular basis, the fees need to be manageable.

The immediacy and intensity of the athlete's world demand an integrated body/mind/spirit approach delivered by well-trained massage professionals. Exceptional demands are placed on professionals who work with athletes and those in physical rehabilitation because of the extraordinary circumstances of these individuals. The environment of competitive sports and physical rehabilitation makes for "bigger-than-life" moments. There is the drama of win or lose, the trauma of injury, and the career-determining or even life-or-death situations of surgery and rehabilitation. Working in the world of sports and fitness can be like a roller coaster ride, but with a lot of monotony between the highs and the lows. I have spent many hours waiting for athletes while they received treatment, slept, were interviewed, had meetings, or forgot appointments. Much of this text was written during this time.

The massage therapist not only must be highly skilled in massage applications for each mode of sports or fitness activity but also must have motivation, maturity, reliability, compassion, tenacity, tolerance, stamina, flexibility, commitment, faith, hope, perseverance, humility, self-esteem, little need for personal glory, and the ability to work behind the scenes, to improvise, and, above all else, to think and solve problems.

This book does not have all the answers or even all the information you will need to be a competent massage therapist. It is virtually impossible to describe in depth each and every sport in a single volume. It is your responsibility to learn about the particular sport of each of your clients. However, this text does cover the general movement patterns used in sports and fitness: running, throwing, hitting, kicking, and so forth. Each sport has an ideal performance form; superimposed on this is the form modified and adapted by the individual athlete. You do not need to be able to expertly perform the sport to understand the demands placed on the body.

The individual athlete is the best expert on his or her own situation. If you are going to be able to help individuals with massage, they need to be willing to teach you and you have to be willing to learn. I have spent hours watching a variety of workouts and types of performance training. I can't throw a football very well but have had the quarterbacks show me how to hold the ball and attempt to throw it. This event was the source of lots of laughter but was a great learning experience for me. I can't dribble a basketball very well either but have had basketball players show me how. I have attempted to do strength and conditioning activities, including using the weight machines and performing balance exercises. I have done the warm-ups and even got stuck on a bar attempting to do a stretch that one of the ice skaters was doing and had to be rescued. In all of these endeavors, I looked really silly, but that is okay.

Primarily I am a teacher, so I wrote this text the same way that I teach a class. The approach that I use, and that seems to work best, is an integrated massage style based on valid scientific research coupled with the clinical success of some massage methods still awaiting validation. Research has identified massage benefits in relatively concrete terms based on physiologic mechanisms. An overview of sport-specific research will be presented later.

Basically, massage aims to produce three types of effect on the body systems: **structural**, **physiologic**, and **psychological**. Although these effects are closely related, it is the initial mechanical effects brought about by the manual skills of a massage therapist that lead to the physiologic and psychological effects. Hence, the stroking, squeezing, compression, rubbing, and so forth that are applied to the skin and underlying soft tissues not only produce physical benefits but also trigger physiologic and psychological responses. To achieve the desired balance and results, it is vital to understand the principles behind the various massage techniques. The type and extent of effect on the body depend on the technique itself, the depth to which it is applied, and the area of the body being massaged.

In addition to massage, those involved in sports, fitness, and rehabilitation are often interested in adjunct therapies, including hydrotherapy, aromatherapy, Asian bodywork methods, magnets, and various forms of relaxation/meditation. Unit Two is devoted massage application and the inclusion of adjunct methods to this content. Understanding sports injuries and massage application requires knowledge of tissue susceptibility to trauma and the mechanical forces involved. Unit Three is devoted to this content. The final unit of this text, Unit Four, combines all of the presented information in a series of case studies. By studying the various cases, the reader can integrate the textbook content into practical hands-on applications.

This book is written as a textbook to support the classroom environment. It can also be used to self-teach. Once the information has been assimilated, the text becomes a reference text because it is impossible to remember it all. The chapters are set up in typical textbook form with objectives and outlines. At the end of each chapter is a workbook section. Throughout the text are various commentaries by athletes and those involved in rehabilitation and associated professions, stories to illustrate a lesson or to bring a concept alive, and helpful hints. It is logical to start at the beginning and work sequentially to the end of the text because each chapter builds on the one before it. You can't just read this book. You need to do it, just as athletes do in training. They practice over, and over, and over.

SUMMARY

It is unrealistic to think that the skills needed to professionally work with the complexities of athletes and those seeking fitness or function can be achieved overnight. It is realistic to expect that this is an advanced study requiring 500 or more hours of classroom study and a minimum of 500 clinic hours. Whether you are in a formal course of study or are self-teaching, expect to commit at least 12 to 24 months of concentrated study and practice with 500 to 1000 focused massage sessions to begin to achieve proficiency.

Your commitment to achieving this type of goal is a reflection of your desire for excellence. An athlete commits countless hours to practice and more hours to study to be excellent. A person in physical rehabilitation does the same. Why should they have any less of a commitment from the massage professional that they choose to work with them? Respect is earned, and this text provides part of the resources to achieve this respect. Some of the content in this text will be very technical because it needs to be. There is a lot to know, and this text has done some of the research for you, but it can't do it all—you must learn to do research, interpret data, and generate appropriate treatment plans yourself. Routines absolutely do not work in this arena. You must be able to think, have a purpose, be innovative, and continue to learn. Every client—not just an athlete—deserves this level of professionalism.

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Visit the Evolve website to download and complete the following exercises.

1. List common myths about athletes and then explain the more accurate view. Examples:

   Myth—Most professional athletes are egocentric.
   Accurate—Most athletes are polite and appreciative.
   Myth—Sports massage is a specific modality.
   Accurate—A person's physical activity needs to be considered as part of the treatment plan.

2. List the professional skills needed to work with this population. Examples: stamina and patience.
3. Using this textbook as a resource, develop a realistic list of knowledge and skills for massage application targeting this population. Examples: sport injuries, body mechanics.
4. Review the chapter objectives, and then respond to each one. Repeat each objective.
5. Respond to the following statement: If I were a competing athlete, I would expect my massage therapist to be able to ________.
6. Respond to the following statement: If I were beginning an exercise program, I would expect my massage therapist to be able to ________.
7. Respond to the following statement: If I were beginning a physical rehabilitation program, I would expect my massage therapist to be able to ________.
8. List at least three factors that make this population unique. Example: tendency toward injury.
9. List the professional skills you currently have that would support your proficiency in this area.
10. List the professional skills you need to develop to competently serve this population.

CHAPTER

2 What Is Sports Massage?

OUTLINE

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1. Compare and contrast performance vs. fitness.
2. List the cumulative effects of the strain of peak performance.
3. Identify the experts who work with athletes.
4. List goals and outcomes common for this population.
5. Explain the categories of sports massage.

KEY TERMS

Athlete	Peak Performance	Rehabilitation Massage
Athletic Trainers	Performance	Remedial Massage
Exercise Physiologists	Physical Therapists	Sports Medicine Physicians
Fitness	Post-event Massage	Sports Psychologists
Intercompetition Massage	Promotional or Event Massage	Trauma
Orthopedic Massage	Recovery Massage	Traumatic Injury

PERFORMANCE VS. FITNESS

Objectives

1. Compare and contrast performance vs. fitness.
2. List the cumulative effects of the strain of peak performance.
3. Identify the experts who work with athletes.

Sports massage is targeted to support fitness, help reduce the demands the sport places on the body, increase the ability to perform the sport, and enhance and shorten recovery time.

Who is an athlete? What is fitness? An **athlete** is a person who participates in sports as an amateur or as a professional. Athletes require precise use of their bodies. The athlete trains the nervous system and muscles to perform in a specific way. Often the activity involves repetitive use of one group of muscles more than others, which may result in hypertrophy and changes in strength, movement patterns, connective tissue formation, and compensation patterns in the rest of the body. These factors contribute to the soft tissue difficulties that often develop in athletes.

Fitness is a lifestyle. It is a body/mind/spirit endeavor. One who is fit typically lives a moderate life in a relatively simple way. Characteristics and behaviors enable a person to have the highest quality of life, an overall state of health, and the maximum degree of adaptive capacity to respond to the environment, as determined by genetic predisposition. There is a balance in the human experiences of energy expenditure and recovery, and the ease of this reflects one's fitness.

Fitness and wellness represent relatively the same realm. Fitness is necessary for everyone's wellness, but the physical activity of an athlete goes beyond fitness; it is performance based. **Performance** is the capacity to complete sport-specific activity with skill and competence. For optimal performance, fitness is a prerequisite.

Because of the intense physical activity involved in sports, an athlete may be prone to injury. Massage can be very beneficial for athletes if the professional performing the massage understands the biomechanics required by the sport. If the specific biomechanics are not understood, massage can impair optimal function in the athlete's performance.

When accumulated strain develops for any reason, the fitness/wellness balance is upset. Illness and/or injury can result. For competing athletes, a major strain is the demand of performance. Performance exceeds fitness, requiring increased energy expenditure, which in turn strains adaptive mechanisms and increases recovery time. Fitness must be achieved before performance, and fitness must be supported to endure the ongoing strain of **peak performance**, the highest level of skill execution.

Those who have become deconditioned and are unfit owing to a bad diet, lack of proper exercise, accelerated and multiple life stresses, as well as other lifestyle habits, will eventually experience some sort of illness or injury. This injury/illness can be acute such as a sprained ankle, or of a chronic nature such as chronic fatigue. There seems to be a genetic tendency for a specific breakdown to occur; this can be considered a genetic weak link. It is likely that we all have these weak links, and that strain will affect this area first.

Traumatic injury is injury caused by an unexpected event. Accidents are a common cause of traumatic injury. Rehabilitation following this type of injury often requires physical training. A person may not consider himself or herself an athlete but may suffer the same results of stress common in athletes–post-activity soreness, fatigue, and joint pain, for example. The goal of rehabilitation is function.

PEAK PERFORMANCE IS *NOT* PEAK FITNESS

Contrary to general beliefs, athletes, especially competing athletes, may not be fit or healthy. In fact, they may be quite fragile in their adaptive abilities, both emotional and physical. This means that any demands to adapt, including massage, should be gauged by the athlete's adaptive capacity. Lack of understanding about the demands placed on athletes often leads to inappropriate massage care. The assumption is that these are strong, healthy, robust individuals, but this is not always true. They may be fatigued, injured, in pain, immunosuppressed, or emotionally and physically stressed and truly unable to adapt to one more stimulus in their life. Unless these stressors are recognized and principles of massage therapy are correctly applied, athletes may be subject to inappropriate massage that includes invasive methods that at the very least are fatiguing and, at worst, cause tissue damage.

Athletes experience body fatigue and brain fatigue. Massage can help restore balance if properly applied. If the body is tired, do not task it more; instead, help it rest. If the brain is tired, do not task it more; help it rest. Often the best massage approach is the general nonspecific massage that feels good, calms, and supports sleep. In physiologic terms, this produces parasympathetic dominance in the autonomic nervous system, which supports homeostasis and self-healing.

Experts specializing in the care of athletes are **sports medicine physicians**, **physical therapists**, **athletic trainers**, **exercise physiologists**, and **sports psychologists** (Box 2-1). It is especially important for athletes to work under the direction of these professionals to ensure proper sports form and training protocols. The professional athlete is more likely to have access to these professionals than are recreational and amateur athletes, who may not have the financial resources to hire training personnel and can incur injury because of inappropriate training protocols.

Athletes depend on the effects of training and the resulting neurologic responses for precise functioning, as seen in the firing sequence of certain muscles. This is especially important before competition. Without proper training and experience, it is easy for massage therapists to disorganize neurologic responses if they do not understand the patterns required for efficient functioning in the sport. The effect is temporary, and unless the athlete is going to compete within 24 hours, it is usually not significant. However, if the massage is given just before competition, the results could be devastating. Any type of massage before a competition must be given carefully. If a massage professional plans to work with an athlete on a continuing basis, it is important that the practitioner really knows the athlete and becomes part of the entire training experience.

BOX 2-1 Athletic Training: Profile of Athletic Trainers

DEFINITION OF ATHLETIC TRAINING

Athletic training is practiced by athletic trainers (ATs)—health care professionals who collaborate with physicians to optimize activity and participation of patients and clients across age and care continuums. Athletic training encompasses the prevention, diagnosis, and intervention of emergency, acute, and chronic medical conditions involving impairment, functional limitations, and disabilities. ATs work under the direction of physicians, as prescribed by state licensure statutes.

Athletic trainers are well-known, recognized, qualified health care professionals.

ATs are highly qualified, multi-skilled health care professionals under the allied health professions category as defined by the Health Resources Services Administration (HRSA) and the Department of Health and Human Services (HHS). Athletic trainers are assigned National Provider Identifier (NPI) numbers, and the taxonomy code for athletic trainers is 2255A2300X. Athletic trainers are listed in the Bureau of Labor Statistics in the "professional and related occupations" section.

STATE REGULATION OF ATHLETIC TRAINERS

- Athletic trainers are licensed or otherwise regulated in 47 states; efforts continue to add licensure in Alaska, California, and Hawaii.
- The National Athletic Trainers' Association (NATA) has made ongoing efforts to update obsolete state practice acts that do not

BOX 2-1 Athletic Training: Profile of Athletic Trainers—cont'd

reflect current qualifications and practice of ATs under health care reform.

- Athletic trainers practice under the direction of physicians.
- ATs work under different job titles (wellness manager, physician extender, rehab specialist, etc.).
- ATs relieve widespread and future workforce shortages in primary care support and outpatient rehab professions.
- Academic curriculum and clinical training follow the medical model. Athletic trainers must graduate from an accredited baccalaureate or master's program; 70% of ATs have a master's degree.
- 46 states require ATs to hold the Board of Certification credential of "Athletic Trainer, Certified" (ATC).

ATs improve patient functional and physical outcomes.

- Physicians, hospitals, clinics, and other employers demand ATs for their versatile wellness services and their injury and illness prevention skills.
- Employers demand ATs for their knowledge and skills in manual therapy and similar treatments for musculoskeletal conditions, including back pain.
- ATs commonly supervise and motivate obese clients and patients to safely improve their health and fitness.
- ATs commonly work with patients with asthma, diabetes, heart disease, and other health conditions.

ATs specialize in patient education to prevent injury and reinjury; this reduces rehabilitative and other health care costs.

- Adding ATs to a patient-centered team does not cost the health care system money. Studies demonstrate that the services of ATs save money for employers and improve quality of life for patients.
- For each $1 invested in preventive care, employers gained up to a $7 return on investment, according to two independent studies.
- Results from a nationwide Medical Outcomes Survey demonstrate that care provided by ATs effects a significant change in all outcome variables measured, with the greatest change noted in functional and physical outcomes. The investigation indicates that care provided by ATs generates a positive change in health-related quality of life patient outcomes (*Journal of Rehabilitation Outcomes Measurement* 3:51, 1999).

Many athletic trainers work outside of athletic settings; they provide physical medicine and rehabilitation (PMR) and other services to people of all ages. ATs work in:

- Physician offices as physician extenders, similar to nurses, physician assistants, physical therapists, and other professional clinical personnel
- Rural and urban hospitals, hospital emergency rooms, and urgent and ambulatory care centers
- Clinics with specialties in sports medicine, cardiac rehab, medical fitness, wellness, and physical therapy
- Occupational health departments in commercial settings, which include manufacturing, distribution, and offices to assist with ergonomics
- Police and fire departments and academies, public safety and municipal departments, and branches of the military
- Public and private secondary schools, colleges and universities, and professional and Olympic sports
- Youth leagues and municipal and independently owned youth sports facilities.

Athletic trainers have designated CPT/UB codes.

The Current Procedural Terminology (CPT) codes are athletic training evaluation (97005) and reevaluation (97006); these codes are part of the PMR CPT family of codes. The American Hospital Association established Uniform Billing (UB) codes—or revenue codes—for athletic training in 1999. The term "qualified health care professional," as found in the CPT code book, is a generic term used to define the professional performing the service described by the code. The term "therapist" is not intended to denote any specific practice or specialty field within PMR.

The following educational content standards are required for athletic training degree programs:

- Risk management and injury prevention
- Pathology of injuries and illnesses
- Orthopedic clinical examination and diagnosis
- Medical conditions and disabilities
- Acute care of injuries and illnesses
- Therapeutic modalities
- Conditioning, rehabilitative exercise, and referral
- Pharmacology
- Psychosocial intervention and referral
- Nutritional aspects of injuries and illnesses
- Health care administration.

THE TITLE OF "ATHLETIC TRAINER" AND THE NATIONAL ATHLETIC TRAINERS' ASSOCIATION

The statutory title of "athletic trainer" is a misnomer. Athletic trainers provide medical services to all types of people—not just athletes participating in sports—and do not train people as personal or fitness trainers do. However, *the profession continues to embrace its proud culture and history by retaining the title.* In other countries, "athletic therapist" and "physiotherapist" are similar titles. The AT profession was founded on providing medical services to athletes. NATA represents more than 34,000 members in the United States and internationally, and about 40,000 ATs are practicing nationally. NATA represents students in 325 accredited collegiate academic programs. The athletic training profession began early in the 20th century, and the National Athletic Trainers' Association was established in 1950.

From National Athletic Trainers' Association, 2952 Stemmons Frwy, Suite 200, Dallas, TX 75247; phone: 214.637.6282 • fax: 214.637.2206; Profile of Athletic Trainers, Sept 2011 #1014, available at http://www.nata.org/athletic-training.

For the athlete, his or her psychological state is crucial to performance; often the competition is won in the mind. Massage therapists are not sports psychologists. Remember that. However, athletes look to us for support, continuity, and feedback. Many athletes are very ritualistic about precompetition readiness. If massage has become part of that ritual and the massage professional is inconsistent in maintaining appointment schedules, an athlete's performance outcome can be adversely affected.

GOALS AND OUTCOMES FOR MASSAGE

Objective

4. List goals and outcomes common for this population.

Two of the most important goals of sports massage are to assist the athlete in achieving and maintaining peak performance and to support healing of injuries. Any massage professional should be able to recognize common sports injuries and should refer the athlete to the appropriate medical professional. Once a diagnosis has been made and a rehabilitation plan developed, the massage professional can support the athlete with general massage application and appropriate methods to enhance the healing process.

Many factors contribute to mechanical injury and trauma in sports. **Trauma** is defined as a physical injury or wound sustained in sports and produced by an external or internal force.

Healing mechanisms manifest as an inflammatory response and resolution of that response. Different tissues heal at different rates. For example, skin heals quickly, whereas ligaments heal slowly. Stress can influence healing by slowing the repair process. Sleep and proper nutrition are necessary for proper healing (Table 2-1).

Typically, post-trauma massage is focused on restorative sleep, pain management, and circulation enhancement. During the acute healing phase, contraindications may exist for deep transverse friction, specific myofascial release, and extensive trigger point work. Medication use, particularly analgesics and antiinflammatory drugs for pain, is common, and their effects must be considered. (Refer to the Evolve website accompanying this book for a list of common medications and their possible

TABLE 2-1 Stages of Tissue Healing and Massage Interventions

Stage 1: Acute Inflammatory Reaction	Stage 2: Subacute Repair and Healing	Stage 3: Chronic and Maturation and Remodeling
CHARACTERISTICS		
Vascular changes	Growth of capillary beds into area	Maturation and remodeling of scar
Inflammatory exudates	Collagen formation	Contracture of scar tissue
Clot formation	Granulation tissue; caution necessary	Alignment of collagen along lines of stress forces (tensegrity)
Phagocytosis, neutralization of irritants	Fragile, easily injured tissue	
Early fibroblastic activity		
CLINICAL SIGNS		
Inflammation	Decreased inflammation	Absence of inflammation
Pain before tissue resistance	Pain during tissue resistance	Pain after tissue resistance
MASSAGE INTERVENTION		
Protection	Controlled motion	Return to function
Control and support of effects of inflammation (PRICE)*	Continued development of mobile scar	Increase in strength and alignment of scar tissue
Passive movement midrange	Cautious and controlled soft tissue mobilization of scar tissue along fiber direction toward injury	Cross-fiber friction of scar tissue coupled with directional stroking along lines of tension away from injury
General massage and lymphatic drainage with caution; support of rest with full-body massage (3 to 7 days)	Active and passive, open- and closed-chain range of motion, midrange. Support of healing with full-body massage (14 to 21 days)	Progressive stretching and active and resisted range of motion; full range. Support of rehabilitation activities with full-body massage (3 to 12 months)

*Promoting healing and preventing compensation patterns.

From Fritz S: *Mosby's fundamentals of therapeutic massage*, ed 5, St Louis, 2013, Mosby.

implications for massage.) Pain medication reduces pain perception so that the athlete can continue to perform before healing is complete. This interferes with successful healing. Antiinflammatory drugs may slow the healing process, particularly connective tissue healing (Dahners and Mullis, 2004; Pountos et al., 2012).

ONGOING CARE OF THE ATHLETE

Regular massage allows the body to function with less restriction and accelerates recovery. This is a major focus of this textbook. Most athletes require varying depths of pressure, from light to very deep; therefore, effective body mechanics applied by the massage practitioner is essential. Working with athletes can be very demanding. Their schedules may be erratic, and their bodies change almost daily in response to training, competition, or injury. Athletes can become dependent on massage to maintain their performance level; therefore, commitment by the massage professional is necessary.

TYPES OF SPORTS MASSAGE

Objective

5. Explain the categories of sports massage.

In the past, massage for athletes has been categorized by when it is given and the reasons for the massage. Some of those categories are discussed here. However, if you are using outcome-based goals, these categories become irrelevant. If massage is being used to assist pre-exercise warm-up, it should be focused on those goals, but it is actually incorrect to call it pre-event massage. The same applies to massage focused on supporting the recovery process post competition. Does this really need to be called **post-event massage**? Currently some of the categories of sports massage are pre-event, intercompetition, remedial, medical or orthopedic, recovery, post-event, maintenance, and promotional or event massage.

PRE-EVENT MASSAGE

Pre-event massage is a stimulating, superficial, fast-paced, rhythmic massage that lasts for 10 to 15 minutes. Emphasis is on the muscles used in the sporting event, and the goal is for the athlete to feel that his or her body is "perfect" physically. Avoid uncomfortable techniques. This warm-up massage is given in addition to the physical warm-up; it is not a substitute. This style of massage can be used from 3 days before the event until immediately preceding the event. Massage techniques that require extensive recovery time or are painful are strictly contraindicated. Be very careful of overworking any area. Sports pre-event massage should be general, nonspecific, light, and warming. Gliding, kneading, and compression methods are commonly used. Avoid localized friction, deep heavy strokes, stretching, and joint-specific work. Such a massage should be pain-free! It is suggested that only massage therapists who work on an ongoing basis with a particular athlete should give the athlete a pre-event massage because they know the athlete's training and adaptive processes.

INTERCOMPETITION MASSAGE

Intercompetition massage, given during breaks in the event, concentrates on the muscles being used or those about to be used. Techniques are short, light, and focused. Localized shaking, gliding, and kneading are appropriate. It is suggested that only massage therapists familiar with a particular athlete provide intercompetition massage because they know the athlete's body well enough to assist rather than inhibit adaptive processes.

POST-EVENT RECOVERY MASSAGE

Recovery massage focuses primarily on athletes who want to recover from a strenuous workout or competition when no injury is present. The method used to help an athlete recover from a workout or competition is similar to a generally focused, full-body massage, using any and all methods that support a return to homeostasis.

IN MY EXPERIENCE

Many sports massage events are running or biking competitions such as marathons. For years, the students at my school provided post-event massage at the Detroit Marathon. The students would work with 500 to 1000 athletes from all over the world. Instructing staff would monitor the performance of students, making sure that the massage methods used were appropriate (i.e., helpful and not harmful). This was really important because they would not work with the athlete again. The event was a one-time only interaction. Entry level students actually performed better in this environment because they had not yet learned all the "advance methods" that have potential for harm. It was the advanced students who had to be watched and reminded to maintain a basic approach. These students wanted to address conditions such as trigger points, myofascial binding, and body asymmetry. The main problem was that advanced students had the assessment skills to find the dysfunctional areas, and they had the skills to address these conditions, BUT this was NOT the time or place to apply the methods. After the event, students and instructors discussed the learning process and provided feedback. Often advanced students were frustrated because they had been told to back off or not do something. Their learning was "just because you know how to do something does not mean you should!" By the way, often other schools had students there, or individual massage therapists volunteered. My instructing staff did not have authority over these individuals, and some of the things observed being done to the athletes who had just run miles had huge potential for harm. Event massage is a great activity, BUT those involved in providing massage need to be trained about the importance of help without harm.

Sample Informed Consent Form for Use at Sporting Events

Name of massage practitioner or organization: ______________________________

Sporting event: ______________________________

Date: ______________________________

I have received, read, and understand informational literature concerning the general benefits of massage and the contraindications for massage. I have disclosed to the massage practitioner any condition I have that would be contraindicated for massage. Other than to determine contraindications, I understand that no specific needs assessment will be performed. The qualifications of the massage practitioner and reporting measures for misconduct have been disclosed to me.

I understand that the massage given here is for the purpose of stress reduction. I understand that massage practitioners do not diagnose illness or disease, perform any spinal manipulations, or prescribe any medical treatments. I acknowledge that massage is not a substitute for medical examination or diagnosis, and it is recommended that I see a health care provider for those services.

I understand that an event sports massage is limited to providing a general, nonspecific massage approach using standard massage methods but does not include any methods to address specifically soft tissue structure or function.

Participant's Signature: ____________________ Date: ______________

Participant's Signature: ____________________ Date: ______________

Participant's Signature: ____________________ Date: ______________

FIGURE 2-1 An example of an informed consent form for use at sporting events. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

REMEDIAL/REHABILITATION/MEDICAL/ ORTHOPEDIC MASSAGE

Remedial, rehabilitation, medical, and orthopedic massage are interrelated terms. **Remedial massage**, which is used for minor to moderate injuries, applies all methods presented in this text. In contrast, **rehabilitation massage** is used for more severe injury or as part of the postsurgical intervention plan. If the injury or surgery is related to the bones or joints, it can be considered **orthopedic massage**.

Methods of massage used in rehabilitation vary. Immediately after injury or surgery, relatively nonspecific, general stress reduction, and healing promotion massage techniques are implemented. Attention is given to the entire body while the area of injury or surgery heals. Any immobility, use of crutches, or changes in posture or gait during recovery will likely create compensation patterns. The massage therapist can manage these compensation patterns while the physician, physical therapist, and trainer focus on the injured area. During active rehabilitation, massage can become part of the recovery process, supervised by an appropriately qualified professional, as part of a total treatment plan.

PROMOTIONAL OR EVENT MASSAGE

Promotional or event massage usually is given at events for amateur athletes and can be of the pre-event or post-event massage style. These massages are offered as a public service to provide educational information. It is important to receive written documentation of informed consent from each person receiving a massage at these events (Figure 2-1). One way to do this is to include an informed consent statement with the sign-in sheet and have each participant read and sign it before receiving the massage. A short brochure or pamphlet explaining the benefits, contraindications, and cautions of sports massage is given to each participant. With permission from the organizer of the event, the brochure may include information allowing participating athletes to contact the massage professional at a later date.

The sports event massage lasts about 15 minutes and is quick-paced. This type of public, promotional environment is one situation in which following a sports massage routine is especially important. The use of lubricants is optional; the massage practitioner may choose not to use them because of the risk of an allergic reaction, staining of an athlete's uniform, or other unforeseen events.

It is important to watch for any swelling that may indicate a sprain, strain, or stress fracture and to refer the athlete to the medical tent for immediate evaluation. It also is important to watch for evidence of thermoregulatory disruption, such as hypothermia or hyperthermia, and to refer the individual immediately to the medical tent if these are noted (being careful to avoid using any diagnostic terms or unduly alarming the individual).

If a massage professional is doing promotional work at sports massage events and is working with many unfamiliar athletes, it is best to perform post-event massage, because the effects of any neurologic disorganization caused by the post-event massage are not significant.

No specific connective tissue work, intense stretching, trigger point work, or other invasive work should be included in the massage of an athlete at a sporting event. The massage should be superficial, supportive, and focused mainly on recovery enhancement.

The Sports Massage Team

Often a group of massage professionals and supervised students work as a team at an event. A practitioner who is familiar with the sport usually is the team leader. It is best if all participating massage practitioners follow a similar routine. Remember, each member of a sports massage team represents the entire massage profession. Ethical, professional behavior is essential. This is why permission of the organizer is required if you plan to supply contact information in a brochure that you distribute at such an event.

SUMMARY

This chapter provides an overview and description of what sports massage entails. Also discussed are the various categories of sports massage. Currently, distinctions between the different categories are becoming blurred as the concept of outcome-based massage becomes more fully understood. For example, recovery massage is not presented here as a method; rather, recovery is regarded as the goal of the client and the treatment objective of the therapist.

This chapter also compares performance and fitness and describes the relevance of differences between the two when the outcome for each massage session is planned.

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Visit the Evolve website to download and complete the following exercises.

1 Compare and contrast an athlete's goal for peak performance with that of a person desiring fitness. Example: athletes target specific function; fitness is an overall state of health. Athletes strain their adaptive mechanism; fitness increases adaptive capacity.
2 List contributing factors to adaptive strain. Examples: deconditioning and injury.
3 Give reasons why an athlete can be considered fragile. Example: peak performance predisposes to injury.
4 Give examples of inappropriate massage care for the athlete. Example: athlete is physically tired and the massage is too aggressive.
5 Describe the professional relationship between a massage therapist, an athletic trainer, and a sport psychologist.
6 Explain how massage can assist the athlete in maintaining peak performance and in supporting the healing process.
7 Re-word the following categories of massage as outcome goals: pre-event, intercompetition, recovery, remedial, promotional. Examples: pre-event and increase arterial flow to limbs.

CHAPTER

3 Evidence for Sports Massage Benefit

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1. Understand and describe massage outcomes based on known and theoretical physiologic mechanisms.
2. List and describe four general outcomes for the athlete/fitness and physical rehabilitation population.
3. Explain evidence that indicates that massage is a supportive and safe intervention.
4. Describe the potential for adverse effects from massage application.
5. Adapt massage for athletes based on research evidence.

KEY TERMS

Athlete
Autonomic Nervous System (ANS)
Bending Loading
Bodywork
Combined Loading
Compression Loading
Condition Management
Cortisol
Counterirritation
Dopamine
Dynorphins
Endocannabinoids
Endorphins
Enkephalins
Entrainment
Epinephrine/Adrenaline
Fitness
Fluid Movement
Growth Hormone
Heart Rate Variability (HRV)
Hyperstimulation Analgesia
Massage
Motor Tone
Muscle Tone
Myofascial/Connective Tissue Dysfunction
Nerve Impingement
Neuroendocrine Regulation
Norepinephrine/Noradrenaline
Oxytocin
Palliative Care
Peak Performance
Performance
Performance Enhancement
Reflex Response
Rotation or Torsion Loading
Serotonin
Shear Loading
Tension Loading
Trauma
Vestibular Apparatus

OUTLINE

This chapter will present research evidence for the benefits of massage therapy and will expose the inaccurate information. Massage outcome potential will be explained, and evidence related to benefit presented. First we will look at the evidence for massage in general, which is the foundation of massage for **athletes.** Then we will look at athletic and fitness massage research specifically, as well as evidence for adjunct methods such as hydrotherapy, Kinesio taping, and so forth.

Massage and **bodywork** can be described as a manual application to the body that influences multiple body responses. Research has shown that massage has validity in influencing body structure and function. It is the body's ability to respond and to adapt to the stimuli and mechanical forces applied during massage that achieves the desired benefits.

As massage research continues to evolve, our understanding of why the methods provide benefit continues to increase. In addition, research has validated many of the outcomes that in the past were based on opinion and experience. At the same time, the increase in quality research has exposed misconceptions and has confirmed or refuted previous thinking. Three claims of massage benefit that were considered important when working with athletes–improved circulation, removal of lactic acid, and increased muscle strength after massage–have proved to be false. Research has also changed our understanding of training protocols and concepts of recovery. Our understanding of stretching has improved, as has our ability to determine whether it supports or harms **performance** or has no demonstrable effect. Even the use of ice and cold applications for recovery is under scrutiny. If you want to work effectively with this population and be respected by other professionals who work with athletes, it is necessary to remain current with the research by conducting ongoing searches in databases such as PubMed. This chapter references research primarily from 2005 until today. However, important findings will occur after publication. Some of these findings may even challenge the information presented here. That is okay. A professional remains open to change and to new information. Unfortunately, some aspects of massage delivery and outcome remain in the "it seems to works but we don't know why" category. When this is the situation, it is necessary to be cautious when making claims that cannot be validated. However, just because a scientific explanation cannot be found for the benefit of a particular approach does not mean it should be discarded and not used. Instead, careful examination of the approach should determine the potential for harm. If concern for harm and detriment is minimal, the method can be incorporated into massage with explanation and intention. For example, the anatomy and physiology interphase for energy-based bodywork methods remains elusive. Compassionate intentional presence and near and/or light touch have little potential for harm. Therefore, respectful integration of an energy-based bodywork method into massage application can be justified. To enhance understanding of the overlap of massage/bodywork in the context of sport and **fitness,** a very mechanistic approach is presented in this text. However, it is important to remember that touch is a multidimensional experience, encompassing the body/mind/spirit experience of both client and therapist and the interplay of these three realms in the therapeutic relationship.

Typically, the application of massage and bodywork is described in terms of methods and modalities instead of physiologic response. To better understand the relationship of massage application to scientifically based evidence and to the synergistic interface with sport performance, it is necessary to move beyond the classic description of massage in terms such as effleurage or gliding strokes, petrissage or kneading, compression, friction, vibration, rocking, shaking (oscillation), tapotement or percussion, and joint movement. Bodywork methods such as reflexology, shiatsu, Rolfing, Trager, and so forth also do not describe the mechanisms of benefits and outcomes. Instead, to support future research, massage application needs to be described by the type of mechanical force applied, what stimulus the mechanical force causes to specific receptors, tissue type, or physiologic function. Variations in depth of pressure, drag on the tissue, speed of application, direction of movement, frequency of application, duration of application, and rhythm allow for extensive application options based on treatment plan outcomes.

EVIDENCE FOR MASSAGE

Objective

1. Understand and describe massage outcomes based on known and theoretical physiologic mechanisms.

The terms *bodywork* and *massage* encompass a huge array of methods and philosophies. This chapter does not intend to teach the application of these methods and styles because excellent instructional texts already exist (see the recommended reading list at the end of the book). The focus of this chapter is to describe the underlying theme of all methods and their relationship to sport and fitness goals, measurable outcomes, and physiologic pleasurable mechanisms, as well as research currently being conducted to support these results (Bialosky et al., 2009). Additionally, logical explanations will be presented for some massage results even though research has not totally proved the response correlation. Many different types of scientific research methods are available. Some provide better evidence than others. Also, some evidence is based on clinical experience and expert opinion. The massage therapy profession is now being challenged to function in an evidence-based and informed manner (Box 3-1).

HOW THE BODY RESPONDS TO MASSAGE

Massage effects appear to be determined by a combination of reflexive and mechanical responses to forces

BOX 3-1 Quality of Evidence

The U.S. Preventive Services Task Force (USPSTF) is a multidisciplinary team of primary care experts who work as part of the U.S. Department of Health and Human Services and use a systematic evidence-based approach to focus on preventive services in the clinical setting. The USPSTF specifically bases its recommendations on a balanced look at the benefits and potentials for harm as follows.

The USPSTF grades the quality of overall evidence for a service on a 3-point scale (good, fair, or poor):

- Good: Evidence includes consistent results from well-designed, well-conducted studies in representative populations that directly assess effects on health outcomes.
- Fair: Evidence is sufficient to determine effects on health outcomes, but the strength of the evidence is limited by the number, quality, or consistency of individual studies, generalizability to routine practice, or the indirect nature of the evidence on health outcomes.
- Poor: Evidence is insufficient to assess effects on health outcomes because of limited numbers or power of studies, important flaws in their design or conduct, gaps in the chain of evidence, or lack of information on important health outcomes.

STRENGTH OF RECOMMENDATIONS

The USPSTF grades its recommendations according to one of five classifications (A, B, C, D, I), reflecting the strength of evidence and the magnitude of net benefit (benefit minus harm).

A The USPSTF strongly recommends that clinicians provide [the service] to eligible patients. The USPSTF found good evidence that [the service] improves important health outcomes and concludes that benefits substantially outweigh harms.

B The USPSTF recommends that clinicians provide [the service] to eligible patients. The USPSTF found at least fair evidence that [the service] improves important health outcomes and concludes that benefits outweigh harms.

C The USPSTF makes no recommendation for or against routine provision of [the service]. The USPSTF found at least fair evidence that [the service] can improve health outcomes but concluded that the balance of benefits and harms is too close to justify a general recommendation.

D The USPSTF recommends against routinely providing [the service] to asymptomatic patients. The USPSTF found at least fair evidence that [the service] is ineffective, or that harms outweigh benefits.

I The USPSTF concludes that evidence is insufficient to recommend for or against routinely providing [the service]. Evidence that the [service] is effective is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.

From U.S. Preventive Services Task Force Ratings: *Grade definitions: guide to clinical preventive services,* ed 3, Periodic updates, Rockville, Md, 2000-2003, Agency for Healthcare Research and Quality.

imposed on the body by massage (Box 3-2) (Figures 3-1 and 3-2).

Reflex response results from stimulation of the nervous system to activate feedback loops with the therapeutic intent of adjusting neuromuscular, neurotransmitter, endocrine, or **autonomic nervous system (ANS)** homeostatic mechanisms. For example, light stimulation of the skin usually results in a tickle or itch response and is arousing and stimulating. Our current understanding is that the effects of massage occur through the interrelationships of the central nervous system (CNS) and the peripheral nervous system (and their reflex patterns and multiple pathways), the ANS, and neuroendocrine control. Current consensus is that massage produces effects through a combination of neural, chemical, mechanical, and psychological factors that are important in supporting athletic performance and a fitness lifestyle.

In general terms, the total sensory input to the CNS affects overall tension throughout the body. This is why nonphysical emotional and mental stress can lead to physical symptoms such as headaches, digestive problems, and muscular discomfort. Massage works on many levels, which aim to reduce the symptoms that cause negative sensory input and to increase positive sensory input. This accounts for the general well-being that clients usually feel after treatment.

Massage can affect the nervous system in several ways. It stimulates nerve receptors in the tissues that control tissue tension. On a sensory level, the responses of mechanoreceptors to touch, pressure, warmth, and so on are stimulated. Generally, a reflex effect leads to further relaxation of the tissues and a reduction in pain.

Tension in the soft tissues can cause overactivity in the sympathetic nervous system. By releasing this tension, massage can restore balance and stimulate the parasympathetic system, resulting in a positive effect on minor and sometimes major medical conditions, such as high blood pressure, migraine, insomnia, and digestive disorders.

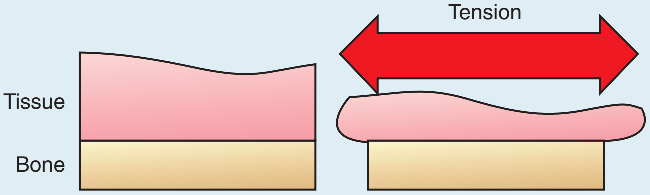
Mechanical responses to massage most often result from tissue deformation and the response of the intricate facial system. Structure can be thought of as anatomy, and function as physiology. Some massage applications can shift structure, primarily through influence on the connective tissues of the body. Massage always has a physiologic result because of required adaptation to the presence of the massage practitioner, the sensory stimulation of various touch receptors, and the client's perception of the therapeutic interaction. Therefore, massage can achieve

BOX 3-2 Mechanical Forces Produced by Massage

Log on to your Evolve website to view videos 3-1 through 3-6 on these mechanical forces produced by massage.

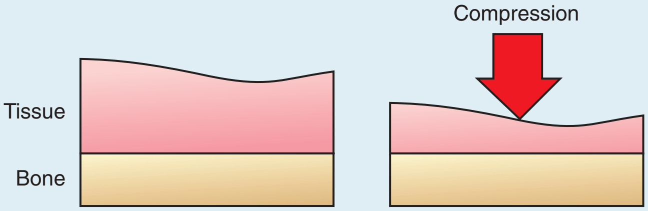
Forces created by massage include tension loading, compression loading, bending loading, shear loading, rotation or torsion loading, and combined loading.

TENSION LOADING



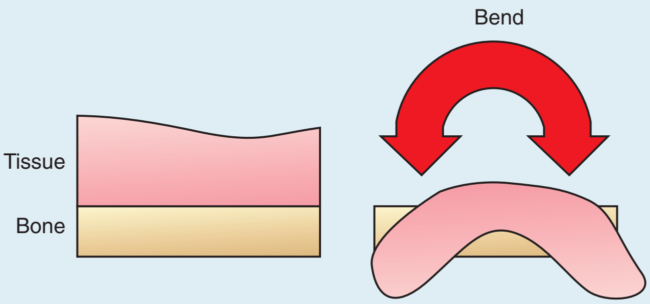
Tissues elongate under tension loading with the intent of lengthening shortened tissues. Tension force is created by methods such as traction, longitudinal stretching, and stroking with tissue drag. Tension forces cause an aggregation of collagen, resulting in thicker and denser tissue to improve the direction of fiber development, stiffness, and strength. Tension loading is effective during the secondary phase of healing after the acute inflammatory stage has begun to dissipate.

COMPRESSION LOADING



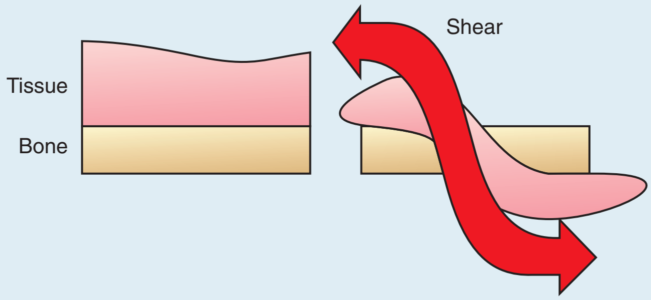
During compression loading, tissue shortens and widens, increasing pressure within the tissue and affecting fluid flow. Compression is effective as a rhythmic pump-like method in facilitating fluid dynamics. Sustained compression results in more pliable connective tissue structures and is effective in reducing tissue density and binding.

BENDING LOADING



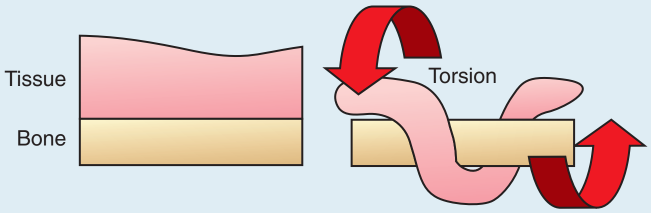
In bending loading, the therapist applies combined forces of tension on the convex side and compression on the concave side of the tissue. Bending is used when combined effects of lengthening and shortening and an increase in pliability are desired.

SHEAR LOADING



In shear loading, the massage therapist moves tissue back and forth, creating a combined pattern of compression and elongation of tissue. This method is particularly effective in creating controlled inflammation and in ensuring that tissue layers slide over one another instead of adhering to underlying layers, creating binding.

ROTATION OR TORSION LOADING



Rotation or torsion loading is a combined application of compression and wringing, resulting in elongation of tissue along the axis of rotation. It is used when a combined effect of fluid dynamics and connective tissue pliability is desired.

COMBINED LOADING

In combined loading, two or more forces are used to load tissue. The more forces are applied to tissue, the more intense is the response. Tension and compression underlie all the different modes of loading; therefore, any form of manipulation is tension, compression, or a combination of these. Tension is important in conditions in which tissue needs to be elongated; compression is important when fluid flow needs to be affected. Oscillation of tissue can be considered combined loading.

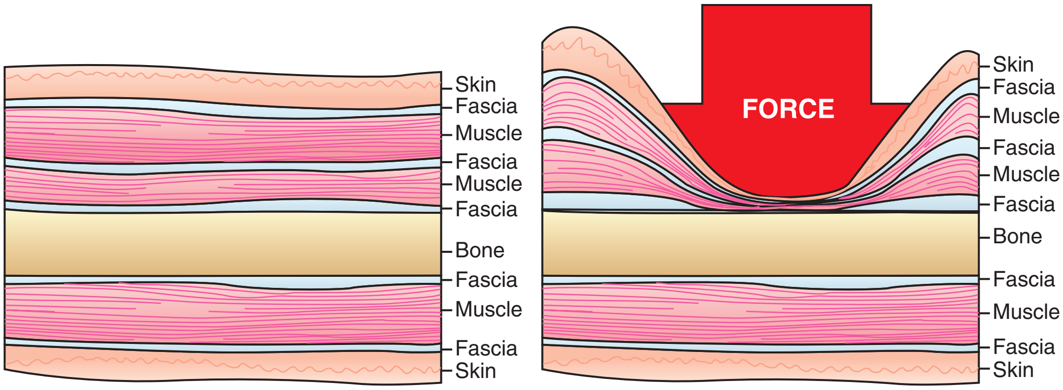


FIGURE 3-1 Massage applications systematically generate force through each tissue layer. This figure provides a graphic representation of force applied, which would begin with light superficial application, progressing with increased pressure to the deepest layer. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 3, St Louis, 2004, Mosby.)

FIGURE 3-2 Examples of mechanical force loading during massage.
A, Tension loading occurs when tissue is elongated. Gliding massage methods and stretching can create tension forces in tissues.
B, Tension forces occur as tissues are stretched.
C, Compression loading occurs when force moves into tissues at a 90-degree angle. In this example, a forearm is used to create compression force in tissues of the shoulder with the client in a side-lying position.
D, Forearm used to compress calf with client in side-lying position.

FIGURE 3-2, cont'd
E, Bending loading. In this example, the hands are used to bend tissues of the calf around the thumbs.
F, Using force compression to displace tissues of the calf, creating a bending force.
G, Example of shear loading. The tissues of the calf are pushed down.
H, Then the same tissues as in part G are pulled up. The back-and-forth movement creates the shear force.
I, Torsion forces twist tissue around a fixed point. In this example, thigh tissues are twisted around the femur.
J, Rotational or torsion forces in massage are generated by kneading. Move tissues by pushing one hand forward and around the fixed point while pulling the other hand back and around.

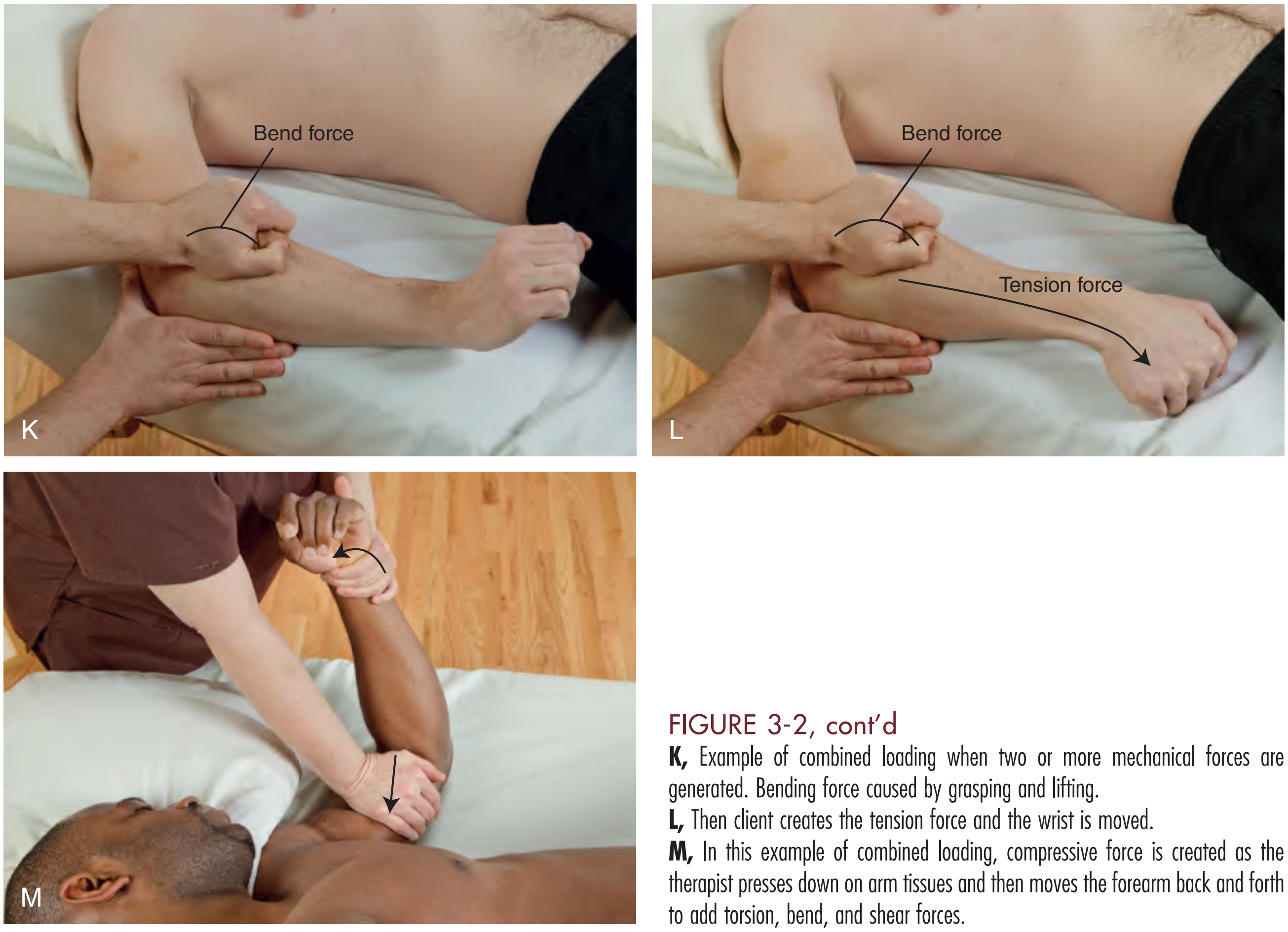


FIGURE 3-2, cont'd
K, Example of combined loading when two or more mechanical forces are generated. Bending force caused by grasping and lifting.
L, Then client creates the tension force and the wrist is moved.
M, In this example of combined loading, compressive force is created as the therapist presses down on arm tissues and then moves the forearm back and forth to add torsion, bend, and shear forces.

primarily physiologic responses of the body, and massage results cannot be isolated as strictly structural outcomes. This is an important concept in understanding the synergistic and multidisciplinary use of various methods to support the athlete.

It is reasonable that massage application is likely to influence the adaptive, restorative, and healing capacities of the body. Anatomic and physiologic outcomes include the following:

- Local tissue repair, as with a sprain or contusion
- Connective tissue normalization that affects elasticity, stiffness, and strength, as when pliability of scar tissue or overall flexibility is improved
- Shifts in pressure gradients to influence body **fluid movement**
- Neuromuscular function interfacing with the muscle length-tension relationship; force couples; motor tone of muscles; concentric, eccentric, and isometric functions; and contraction patterns of muscles working together to support efficient movement
- Mood and pain modulation through shifts in ANS function, yielding neurochemical and neuroendocrine responses
- Increased immune response to support systemic health and healing

Each of these common outcomes for massage supports rehabilitation, fitness, and performance recovery.

SPORT/FITNESS AND REHABILITATION OUTCOMES

Objective

2. List and describe four general outcomes for the athlete/fitness and physical rehabilitation population.

Research often attempts to answer the question, "Does this (medicine, surgery, exercise, machine, food, and so forth) affect this outcome?" Before the evidence is explored, the outcomes need to be defined. The main outcomes of massage for sport and fitness are increased body stamina, stability, mobility, flexibility, and agility; reduced soft tissue tension and binding; normalized fluid (blood and lymph) movement; management of pain; reduction of suffering; support of healing mechanisms; alteration of mood; improved physical and mental performance; and experiences of pleasure. All of these outcomes can be appropriately applied to athlete care or rehabilitation after pathology, especially within the context of a multidisciplinary system.

These outcomes can be classified as four goal patterns for sport and fitness:

1. Performance enhancement/recovery
2. Condition management
3. Rehabilitation/therapeutic change
4. Palliative care

The question is, "Is the evidence that supports massage as an intervention to achieve these outcomes as good as or better than that for other types of interventions, and can massage be supportive in conjunction with other approaches to care?"

PERFORMANCE ENHANCEMENT/RECOVERY

As was previously discussed, fitness and performance are not the same. Optimal performance is most often achieved when fitness is attended to first. Performance motivation and activity exceed fitness requirements by pushing the body to achieve activities that are outside the fitness parameters. Performance therefore becomes a strain on the system. Balancing fitness and performance is tricky with athletes. It is important for those whose goals are fitness oriented to not exceed the beneficial physical outcomes by getting caught up in performance demands that lead to increased strain on adaptive capacity.

Continual performance demand interferes with fitness and compromises health. Normal function and performance are not the same. A person who is learning to walk again after an accident exerts effort and has similar physical manifestations and demands on the body as an athlete does when seeking to decrease his or her 40-yard dash time. However, one is seeking to regain normal function, and the other is striving for **peak performance**. Performance is more than normal function.

The sports massage therapist needs to consider how the massage application supports the following client goals:

- Achieve normal function through rehabilitation and conditioning
- Maintain fitness
- Reduce the negative effects that performance demand places on the body in excess of normal function

All people who engage in exercise may strive for excellence at some performance level. The elderly person who is beginning a cardiac rehabilitation program, the professional athlete striving for success in competition, and the child learning to walk—anyone who uses the body in a precise way—are all concerned about the ability to carry out an action with skill. Their motivations may vary but the desired outcome is the same—increased proficiency when performing the activity. Physical performance involves training, practice, and demand on the body. When desired performance levels are achieved and practiced, they become automatic.

Performance enhancement requires increasing demand on the body through practice. Maintaining performance involves attention to demand on the body and reinforcement. Each individual has a range of peak performance with the triad of body/mind/spirit function in his or her optimal range. As discussed in Chapter 8, this is called "the zone." Peak performance is difficult to maintain for extended periods of time. Recovery is necessary to restore depleted energy and regenerate damaged soft tissue. Most athletes train at levels below peak performance with the desired outcome of reaching that peak during competition. This process is compromised if ongoing competition is extended over periods of time. This is common among professional athletes, especially in team sports such as baseball, basketball, football, hockey, and soccer.

Massage application can support performance by facilitating recovery and removing impediments to training.

CONDITION MANAGEMENT

The goal of **condition management** is to manage ongoing strain that is not going to change. Examples of such strain include inherent joint laxity, previous injury, emotional demands, and playing schedule. Maintaining the status quo is a common outcome for competing athletes, especially toward the end of a playing season.

REHABILITATION/THERAPEUTIC CHANGE

Injury is a common consequence of physical activity. Anyone who has worked with competing athletes knows the importance of injury prevention and of effective, accelerated injury recovery. Most athletes practice or compete when injured at one time or another. When injury is involved, performance is compromised. It takes more energy, accommodation, and compensation to perform when injured. Specifically, rehabilitation is the return to normal function, and for the athlete, this means return to peak performance (i.e., to function above normal).

Massage in this area is complex and requires the most training. Unit Three of this text deals specifically with injury. The specific massage application for injury is integrated into the general massage protocol.

PALLIATIVE CARE

Palliative care includes comfort, support, nurturance, and pleasure, which are essential in the care of the athlete. Attention to warm environment, atmosphere, and ambience is part of the caring experience. Patience, flexibility, and commitment are included in the process. Competing athletes are tired, disappointed, and in pain much of the time. Periods of exhilaration and disappointment occur within complex life experiences. The losing athlete needs more support than the winning one. The older athlete needs more care than the young one. When exercising for fitness, weight loss, and rehabilitation, similar stresses occur. Reducing suffering and offering pleasurable sensation are invaluable in reducing the psychological and physical responses to these stresses.

In both training and rehabilitation, plateaus are reached. The satisfaction of seeing ongoing changes is diminished, and palliative care may be able to support the athlete during these periods. Diminished performance due to fatigue and other pressures can be comforted temporarily by nurturing touch. Sometimes there is just too much aching and pain to endure any longer; in this case, palliative massage is the most beneficial technique.

An example is seen in the case of rookie football players in the second week of training camp. They are tired, stressed, sore, and a bit difficult. Their adaptive capacity is maxed out at the moment, and yet they are driven to perform. The best massage approach is palliative care, not performance enhancement.

In the next section, we will consider whether research findings and clinical evidence support the benefit of massage for these outcomes.

GENERAL MASSAGE BENEFITS AND SAFETY

Objective

3. Explain evidence that indicates that massage is a supportive and safe intervention.

Benefits and safety are the most important factors to consider for any client population. In the sport and fitness world, we have the ability to use research evidence to justify general massage as the foundational approach for this population.

Research findings are mixed regarding the efficacy of massage. Generally, massage as the primary treatment for various conditions was not found to be a definitive treatment on its own, but studies were supportive of many other interventions used in enhancing effects or managing side effects of other treatments. This means that typically massage would be a beneficial part of a fitness program but should not be expected to provide optimal outcomes when it is the only therapeutic intervention used.

The "why massage works" remains elusive, but recurring findings suggest possible physiologic mechanisms for massage benefit. One study by Field and her associates (2005) is particularly relevant for this text because it deals with serotonin, which is associated with body pain modulation mechanisms. In other studies, Diego et al. (2004, 2009) speaks to how massage needs to be applied with sufficient nonpainful compressive force to stimulate an anti-arousal response, and that massage that is considered light tends to stimulate the sympathetic ANS response (Field et al., 2010).

PRESSURE DEPTH

Pressure-based massage produces different physiologic changes than are produced by light touch (Sefton et al., 2011; Rapaport et al., 2010). Application of moderate pressure massage appears necessary to influence hypothalamic-pituitary-adrenal function (Rapaport et al., 2010; Field et al., 2010) and diastolic blood pressure (Moraska et al., 2010). Light or moderate pressure massage (or a combination) may reduce the sensitivity of spinal nociceptive reflexes (Sefton et al., 2011; Roberts, 2011).

Light pressure gliding stroke–based massage has been shown to lower heart rate and systolic blood pressure and to decrease the deterioration of natural killer cell activity; however, no effects were identified for cortisol levels and diastolic blood pressure (Hillier et al., 2010; Billhult et al., 2009). Pressure levels used during massage are an important concept for athletes seeking restorative benefits from massage. It appears that moderate to light pressure can affect generalized restorative function, and deep aggressive massage application is not necessary to achieve these benefits.

The study "Massage Reduces Pain Perception and Hyperalgesia in Experimental Muscle Pain: A Randomized, Controlled Trial" (Frey Law et al., 2008) suggests that massage is capable of reducing myalgia symptoms by approximately 25% to 50% (extent of effect varies with the assessment technique used to measure pain). The purpose of this study was to determine the effects of massage on pressure pain thresholds (PPTs) and perceived pain. Researchers used delayed-onset muscle soreness (DOMS) as a model of myalgia (muscle pain). This condition is a major issue for athletes and those attempting to integrate an exercise program into their lifestyle.

The way Frey Law and associates conducted the research was to randomly assign participants to a no treatment control, superficial touch, or deep tissue massage group. A specific type of wrist exercise was performed at visit 1 to cause DOMS 48 hours later at visit 2. Pain, assessed using a visual analog scale (VAS), and pressure needed to cause pain were measured at baseline, after exercise, before treatment, and after treatment.

Results of the study showed that deep massage decreased pain (48.4% DOMS reversal) during muscle stretch. Mechanical hyperalgesia (increased pain response to pressure) was reduced (27.5% reversal) in both the deep massage and superficial touch groups when compared with the control group. The control group did not receive any massage and experienced an increased pain perception of 38.4%. Resting pain did not vary between treatment groups.

If we analyze the Frey et al. study, we can consider that both deep and light pressure massage reduced the sensation of pain, and deep pressure massage helped reduce pain when accompanied by stretching of sore muscles. However, the sensation of pain when there was no activity was not reduced by massage. Now if we think about how this information is used during massage practice, it might be seen as follows.

Example

A client just increased the intensity of his conditioning program and is sore and achy. The client feels stiff, and it hurts to stretch. Based on information provided in the study, massage would likely be most beneficial if a variety of pressures were used, and deeper pressure massage should target those areas that hurt when the client stretches. It might be important to explain to the client that he may still feel achy, but he should be able to move better.

ADVERSE EFFECT

Objective

4. Describe the potential for adverse effects from massage application.

Massage is not always the best technique for managing symptoms. According to Hanley et al. (2003), despite very strong patient preference for therapeutic massage, it did not show any benefit over a relaxation tape used to control postsurgery pain. Massage was effective in reducing anxiety but was no more effective than relaxing in a quiet room (Sherman et al., 2010).

Although these studies indicate that massage is effective for anxiety management, it is no more effective than other relaxation interventions. Key, however, is that people *liked* massage, which is an important factor in compliance with treatment. Muller-Oerlinghausen et al. (2004) concluded that slow-stroke massage is suitable as an intervention for depression, along with other treatment, and is readily accepted by very ill patients. A reduction in distress has been noted among oncology patients in response to massage, regardless of gender, age, ethnicity, or cancer type.

The athletic population often undergoes surgery to repair muscle skeletal injury. During the healing and rehabilitation process, it is common for depression and anxiety to occur based on the change in daily life schedule, as well as concern for future performance ability. Massage and other forms of relaxation intervention can be helpful.

POTENTIAL FOR HARM

When any treatment is assessed, safety is a primary concern (i.e., do no harm). If harm is possible, then the benefits of receiving massage must exceed the potential for harm. A summary of a review of massage safety by Ernst et al. (2006) concludes that massage is generally safe. Massage is not entirely risk free, and we need to be aware of potential harm. However, serious adverse effects are rare. Most adverse effects resulting from massage were associated with aggressive types of massage or massage delivered by untrained individuals. Also, these effects were associated most often with massage techniques other than "Swedish" (classic) massage. These findings are extremely important for those working with athletes. In general, over the years, "sport massage" has incorporated aggressive methods.

Another situation in which adverse effects may occur is when massage interferes with various types of implants such as stents, ports, prostheses, and so forth. Haskal (2008), in the *Journal of Vascular and Interventional Radiology,* reported a case where a stent placed in the lower limb as treatment for peripheral artery disease migrated to the right atrium after 3 years. Open heart surgery was required to remove the embedded stent fragments. The mechanism attributed with dislodging and moving the stent was deep tissue massage of the thigh. Although this outcome is rare, it is important to pay attention to adverse effects caused by massage. Athletes may have had various surgeries to repair injuries. Often various stabilizing devices such as pins and screws are used. Care needs to be taken to avoid compressing tissues into these areas to prevent potential damage to tissues as they are pushed into the stabilizing devices. Also, the "deep tissue" approach is often used with athletes without considering the potential for damage. Moderate to heavy pressure applied with a small contact such as at the tip of the elbow or with a massage implement such as a hand-held pressure device is more likely to cause tissue damage than pressure applied with a broad contact such as the forearm. Aggressive stretching procedures provide other opportunities for structural damage.

Benefits of stretching in general are being questioned (see later in chapter). A physiologic and safe range of motion has been determined for joints. Any stretching beyond this motion increases the potential for harm. In a cross-sectional study of 100 clients, 10% of massage clients experienced some minor discomfort after the massage session; however, 23% experienced unexpected, nonmusculoskeletal positive side effects. Most negative symptoms started within 12 hours after the massage and lasted for no longer than 36 hours. Most of the positive benefits began to be noted immediately after massage and lasted longer than 48 hours. No major side effects occurred during this study (Cambron et al., 2007). Soreness after massage can affect performance for an athlete. Based on findings of this study, it may be prudent for the athlete to avoid massage a day and a half before competition; however, because the benefits last for at least 2 days, the athlete should still experience positive results from massage.

KEY POINTS

The studies in this section are beginning to provide evidence that massage may do the following:

- May play a role in reducing detrimental stress-related symptoms
- May be pleasurable
- May appear to manage some muscle-type pain
- May support social bonding
- May likely improve perception of quality of life for those who enjoy massage

More important, massage therapy is typically safe when provided in a conservative and general manner with sufficient nonpainful pressure.

NEUROENDOCRINE REGULATION

Objective

1. Understand and describe massage outcomes based on known and theoretical physiologic mechanisms.

IN MY EXPERIENCE

I worked with two NBA basketball players while they were playing for the world championship. I flew into the location 3 days before the game that would decide which team would be the champions that year. It had been a long, hard season for both teams, and many players were playing with injuries. The two individuals I was working with were injury-free at the time but were tired. I had adjusted the intensity of the massage to be more general and limited the amount of specific work. This approach worked well for the first 2 days I was there; however, on the day before the game, I could tell that their fatigue had increased, and one of the players told me it felt like he was getting sick. I was there, and the guys wanted a massage. Again I adjusted the massage to primarily support sleep. On the day of the game, the sick player woke up with a headache and neck stiffness. Both wanted a massage. I moved into palliative mode for both and allowed the massage to evolve into a nap. After the nap, I used some simple methods to loosen up the sick player's neck. The game was played later that day. I was concerned about the effects of massage on the day of the game. Even though I had worked with both individuals for 3 years, I remained concerned about providing massage on the day of the game. My clients' team lost the game by a very narrow margin. It was a really hard-fought game. Both guys informed me that the massage helped, and I was relieved. One of the other players on the team had received a massage the night before the game from a local massage therapist whom he did not know but who was recommended by the hotel concierge. The massage included some trigger point application and stretching. He missed a couple of very important shots during the game. Later, one of my clients told me that the individual had woken up really stiff on the morning of the game. One of the staff members who work with the team in the training room was really upset about the condition of the player and blamed the massage. He asked me what I thought. I was not there to observe the nature of the work, nor did I actually speak with the player. However, I did explain what is considered appropriate massage before competition. Makes you wonder, doesn't it?

Neuroendocrine substances carry messages that regulate physiologic functions. **Neuroendocrine regulation** is a continuous, ever-changing chemical mix that fluctuates with each external and internal demand on the body to respond, adapt, or maintain a functional degree of homeostasis. The immune system produces and responds to these communication substances. Substances that make up this "chemical soup" remain the same, but the proportion and ratio change with each regulating function or message transmission. The "flavor" of the soup, which is determined by the ratio of the chemical mix, affects such factors as mood, attentiveness, arousal, passiveness, vigilance, calm, ability to sleep, receptivity to touch, response to touch, anger, pessimism, optimism, connectedness, loneliness, depression, desire, hunger, love, and commitment.

MOOD

Massage therapy appears to have a beneficial effect on anxiety levels; this is important for the management of performance anxiety experienced by many athletes. The therapeutic relationship established between massage therapist and client is similar to that seen in psychotherapy, a treatment that relies on communication and the therapeutic relationship to produce effects. It is possible that massage effects are related to the therapeutic relationship (Moyer et al., 2004). Excessive sympathetic output causes most of the stress-related diseases and dysfunctions, including headache, gastrointestinal difficulties, high blood pressure, anxiety, muscle tension and aches, and sexual dysfunction.

Long-term stress (i.e., stress that cannot be resolved by fleeing or fighting) may trigger the release of cortisol, a cortisone manufactured by the body. Long-term high blood levels of **cortisol** cause side effects similar to those of the drug cortisone, including fluid retention, hypertension, muscle weakness, osteoporosis, breakdown of connective tissue, peptic ulcer, impaired wound healing, vertigo, headache, reduced ability to deal with stress, hypersensitivity, weight gain, nausea, fatigue, and psychological disturbances.

Because of its generalized effect on the ANS and associated functions, massage can cause changes in mood and excitement levels and can induce the relaxation/restoration response. Massage seems to be a gentle modulator, producing feelings of general well-being and comfort. The pleasure aspect of massage supports these outcomes. This is especially important for sport recovery. The emotional arousal often found in rehabilitation situations is also favorably influenced.

Initially, massage stimulates sympathetic functions. The increase in autonomic, sympathetic arousal is followed by a decrease if the massage is slowed; arousal is sustained with sufficient pleasurable pressure lasting about 45 to 50 minutes. Pressure levels must be relatively deep but not painful. Slow, repetitive stroking, broad-based compression, rhythmic oscillation, and movement all initiate relaxation responses. Sufficient pressure applied with a compressive force to the tissues supports serotonin functions and vagal nerve tone. Compression and a fast-paced massage style stimulate sympathetic responses and may lift depression temporarily.

PAIN MODULATION

Point holding, such as acupressure or reflexology, releases the body's own painkillers and mood-altering chemicals from the entire endorphin class. These chemicals stimulate the parasympathetic responses of relaxation, restoration, and contentment. These methods of massage depend on the creation of moderate, controlled pain to relieve pain. It takes a larger pain or stress stimulus to generate the endorphin response than the perception of existing pain. When release of substance P triggers pain, enkephalins are released and suppress the pain signal. A negative feedback system activates the release of serotonin and endogenous opiates, which inhibit pain. Therapeutic massage methods can be used to create a controlled, noxious (pain) stimulation that triggers this cycle. Clients often refer to this noxious stimulation as "good pain."

Altering the muscles so that they are more or less tense, or changing the consistency of the connective tissue, affects the ANS through the feedback loop, which in turn affects the powerful body/mind phenomenon.

Research now indicates that most problems in behavior, mood, and perception of stress and pain, as well as other so-called mental/emotional dysfunction, are caused by dysregulation or failure of certain biochemical agents. These behaviors, symptoms, and emotional and physical states often are the result of normal chemical mixes that occur at inappropriate times. Athletes are particularly sensitive to neurochemical influences. Highs and lows, wins and losses, pain, and so forth place increased demands on the system.

The effects of neurotransmitters released during massage may explain and validate the use of sensory stimulation methods for treating chronic pain, anxiety, and depression. Much of the research on massage, especially that done at the Touch Research Institute of the University of Miami School of Medicine, revolves around shifts in the proportion and ratio of the composition of the body's "chemical soup" brought about by massage.

NEUROENDOCRINE CHEMICALS

Neuroendocrine chemicals potentially influenced by massage include the following:

- Dopamine
- Serotonin
- Epinephrine/adrenaline
- Norepinephrine/noradrenaline
- Enkephalins, endorphins, and dynorphins
- Oxytocin
- Cortisol
- Growth hormone
- Endocannabinoids

Dopamine

Dopamine influences motor activity that involves movement (especially learned, fine movement such as handwriting), conscious selection (the ability to focus attention), and mood (in terms of inspiration, possibly intuition, joy, and enthusiasm). Dopamine is involved in pleasure states, seeking behavior, and the internal record system. Low levels of dopamine result in opposite effects such as lack of motor control, clumsiness, inability to focus attention, and boredom. Massage seems to increase the available level of dopamine in the body; this may explain the pleasure and satisfaction experienced during and after massage. The importance of optimal dopamine levels for the athlete is evident.

Serotonin

Serotonin allows a person to maintain context-appropriate behavior; that is, to do the appropriate thing at the appropriate time. It regulates mood in terms of appropriate emotions, attention to thoughts, and calming, quieting, comforting effects; it also subdues irritability and regulates drive states so that the urge to talk, touch, and be involved in power struggles can be suppressed. Serotonin is involved in satiety; adequate levels reduce the sense of hunger and craving such as for food or sex. It also modulates the sleep/wake cycle. A low serotonin level has been implicated in depression, eating disorders, pain disorders, and obsessive-compulsive disorders. A balancing effect has been noted between dopamine and serotonin, much like agonist and antagonist muscles. Athletic competition supports dopamine dominance, but recovery time is serotonin-dependent. Aggressive and impulsive behavior of athletes may be related to imbalances in this area. Massage seems to increase the available level of serotonin. Massage may support the optimal ratio of serotonin and dopamine, especially when used to aid recovery after competition. Care needs to be taken before competition to not disrupt the delicate balance of these neurotransmitters.

Epinephrine/Adrenaline and Norepinephrine/Noradrenaline

The terms **epinephrine/adrenaline** and **norepinephrine/noradrenaline** are used interchangeably in scientific texts. Epinephrine activates arousal mechanisms in the body, whereas norepinephrine functions more in the brain. These are the activation, arousal, alertness, and alarm chemicals of the fight-or-flight response and of all sympathetic arousal functions and behaviors. Athletic competition supports the release of these chemicals. If the levels of these chemicals are too high, or if they are released at an inappropriate time, a person may feel as if something very important is demanding his or her attention or may react with the basic survival drive of fight or flight (hypervigilance and hyperactivity). The person might have a disturbed sleep pattern, particularly in terms of lack of rapid eye movement (REM) sleep, which is restorative sleep. The individual with low levels of epinephrine and norepinephrine is sluggish, drowsy, fatigued, and underaroused.

Massage seems to have a regulating effect on epinephrine and norepinephrine through stimulation or inhibition of the sympathetic and parasympathetic nervous systems. This generalized balancing function of massage seems to recalibrate the appropriate adrenaline and noradrenaline levels. Depending on the response of the ANS, massage can just as easily wake a person up and relieve fatigue as it can calm down a person who is anxious and pacing the floor.

It should be noted that initially, touch stimulates the sympathetic nervous system, whereas it seems to take 15 minutes or so of sustained stimulation to begin to engage the parasympathetic functions. Therefore, it makes sense that a 15-minute chair massage tends to increase production of epinephrine and norepinephrine, which can help athletes become more attentive, whereas a 1-hour slow, rhythmic massage engages the parasympathetic functions, reducing epinephrine and norepinephrine levels and encouraging a good night's sleep, necessary for recovery and healing.

Enkephalins, Endorphins, and Dynorphins

Enkephalins, endorphins, and **dynorphins** are mood lifters that support satiety and modulate pain. Massage may increase available levels of these chemicals secondary to the introduction of non-harmful pain stimuli. The massage effect is delayed until chemical levels rise to an inhibitory level. It usually takes about 15 minutes for blood levels of enkephalins, endorphins, and dynorphins to begin to rise. Appropriate availability of these pain-modulating chemicals is essential for athletes.

Oxytocin

The hormone **oxytocin** has been implicated in pair or couple bonding, parental bonding, feelings of attachment, and caretaking, along with its more clinical functions during pregnancy, delivery, and lactation. Massage tends to increase the available level of oxytocin, which could explain the connected and intimate feeling of massage.

Because athletes tend to be single-minded and hyperfocused, the oxytocin influence can support dependence on the therapist. If the massage routine is disrupted, the athlete's performance can be affected. In this sense, commitment and consistency by the therapist working with competing athletes are essential.

Cortisol

Cortisol and other glucocorticoids are stress hormones produced by the adrenal glands during prolonged stress. Elevated levels of these hormones indicate increased sympathetic arousal. Cortisol and other glucocorticoids have been implicated in many stress-related symptoms and diseases, including suppressed immunity states, sleep disturbances, and increases in the level of substance P. Athletes and those in extensive physical rehabilitation programs are particularly susceptible to increased and sustained cortisol levels. Massage may influence levels of cortisol secondary to the increase in parasympathetic activation.

Growth Hormone

Growth hormone promotes cell division and in adults has been implicated in the functions of tissue repair and regeneration. This hormone is necessary for healing and is most active during sleep. Massage increases the availability of growth hormone indirectly through increased vagal stimulation, predisposing to parasympathetic dominance, encouraging sleep, and reducing the level of cortisol. Again, especially in competing athletes, recovery is a primary goal, and optimal levels of growth hormone are necessary.

Endocannabinoids

Endocannabinoid chemicals are produced in the body; compounds in the cannabis plant produce similar responses, just as morphine creates similar effects as endogenous endorphins. The endocannabinoid system plays an important role in regulating a variety of physiologic processes, including appetite control, energy balance, pain perception, and immune responses. The endocannabinoid (eCB) system is involved in modulation of pain and inflammation. The endocannabinoid system has recently been implicated in the regulation of bone metabolism and may help to reverse bone demineralization (Rossi et al., 2009; Bab et al., 2009).

As of this writing, the research data are insufficient to allow definitive statements regarding the treatment effects of massage therapy on cortisol and other stress-related substances. Although multiple research studies have found significant improvements in stress perception following massage therapy, available studies do not present a high enough level of evidence to allow definitive statements about the effects that massage therapy has on the physiologic functions associated with stress (Moraska et al., 2010).

It is not clear if massage directly influences neurochemicals that influence mood and behavior, but research in touch is promising. For example, a study named "Influence of a 'Warm Touch' Support Enhancement Intervention Among Married Couples on Ambulatory Blood Pressure, Oxytocin, Alpha Amylase, and Cortisol" (Holt-Lunstad et al., 2008) investigated whether a support intervention (warm touch enhancement) influences physiologic stress systems that are linked to important health outcomes. Findings indicated that physical and physiologic bonds occur with consistent warm touch. The compassionate touch of massage is a form of warm touch. Therefore, it is common for a bond to be formed between client and massage therapist. This bond between athlete and massage therapist can be exaggerated within the context of the therapeutic massage because of the intensity of the performance demand.

Serotonin is another important neurochemical related to stress levels. A study conducted in the Netherlands (Bakermans-Kranenburg and van Ijzendoorn, 2008) explored the relationship of oxytocin and serotonin to what they termed "sensitive parenting." Animal studies suggest an important role of oxytocin in parenting and in social interactions with offspring. Evidence also indicates that the neurotransmitter serotonin may be important through its influence on mood and the release of oxytocin.

It is common to find a correlation between stress, anxiety, depression, and pain. This combination is common within the sport and fitness world. When a correlation is noted, a relationship between elements exists, but this does not mean that one of the elements causes the other. Therefore, although stress, anxiety, depression, and pain are commonly found together, it is not clear whether any one of these elements causes any of the others. Regardless, these four situations often respond to the same applications of massage. The following studies indicate that massage is helpful in management of these conditions. In 2002, a connection was made between pain perception and oxytocin using a massage-like intervention (Lund et al., 2002). A study of women giving birth indicates that oxytocin levels are increased using acupressure (Kashanian and Shahali, 2009).

Other studies have found that massage did not necessarily influence oxytocin levels. Recall that oxytocin is related to feelings of connectedness and bonding. Although most of the oxytocin studies involve touch, as massage therapists we can at least intelligently speculate that massage would produce similar responses because massage is a pleasurable touch.

Still other studies have found that (1) arginine vasopressin and/or cortisol levels changed after massage, indicating reduced stress response (Bello et al., 2008; Garner et al., 2008; Mackereth et al., 2009; Stringer et al., 2008; Lindgren et al., 2010), and that (2) the cortisol reduction response to massage is small if it occurs at all and may not equate to the reported physiologic changes (Noto et al., 2010; Moyer et al., 2011).

It can be summarized that therapeutic massage may, through the influence on the autonomic nervous system and the use of not harmful pain stimuli, help balance blood levels of serotonin, dopamine, endocannabinoids, and endorphins, which, in turn, facilitates the production of natural killer cells in the immune system and regulates mood. Oxytocin tends to increase supporting feelings of connectedness. These responses indicate that it would be beneficial to include massage as part of the total treatment program for athletes as well as in fitness programs.

SOMATIC INFLUENCE

Objective

1. Understand and describe massage outcomes based on known and theoretical physiologic mechanisms.

The effects of massage can be processed through the somatic division of the peripheral nervous system. The somatic division controls movement and muscle contraction and relaxation patterns, as well as muscle and motor tone. **Muscle tone** is a mixture of tension in the connective tissue elements of the muscle and intermuscular fluid pressure. An example of muscle tone dysfunction is delayed-onset muscle soreness. Muscle tone is influenced more by mechanical massage applications as previously discussed. **Motor tone** is produced by motor neuron excitability and is influenced by reflexive massage application, which inhibits motor neuron activity. The most common reason for an increase in motor tone is the increase in sympathetic arousal and in sustained sympathetic dominance. Another cause is proactive muscle guarding after injury and nervous system damage. Both situations are common in athletes.

The usual outcome of reflexive massage is inhibitory and anti-arousal. Anti-arousal massage (relaxation massage) may influence motor tone activity in the same way that pharmaceutical muscle relaxers do, because the main reason for motor tone difficulties is sympathetic arousal.

In working with the neuromuscular mechanism in massage, the basic premises are as follows:

- Substitute a different neurologic signal stimulation to support a normal muscle resting length.
- Influence muscle and motor tone by lengthening and stretching muscles and connective tissue.
- Normalize fluid dynamics.
- Reeducate the muscles involved.

Dysfunction of soft tissue (muscle and connective tissue) without proprioceptive hyperactivity or hypoactivity is uncommon. It is believed that proprioceptive hyperactivity causes tense or spastic muscles and hypoactivity of opposing muscle groups. The main proprioceptors influenced by massage are the spindle cell and the Golgi tendon receptor. Mechanoreceptors of the skin are also influenced by stretching, compression, rubbing, and vibration of the skin. Stimulation of joint mechanoreceptors affects adjacent muscles, and the stimulation of the skin overlying muscle and joint structures has beneficial effects on these owing to shared innervations.

Deep broad-based massage has a minimal and short-term inhibitory effect on motor tone of muscle. It is used primarily to support a muscle reeducation process such as therapeutic exercise, or to temporarily reduce motor tone so that muscle activation sequences (firing patterns) can be reset. Inhibiting motor tone allows more mechanical methods to address tissue shortening without causing muscle spasm.

Active movements of the body, using techniques such as active assisted joint movement, and the application of active muscle contraction and release, as used during muscle energy methods of tense and relax, reciprocal inhibition, and combined methods of strain/counterstrain, do seem to improve motor function through interaction with proprioceptive function.

Somatic effects are produced by the following means:

- Vestibular and cerebellar stimulation
- Hyperstimulation analgesia
- Counterirritation
- Reduction of nerve impingement (entrapment and compression)
- Reduction of muscle inhibition from fluid pressure

VESTIBULAR APPARATUS AND CEREBELLUM

The **vestibular apparatus** is a complex system composed of sensors in the inner ear (vestibular labyrinth), upper neck (cervical proprioception), eyes (visual motion and three-dimensional orientation), and body (somatic proprioception) processed in several areas of the brain (brainstem, cerebellum, parietal and temporal cortices). Reflex activity affects the eyes (eurogeni-ocular reflexes), the neck (vestibulocolic reflexes), and balance (vestibulospinal reflexes) by sending and receiving information at the same time about how we are oriented to the environment around us. As an example, many amusement park rides create disorienting sensations in the vestibular apparatus that contribute to the effects of the ride.

The vestibular apparatus and the cerebellum are interrelated. Output from the cerebellum goes to the motor cortex and the brainstem. Stimulating the cerebellum by altering the motor tone of muscles, the position of the body, and vestibular balance stimulates the hypothalamus to adjust ANS functions to restore homeostasis. Reflex response time seems to be quicker in athletes than in nonathletes. Most athletes are extremely sensitive in this area.

The massage techniques that most strongly affect the vestibular apparatus and therefore the cerebellum are those that produce rhythmic oscillation, including rocking during the application of massage. Rocking produces movement at the neck and head that influences the sense of equilibrium. Rocking stimulates inner ear balance mechanisms, including the vestibular nuclear complex and the labyrinthine righting reflexes, to keep the head level. Stimulation of these reflexes produces a body-wide effect involving stimulation of muscle contraction patterns.

Massage can alter body positional sense and the position of the eyes in response to postural change. It initiates specific movement patterns that change sensory input from muscles, tendons, joints, and skin and stimulate various vestibular reflexes. This feedback information, which adjusts and coordinates movement, is relayed directly to the motor cortex and the cerebellum, allowing the body to integrate sensory data and adjust to a more efficient postural balance. If massage application involves vestibular influences, short-term nausea and dizziness can occur while the mechanisms rebalance. Using massage to restore appropriate muscle activation firing pattern sequences and gait reflexes is valuable. Influencing the balance of the various force couples within the body can shift the relationship of the eyes, neck, hips, and so forth and influences positional balance, mobility, and agility.

HYPERSTIMULATION ANALGESIA

In 1965, Melzack and Wall proposed the gate control theory. Although some aspects of the original theory have been modified over the past 40 years, the basic premise remains viable. According to this theory, a gating mechanism functions at the level of the spinal cord. Pain impulses pass through a "gate" to reach the lateral spinothalamic system. Pain impulses are transmitted by large-diameter and small-diameter nerve fibers. Stimulation (e.g., rubbing, massaging) of large-diameter fibers prevents small-diameter fibers from transmitting signals and helps suppress the sensation of pain, especially sharp or visceral pain. Various massage methods, including pressure, positioning, and lengthening, provide this stimulation at sufficient intensity to activate the gating mechanism and produce **hyperstimulation analgesia**. Pain sensation may be reduced through manual analgesia by stimulating the sensory gating achieved when multiple sensations are processed at the same time. The reflexology (foot massage) benefit seems to be mediated by hyperstimulation analgesia.

Tactile stimulation produced by massage travels through the large-diameter fibers. These fibers also carry a faster signal. In essence, massage sensations win the race to the brain, and pain sensations are blocked because the gate is closed. Stimulating techniques such as percussion or vibration of painful areas to activate "stimulation-produced analgesia," or hyperstimulation analgesia, also are effective. Pain management for those involved with sport and fitness is essential. Therefore, these methods are beneficial.

COUNTERIRRITATION

Counterirritation is a superficial irritation that masks some irritation of deeper structures. Counterirritation may be explained by the gate control theory. Inhibition in central sensory pathways, produced by rubbing or oscillating (shaking) an area, may explain counterirritation.

All methods of massage can be used to produce counterirritation. Any massage method that introduces a controlled sensory stimulation intense enough to be interpreted by the client as a "good pain" signal will work to create counterirritation.

Massage therapy in many forms stimulates the skin over an area of discomfort. Techniques that create friction for the skin and underlying tissue to cause reddening of the skin are effective. Many sport therapeutic ointments contain cooling and warming agents and mildly caustic substances (capsicum) and are useful for muscle and joint pain. This is also a form of counterirritation.

NERVE IMPINGEMENT

A nerve that is compressed or squeezed is a **nerve impingement**. Tissues that can bind include skin, fascia, muscles, ligaments, joint structures, and bones. An increase in fluid in an area can also result in nerve impingement. Shortened muscles and connective tissues (fascia) often impinge on major and minor nerves, causing discomfort. Tissues that are long and taut can also impinge on a nerve.

The specific nerve root, trunk, or division affected determines the condition such as thoracic outlet syndrome, sciatica, or carpal tunnel syndrome. Therapeutic massage techniques work in many ways to reduce pressure on nerves. The main ways include the following:

- Reflexively changing the tension pattern and lengthening the short muscles
- Mechanically stretching and softening connective tissue
- Reducing localized edema
- Interrupting the pain-spasm-pain cycle caused by protective muscle spasm that occurs in response to pain
- Supporting the effectiveness of therapeutic exercise to shift posture and function

• Supporting the use of medications such as antispasmodics, analgesics, antiinflammatories, and circulation enhancers such as vasodilators.

CONNECTIVE TISSUE INFLUENCES

1. Understand and describe massage outcomes based on known and theoretical physiologic mechanisms.

The mechanical behavior of soft issue in response to tissue loading is related to the property of connective tissue viscoelasticity, as described in the anatomy and physiology review in Unit One. Connective tissue is a biological material that contains a combination of stiff and elastic fibers embedding a gel medium. Connective tissue, the structural component of the body, is the most abundant body tissue. Its functions include support, structure, space, stabilization, and scar formation. It assumes many forms and shapes, from fluid blood to dense bone. The pliability of connective tissue, which is based on its water-binding components, is significantly affected by connective tissue massage. Connective tissue is adaptive and is responsive to a variety of influences, such as injury, immobilization, overuse (increased demand), and underuse (decreased demand).

The basic connective tissue massage approach consists of mechanically softening the tissue by introducing various mechanical forces that result in pressure, pulling, movement, and stretch on the tissues; this allows them to rehydrate and become more pliable. The process is similar to softening gelatin by warming it. If you want connective tissue to stay soft, water must be added. This is one reason why it is important for the client to drink water before and after the massage.

Stretching, pulling, or pressure on the connective tissue is a little different from that seen with neuromuscular methods. Neuromuscular techniques usually flow in the direction of the fibers to affect the proprioceptive mechanism and create a quick response. Connective tissue approaches are slow and sustained, usually against or across the fibers. Connective tissue stretching is elongated or telescoped at the point of the tissue movement barrier.

Another aspect of connective tissue massage application is the generation of healing potentials through creation of controlled therapeutic inflammation.

The most specific localized example of this type of application is the cross-fiber friction concept of Dr. James Cyriax. This method is effective, especially around joints, where the tendons and ligaments become bound down to underlying or adjacent tissue. Deep transverse friction is always a specific rehabilitation intervention. It introduces therapeutic inflammation through creation of a specific and controlled acute reinjury of the tissues. Frictioning can last as long as 15 minutes to create controlled reinjury of the tissue, which introduces a small amount of inflammation and traumatic hyperemia to the area. The result consists of restructuring of the connective tissue, increased circulation to the area, and temporary analgesia.

Proper rehabilitation after friction massage is essential for the friction technique to be effective and produce a mobile scar or rehealing of the tissue. The area must be contracted painlessly with no strain placed on the tissue. This is done by fixing the joint in a position in which the muscle is relaxed, and then having the client contract the muscle as far as it will go. This is sometimes called a *broadening contraction* (Figure 3-3). The exercise is performed as 5 to 10 repetitions, 3 to 4 times a day.

MYOFASCIAL SYSTEM

Day et al. (2009) consider the myofascial system to be a three-dimensional continuum, meaning that we cannot really separate muscle or any other type of tissue from the surrounding fascia or the body as a whole (i.e., there is no such thing as an individual muscle). Dr. Carla Stecco and Dr. Antonio Stecco have carried out extensive research into the anatomy and histology of the fascia via dissection of unembalmed cadavers, providing a biomechanical model that assists in deciphering the role of fascia in

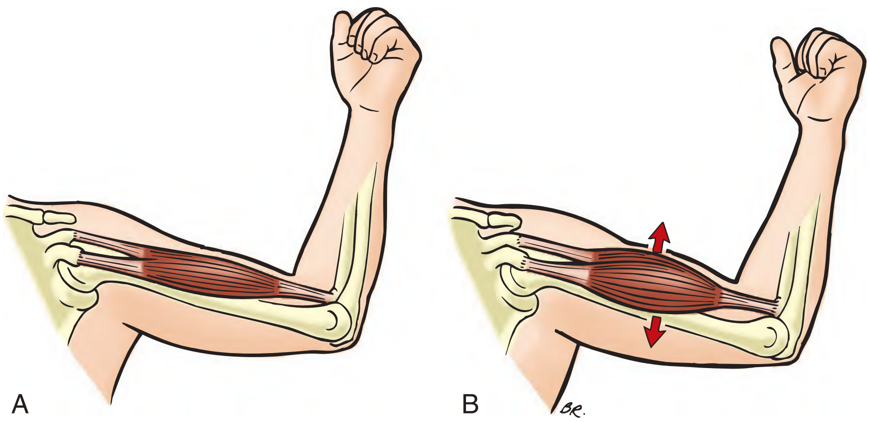


FIGURE 3-3 Broadening contraction.
A, Beginning point.
B, Contract the muscle by flexing the joint. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 3, St Louis, 2004, Mosby.)

musculoskeletal disorders. Everything moves within the body, and parts need to slide over and around other parts of the body. Slippery fluid secreted by the body allows structures to slide. In muscle or myofascia, part of the fascia is anchored to bone (or another structure), and part is free to slide. If tissues cannot slide as they are supposed to, inflammation and reduced range of motion and strength can occur. Fascia is formed by crimped/wavy collagen fibers and elastic fibers arranged in distinct layers, and within each layer the fibers are aligned in a different direction. These fibers are embedded in a gelatin-like structure called *ground substance*. Fascia can be stretched because of the wavy nature of the fiber structure and the elastic fibers, which allows fascia to return to its original resting state. Subcutaneous fascia (tissue containing body fat located under the skin but on top of muscle) forms a very elastic sliding membrane essential for thermal regulation, metabolic exchanges, and protection of vessels and nerves. Deep fascia is more stiff and thin (think "duct tape") than subcutaneous fascia. Deep fascia surrounds and compartmentalizes the muscles and forms the structures that attach soft tissues to bone. This type of fascia also forms a complex latticework of connective tissue, resembling struts, cross-beams, and guy wires, which help to maintain the structural integrity and function of the body. Another important fascia process is the ability of fibers and the tissue layer to slide relative to each other. According to Medline, the lubricating substance, called *mucopolysaccharide,* acts as both a lubricant (allowing the fibers to easily slide over one another) and a glue (holding fibers of the tissue together into bundles). Remember that connective tissues are made up of tendons, ligaments, and the fascial sheaths that envelop, or bind down, muscles into separate groups. These fascial sheaths, or fasciae, are named according to where they are located within the muscles:

- *Endomysium:* innermost fascial sheath, which envelops individual muscle fibers
- *Perimysium:* fascial sheath that binds groups of muscle fibers into individual fascicles (bundles). In addition, the perimysium provides slip planes between muscle bundles necessary for shape and directional changes, and one structure slides upon another. Thin layers of adipocytes (fat cells) are found between fascial layers separating adjacent structures, allowing single layers to slide over those below, beside, and above it (Purslow, 2010).
- *Epimysium:* outermost fascial sheath, which binds entire fascicles

Tom Myers (Anatomy Trains) for many years has described that the overall concept in myofascial anatomy is to trace grains and lines of the muscle and fascia while searching for straps, slings, and tensional lines, which extend farther than in a solitary muscle. Privileged to train directly with Ida Rolf (Rolfing), Tom Myers developed the Anatomy Trains concept, which is now validated by the researchers mentioned. An alternate name is emerging—*myokinetic chain* (Stecco, 2004).

It is likely that innervated fascia is maintained in a taut resting state called *fascial tone,* which refers to the different muscular fibers that pull on it (think "trampoline"). Fascial tone provides stability, supports tensegrity, and therefore becomes a mechanism of force transmission and potentially a communication network somewhat like a spider web. A spider can feel the vibrations and pulls and tugs on its web, alerting it that something has touched the web. The endomysium appears to be involved with transmission of contractile forces from adjacent muscle fibers within fascicles to prevent overstretching. The perimysium and the epimysium transmit mechanical forces through interconnected fascial units (myokinetic chains). Myofascial tissues connect muscles mechanically to neighboring muscular and nonmuscular structures (Yucesoy, 2010).

Free nerve endings and receptors within the fascial tissue sense any variation in the shape of the fascia and therefore any movement of the body, whenever it occurs (Stecco et al., 2007). Deep fascia is designed to sense and assist in organizing movements and plays a proprioceptive role. At the same time, the larger nerve fibers are often surrounded by loose connective tissue, which isolates the nerve from the traction to which the fascia is subjected.

Whenever a body part moves in any given direction, a myofascial, tensional rearrangement is evident within the corresponding fascia. Sensory nerve receptors embedded within the fascia are stimulated, producing accurate directional information that is sent to the central nervous system. Changes (too loose/too tight/twisted) in the gliding of the fascia will cause altered movement and tissue adaptation.

Robert Schleip directs the Fascia Research Project at Ulm University, Germany, and serves as Research Director of the European Rolfing Association. Schleip (2003) indicates that fascia is embedded with sensory receptors called *mechanoreceptors.* The presence of these receptors makes fascia a sensory organ with free nerve endings that respond to mechanical force stimulation. Massage is a form of mechanical force stimulation. Schleip et al. (2006) indicate that when connective tissues are out of balance, resulting in soft tissue strain, mechanoreceptors in the fascia can trigger changes in the autonomic nervous system.

Mechanical Stimulation and Interfascial Water

The European Fascia Group (Schleip et al., 2006) found that when fascia is stretched, water is squeezed out, causing complex and dynamic water changes. Water in our bodies has different physical properties from ordinary water because of the presence of proteins and other biomolecules in the water. Research is now providing insight into the behavior of water that interacts with protein in the human body. Proteins change the properties of water to perform particular tasks in different parts of our cells.

In response to mechanical stimuli, smooth muscle–like contraction and relaxation responses of the whole tissue occur, creating squeezing and refilling effects in the semiliquid ground substance. Sommer and Zhu (2008) note that interfascial water plays a key part in what is termed *protein folding,* the process necessary for cells to form their characteristic shapes, and that nanocrystals are a part of this process, and that these are influenced by light. "In the course of a systematic exploration of interfascial water layers on solids, we discovered microtornadoes, found [as] a complementary explanation [of] the surface conductivity on hydrogenated diamond, and arrived at a practical method to repair elastin degeneration using light."

Pollack, a leading researcher in this field, and associates have shown that water at times can demonstrate a tendency to behave in a crystalline manner (2010). He has discussed interfascial water in living cells known as *vicinal (crystalline) water*. Interfascial water exhibits structural organizations that differ from those of common bulk water. Vicinal water seems to be influenced by structural properties that characterize the cell.

Several years ago, Klinger et al. (2004) showed that the water content of fascia partially determines its stiffness, and that stretching or compression of fascia (as occurs during almost all manual therapies) causes water to be extruded (as with squeezing of a sponge), making the tissues more pliable and supple. After a while, the water is taken up again, and stiffness returns, but in the meantime, structures can be mobilized and stretched more effectively and comfortably than when they were densely packed with water.

Klinger et al. (2004) measured wet and dry fresh human fascia and found that during an isometric stretch, water is extruded, refilling during a subsequent rest period. As water extrudes during stretching, temporary relaxation occurs in the longitudinal arrangement of collagen fibers. If the strain is moderate, and no microinjuries occur, water soaks back into the tissue until it swells, becoming stiffer than before.

Research suggests that tissue response to manual therapy may relate to the sponge-like squeezing and refilling effects noted in the semiliquid ground substance of connective tissue.

Muscle energy technique–like contractions and stretches almost certainly have similar effects on the water content of connective tissue, as do myofascial release methods and the multiple force-loading elements of massage.

According to Langevin et al. (2005), it is the dynamic, cytoskeleton-dependent responses of fibroblasts to changes in tissue length that have important implications for our understanding of normal movement and posture, as well as therapies using mechanical stimulation of connective tissue, including physical therapy, massage, and acupuncture.

Mechanical Stimulation Research Results

- 80% of main trigger points lie on points located on a meridian (Wall & Melzack, 1990; Langevin & Yandow, 2002).
- Meridians may be fascial pathways; the fascial network represents one continuum from the internal cranial reciprocal tension membranes located inside the skull to the plantar fascia of the feet, similar to the interconnected pathway of meridians (Langevin & Yandow, 2002).
- Trigger points and acupuncture points may signify the same phenomenon (Kawakita et al., 2002).
- Acupuncture points and many effects of acupuncture seem related to the fact that most localized Ah shi points lie directly over areas of fascial cleavage (Langevin et al., 2001).
- Acupuncture points and most trigger points are structurally situated in connective tissue. The fascia network of the human body may be the physical substrate represented by the meridians of traditional Chinese medicine (TCM) (Bai et al., 2011).
- A cellular network of fibroblasts within loose connective tissue that occurs throughout the body may support yet unknown body-wide cellular signaling systems, which influence integrative functions at the level of the whole body (Langevin et al., 2004).
- Temporomandibular joint dysfunction may play an important role in the restriction of hip motion experienced by patients with complex regional pain syndrome, indicating a connectedness between these two regions of the body (Fischer et al., 2009).

MYOFASCIAL TRIGGER POINTS

Ongoing research is beginning to clarify our understanding of trigger points; however, the phenomenon remains unclear. Simons' Integrated Hypothesis (2008) describes a complex process of trigger point formation and perpetuation. In the trigger point region, sensitized nociceptors lead to local and referred pain because of excessive acetylcholine (Ach) leakage at the motor endplate, which results in sarcomere shortening (Niddam et al., 2007). Motor dysfunction of the myofascial tissue forms a constant, discrete hardness, usually palpable as a nodule in a taut band within the belly of the muscle, and increased pain and acidic inflammation–related sensitizing biochemicals at the trigger point site (Shah & Gilliams, 2008; Shah et al., 2008). Tissue texture is altered, and compromised capillary circulation occurs. This leads to local hypoxia and/or tissue damage. A positive feedback loop occurs. Trigger points have been identified by sonograph and on magnetic resonance imaging (Kuan, 2009; Sikdar et al., 2009).

Latent points are trigger points that are not actively causing referred pain but that may interfere with motor function (Ge et al., 2008); if contributing to the ongoing symptom pattern, they should be addressed.

Research points toward a holistic role for the mechanical distribution of strain in the body that goes far beyond merely dealing with localized tissue pain. Creating an even tone across the bones and myofascial component and, further, across the entire fascial net can have profound implications for health–both cellular and general. The goal for massage is to support balance in the myofascial systems.

Classifications of fascial layering are artificial because the tensegric nature of fascia is seen as one large, interconnected, three-dimensional microscopic dynamic grid structure that connects everything with everything. Through the fascial system, if you pull on the little toe, you affect the nose, and if the structure of the nose is dysfunctional, it can pull anywhere in the body, including the little toe.

Although fascia generally orients itself vertically in the body, it will orient in any directional stress pattern. For example, scar tissue may redirect fascial structures, as can **trauma**, repetitive strain patterns, and immobility. This redirection of structural forces occurs as a result of compensation patterns. During physical assessment, the body appears "pulled" out of symmetry, or stuck.

Three or four transverse fascial planes are present in the body (depending on the resource you use). They are located at the cranial base, the cervical thoracic area, the diaphragm, and the lumbar and pelvic floor areas. Transverse planes are available for joints as well.

MYOFASCIAL/CONNECTIVE TISSUE DYSFUNCTION

Myofascial/connective tissue dysfunction compromises the efficiency of the body, requiring an increase in energy expenditure to achieve functioning ability. Fatigue and pain often result. Fascial shortening and thickening restrict movement, and the easy undulations of body rhythms and **entrainment** mechanisms are disturbed. Twists and torsions of the fascia bind and restrict movement from the cellular level outward to joint mobility. This binding can be likened to ill-fitting clothing or, more graphically, "fascial wedgies." The dysfunctions are difficult to diagnose medically, are not apparent with standard medical testing, and are a factor in many elusive chronic pain and fatigue patterns. They can disrupt athletic performance demands.

Healing of damage to body tissues requires the formation of connective tissue. In the first stages of healing, the inflammatory response is one trigger that generates the healing process. When the inflammatory response does not effectively resolve itself, more new tissue than is needed forms, and adhesions or fibrotic tissue develops. An adhesion is an attachment of connective tissue to structures not directly involved with the area of injury. Fibrosis is abnormal tissue formation, often in response to increased protein content in stagnant edematous tissue. Massage can be used to effect chronic inflammation, adhesion, and fibrotic tissue formation. Forces are applied to adhesions and fibrotic tissue, creating mild inflammation to stimulate connective tissue remodeling.

Connective tissue dysfunction usually is suspected as a factor in disorders older than 12 weeks, especially if the inflammatory response and the muscle tone patterns have not effectively resolved during normal healing.

Two basic massage approaches are used to address connective tissue dysfunction and, more important, to prevent dysfunction from occurring:

1. Some methods address the ground substance, which is thixotropic, meaning that the substance liquefies on agitation and reverts to a gel when standing. Ground substance is also a colloid. A colloid is a system of solids in a liquid medium that resists abrupt pressure but yields to slow, sustained pressure. (Think "silly putty" or "clay.")
2. Other methods address fibers contained within the ground substance. These fibers may be collagenous (rope-like), elastic (rubber band–like), or reticular (mesh-like).

Methods that primarily affect the ground substance have a quality of slow, sustained pressure and agitation. Use of shearing, bending, and torsion forces and tension (tensile stretch) applied during massage adds energy to the matrix, softening it and encouraging rehydration. Most massage methods can soften the ground substance as long as the application is not abrupt.

Thermal influences from repeated loading and unloading create hysteresis, which is the process of energy loss due to friction when tissues are loaded and unloaded. On/off application of compression and oscillation methods that are intense enough to load tissues are often used. Heat will be produced during such a sequence, affecting the viscosity of the ground substance. The increase in pliability is due to the thixotropic nature of connective tissue ground substance through the introduction of energy by the application of forces, particularly shear and torsion, which cause a gel to become less viscous, because the tissue is hydrophilic and attracts water. Attention to these methods and outcomes is supportive of athletic massage goals.

Because of the water content of connective tissue, the balance of fluid flow, appropriate hydration, and principles of fluid dynamics in the body point to the importance of applying effective massage to address fluid movement in the body. Thermal or warming modalities support this process.

The fiber component of connective tissue is affected by methods that elongate fibers past the elastic range (i.e., past the normal give) into the plastic range (i.e., past the bind or point of restriction). For chronic conditions, an acute inflammatory response can be created by using massage to create minor rupture of collagen fibers, leaving free endpoints. These endpoints initiate an inflammatory response and synthesis of collagen by fibroblasts. The collagen is deposited to reunite the endpoints. The newly formed tissue has low tensile strength, is more susceptible to forces imposed, and can be encouraged to change structure, including increased or decreased tissue density, direction, and layering. Continued massage applications serve to influence tissue direction, length, and pliability, and to support effective healing. The positive therapeutic objective is to create therapeutic inflammation to encourage adaptation to controlled damage. Methods used to create the therapeutic inflammatory process are intense and may be interpreted as pain. The method used most often is friction (shear force).

Fascial restrictions can create abnormal strain patterns that can crowd or pull the osseous structures out of proper alignment. This results in compression of joints, producing pain and/or movement dysfunction. Neural and vascular structures can become entrapped in these restrictions, causing neurologic or ischemic conditions. Shortening of the myofascial fascicle can limit its functional length, reducing its strength, contractile potential, and deceleration capacity.

After injury, two separate processes may be occurring simultaneously: scar tissue development within traumatized tissues, and fibrosis in surrounding tissues caused by the presence of an inflammatory mediator. According to Langevin and Sherman (2007), fear of pain related to movement leads to a cycle of decreased movement, connective tissue remodeling, inflammation, and nervous system sensitization, which results in further decreased mobility. The mechanisms of a variety of treatments, such as massage, may reverse these abnormalities by applying mechanical forces to soft tissues (Chaitow & DeLany, 2002).

Based on a tensegrity principle (everything is connected, like a spider web), direct or indirect connections between fasciae seem to allow the transfer of tension over long distances. Massage applied to deform (change the shape) and stretch the soft tissue has an effect on the electrical and mechanical activities of other muscles not being massaged, but still indirectly connected to the massaged tissue. Massage therapy appears to influence muscle motor tone not only by massaging directly on the tissue, but also by indirectly affecting another distant soft tissue structure (Kassolik et al., 2009).

These concepts are useful for massage practitioners who work with athletes and other performers, in whom flexible and well-organized fasciae and myofascial relationships enhance performance and reduce the incidence of injury. Because the living tensegrity network is both a mechanical and a vibratory network, restrictions in one part have both structural and energetic consequences for the entire organism.

Various fascia-targeted techniques used in massage and other bodywork methods contain the same components. Any form of application that deforms (changes the shape of) tissue will affect fascia. All tissue compression, twisting, and stretching approaches may influence fascia. During massage, the therapist finds the area of tightness/bind where normal sliding of fascia does not occur, and some sort of mechanical force is applied to the area, allowing tissues to normalize by becoming more pliable, stimulating increased lubrication, changing water content, and sending signals to adjacent and distant areas of the body. It is likely that many more effects are waiting to be identified through the research process.

The more elastic connective tissue is present around a joint, the greater is the range of motion in that joint. Paoletti (2002), Stecco (2004), and Stecco et al. (2006) hypothesize that the deep fascia transmits forces between two adjacent joints and between synergic muscle groups, supporting the concepts of myokinetic chains.

The endocannabinoid (eCB) system, similar to the endorphin system, is involved in modulation of pain and inflammation. Endocannabinoid chemicals are produced in the body, and compounds in the cannabis plant causes similar responses, just as morphine creates effects similar to those produced by endogenous endorphins. The endocannabinoid system plays an important role in regulating a variety of physiologic processes, including appetite control, energy balance, pain perception, and immune responses. The endocannabinoid system has also been implicated in the regulation of bone metabolism (McPartland, 2008).

According to McPartland (2008), eCB reduces inflammation in myofascial tissues and plays a role in fascia reorganization. Evidence suggests that the eCB system may help resolve myofascial trigger points, and even may address pain that is resistant to treatment (Jhaveri et al., 2007); (Guindon & Hohmann, 2008). Studies of endogenous cannabinoids (endocannabinoids) have demonstrated that they are present in most tissues, and that in some pain states, such as neuropathic pain, levels of endocannabinoids are elevated at key sites involved in pain processing. Norrbrink and Lundeberg (2011) found massage to be effective in the management of neurogenic pain. This may become an important benefit if a connection is present between massage effects and the endocannabinoid system of the body. The eCB system is also influenced by exercise (Sparling et al., 2003).

Manipulation of fascial tissues by equiaxial stretching, which affects fibroblasts and myofibroblasts, has revealed that fascia, chondrocytes, and synoviocytes found in cartilage and joint membrane adipocytes in the superficial fascia and keratinocytes in the skin increased activity of the endocannabinoid system (McPartland, 2008). Because mechanical forces imposed on tissue by massage essentially manipulate the tissue in a similar manner as equiaxial stretching, it is logical to expect that massage would affect the endocannabinoid system by increasing the effects of this system. As with most massage therapy–related research, it is necessary to continue to study this area with a quality research design before definitive statements can be made, but the preliminary findings are exciting. Because management of pain and inflammation is a major goal of massage for athletes, it is logical to factor the effects of an unregulated endocannabinoid system into the goals for massage. Additionally, the immune system is supported, as is the appetite, which is important to the athlete.

MALE AND FEMALE HORMONE EFFECTS ON CONNECTIVE TISSUE

Connective tissue in the body is influenced by sex hormones. This information begins to explain why female athletes experience an increased frequency of ligament injuries. It appears that variation in estradiol and progesterone levels during the menstrual cycle influences ligament laxity and stiffness, and that estrogen receptors are found in tendon and ligament fibroblasts (Kjær & Hanse, 2008; Park et al., 2009; Moreno-Lorenzo et al., 2011).

Increased laxity may explain why anterior cruciate ligament (ACL) injury is so common in female athletes. Female hormone levels are related to increased knee joint laxity and decreased stiffness at ovulation.

KEY POINTS

- Massage benefits may occur when we normalize tissues that are tense/tight/deformed/twisted/compressed by introducing mechanical forces (pulling, pressing, bending, twisting) into tissues of the body using massage, stretching, mobilizing, etc.
- The fascia is everywhere, connecting everything together so that the body functions as one integrated unit instead of as individual parts. We still do not know specifics about the massage application that best influences the fascia.
- Endocannabinoids are stimulated by some fascial methods. Focused tension (stretching) of the tissues currently appears to be the most effective mechanical force to influence fascia.
- We think that the force applied during massage needs to move the tissue until it binds, and at that point, just a bit more force is applied, holding it there.
- The current range reported for how long force should be applied is from 15 seconds to 3 minutes.
- Right now, we just do not know how often force needs to be applied, but expert opinions range from daily to weekly. These opinions may be more related to the way massage is practiced, following the "best to get a massage once a week" process.
- Manipulation of the fascia also affects the endocannabinoid system, which supports the premise of reduction of pain and inflammation.
- Connective tissue may be more lax or stiffer, which is determined by sex hormone levels.

FLUID MOVEMENT—BLOOD AND LYMPH

Objective

1. Understand and describe massage outcomes based on known and theoretical physiologic mechanisms.

The adult human body is approximately 70% water. This water, or fluid, is usually named for the tubes or compartments that contain it (e.g., lymph for lymph vessels). Fluids include blood in the vessels and heart, lymph in the lymph vessels, synovial fluid in the joint capsules and bursal sacs, cerebrospinal fluid in the nervous system, and interstitial fluid that surrounds all soft tissue cells. Water is found inside all cells (intracellular fluid) and is bound with glycoproteins in connective tissue ground substance. The ratio of water in connective tissue helps to determine its consistency. Just as elsewhere, water in the body moves in waves through the action of pumps, which include the heart, the respiratory diaphragm, the smooth muscle of the vascular and lymph systems, and the rhythmic movement of muscles and fascia. Water moves along paths of least resistance from high pressure to low pressure and flows downhill with gravity. Water moves at differing speeds according to other variables present, and its properties must be considered when massage methods are applied.

CIRCULATION

Circulation may be affected by massage, but the research is sparse. Castro-Sánchez et al. (2009) found that connective tissue massage improves blood circulation in the lower limbs of type 2 diabetic patients at stage I or IIa and may be useful in slowing the progression of peripheral artery disease. A different study led by Castro-Sánchez (2009) indicated that a combined program of exercise and massage improves arterial blood pressure in persons with type 2 diabetes with peripheral arterial disease. Walton (2008) investigated myofascial release techniques in the treatment of primary Raynaud's phenomenon and found that releasing restricted fascia using myofascial techniques may influence the duration and severity of vasospastic episodes experienced with this condition. Massage appears to cause an increase in peripheral blood flow in treated areas, as well as in adjacent not-massaged areas. Areas massaged and adjacent areas are significantly warmer for over 60 minutes owing to increased peripheral blood flow (Sefton et al., 2010).

Massage may reduce blood flow in tissues as well. It was found that massage (gliding and kneading specifically) may impair tissue recovery following strenuous exercise by mechanically blocking blood flow (Wiltshire et al., 2010).

EXERCISE AND LACTIC ACID

Another area of research involves exercise and lactic acid. Lactic acid does not actually exist as an acid in the body; it exists in another form called *lactate*. It is a myth that lactic acid is the cause of stiffness felt after a sporting event, such as a marathon, and that massage can flush it out. Another misconception is that lactate is responsible for acidifying the blood, thereby causing fatigue and that burning sensation during prolonged exercise. The truth is that lactate is actually an important fuel that is used by muscles during prolonged exercise (Messonnier et al., 2006). Lactate released from the muscle is converted in the liver to glucose, which then is used as an energy source. So rather than cause fatigue, it actually helps to delay possible lowering of blood glucose concentration–a condition called *hypoglycemia*.

DELAYED-ONSET MUSCLE SORENESS

Postexercise stiffness, called *delayed-onset muscle soreness* (DOMS), is due most often to damage to the muscle and does not result from an accumulation of lactic acid or lactic acid crystals in the muscle. After unaccustomed exercise that results in DOMS, levels of an enzyme called *creatine kinase* increase, indicating that muscle damage has occurred. This type of tissue damage occurs in the form of tiny microscopic tears in the muscle. Hydroxyproline, an amino acid produced during the breakdown of collagen, is also present, indicating that connective tissue in and around muscle structures is also disrupted. This information shows that stiffness results from muscle damage and breakdown of connective tissue.

Inflammation occurs as part of the normal healing process. Signs of inflammation include heat, redness, swelling, and pain. One theory is that inflamed and swollen muscle fibers press on pain receptors (think "overfilled water balloon") and alert the brain to register pain. Another theory suggests that cells called *phagocytes* that come to clean up the damaged tissue further damage the tissue, which leads to pain. Still another theory is based on the premise that free radicals (molecules that are highly reactive and harmful in the body) produced by inflammatory cells aggravate already existing damage, causing pain. Most likely, a combination of all of these factors contributes to the pain of DOMS. Use of massage applications to target lymphatic drainage may reduce the increase in fluid pressure in the tissue caused by the swelling aspect of the inflammatory response. If this does actually occur, a decrease in pain and stiffness should follow, but this hypothesis remains unproved.

Bakowski et al. (2008) and Zainuddin et al. (2005) indicate that massage was effective in alleviating DOMS by approximately 30% by reducing swelling. They found that massage treatment had significant effects on plasma creatine kinase activity, with a significantly lower peak value at 4 days post exercise. However, despite these changes, massage application had no effects on muscle function. In a different study, Bakowski et al. (2008) found that massage administered 30 minutes after exercise could have a beneficial influence on DOMS by reducing soreness but without influence on muscle swelling and range of motion. Massage applied too aggressively can actually interfere with the recovery process because of the potential for even more tissue damage, which then triggers the inflammatory response and more swelling.

LYMPHATIC MOVEMENT

It is even more difficult to justify massage for lymphatic movement. In lymphedema caused by damage or removal of collecting trunks, lymph is present only in the subepidermal (just under the skin) lymphatics, whereas the bulk of stagnant tissue fluid accumulates in the subcutaneous tissue and above and beneath muscular fascia. These findings should be useful for designing pneumatic rhythmic pumping devices that wrap around the edematous limb, leading to rational manual lymphatic drainage in terms of sites of massage and level of applied external pressures. Manual lymph drainage after treadmill exercise was associated with a faster decrease in serum levels of muscle enzymes. This may indicate improved regenerative processes related to structural damage of muscle cell integrity (Schillinger et al., 2006). Lacomba et al. (2010) reported that physiotherapy (exercise and manual lymph drain) could be an effective intervention in the prevention of secondary lymphedema for at least 1 year after surgery for breast cancer involving dissection of axillary lymph nodes.

Authors of the study titled "Systematic Review of Efficacy for Manual Lymphatic Drainage Techniques in Sports Medicine and Rehabilitation: An Evidence-Based Practice Approach" sum up the evidence for massage effects on lymph movement by commenting that manual lymphatic drainage techniques remain a clinical art founded upon hypotheses, theory, and preliminary evidence (Giampietro et al., 2009). Lymphatics supplying skeletal muscle are rhythmically compressed during movement and cardiac and respiratory functions. It is interesting to note that active muscle contraction is required to effect lymphatic movement. Passive tissue displacement does not support efficient lymphatic drainage; investigators have reported that respiratory activity promotes lymph formation, but mechanical ventilation does not (Negrini & Moriondo, 2011). These findings question whether manual forms of lymphatic drainage used when the client is passive are effective. Current research (Bongi et al., 2011; Castro-Sánchez et al., 2010; Lacomba et al., 2010; Duman et al., 2009) does support the effectiveness of manual movement of lymph. Kinesio taping (described in greater detail later in the chapter) shows promise for improving lymphatic movement (Białoszewski et al., 2009; Tsai et al., 2009).

KEY POINTS

- Based on current research, it is difficult to confidently state that massage influences the movement of body fluids, even though research seems to support that massage affects the water content of fascia.
- The main component of body fluid is water. It seems reasonable to expect that mechanical forces applied during massage will at the very least affect the fluid in a particular area during the time the tissue is being massaged.
- Squeezing and compressing fluid in tissue (massage) should help the body move and process various body fluids, but more research is needed before we can confidently claim a specific massage effect on blood and lymphatic movement.
- Although it is appropriate to use methods that are thought to influence blood and lymph movement, as massage professionals, we need to disclose that the methods appear to be clinically effective, but that research remains unable to prove the outcomes.

RESEARCH RELATED TO MASSAGE, TISSUE HEALING, AND MUSCULOSKELETAL PAIN

Objective

1. Understand and describe massage outcomes based on known and theoretical physiologic mechanisms.

Research provides varying levels of evidence for the benefits of massage therapy in different chronic pain conditions (Tsao, 2007). Existing research provides good support for the analgesic (reduced pain sensations) effects of massage for nonspecific low back pain, but only moderate support for such effects on shoulder pain and headache pain. Only modest, preliminary support has been found for use of massage in the treatment of mixed chronic pain conditions, neck pain, and carpal tunnel syndrome.

Studies suggest that cyclic stretching of fibroblasts contributes to antifibrotic processes of wound healing by reducing connective tissue growth factor (CTGF) production (Kanazawa et al., 2009). This finding may support the use of massage to manage scar tissue formation and promote pliability in scar tissue.

Ho et al. (2009) studied massage therapy (MT) for adhesive capsulitis (AC), shoulder impingement syndrome (SIS), and nonspecific shoulder pain/dysfunction. For SIS, no clear evidence suggests additional benefits of MT over other interventions. MT was not shown to be more effective than other conservative interventions for AC; however, massage and mobilization-with-movement methods may be useful in comparison with no treatment for short-term outcomes for shoulder dysfunction. In another study, it was determined that massage is safe and may provide clinical benefits for treating chronic neck pain, at least in the short term (Sherman et al., 2009).

Application of a single session of manual therapy (massage is a type of manual therapy) program produces a decrease in tension, anger status, and perceived pain and pressure pain thresholds in patients with chronic tension-type headache. In addition, an immediate increase in heart rate variability has been reported. **Heart rate variability (HRV)** is a physiologic phenomenon whereby the time interval between heartbeats varies. When people have greater heart rate variability, it is because a better balance between ongoing sympathetic and parasympathetic influences on the heart has been attained. Generally, people have greater heart rate variability when they are relaxed and when they are breathing in a regular or slow pattern (Toro-Velasco et al., 2009).

Arroyo-Morales et al. (2008) used electromyography (EMG) to evaluate and record electrical activity produced by skeletal muscles. They found that massage is beneficial when applied as a passive recovery technique after a high-intensity exercise protocol. This means that the muscles relax and a psychological state of relaxation occurs. However, this same response may cause short-term loss of muscle strength or a change in the muscle fiber tension-length relationship, leading to altered muscle function.

Vigorous exercise causes tiny tears in muscle fibers, resulting in an immune reaction that may lead to inflammation to repair injured cells. A small study performed by Justin D. Crane and associates (2012) found that massage applied to skeletal muscle that has been acutely damaged through exercise appears to be clinically beneficial in reducing inflammation and promoting mitochondrial biogenesis; mitochondria increase their ability to make adenosine triphosphate through this process. Researchers have screened tissues from massaged and unmassaged legs after exercise to compare their repair processes. Based on this study, it is known that massage affects the production of compounds called *cytokines,* which have a role in the inflammatory process. Massage also stimulates mitochondria inside cells that convert glucose into the energy essential for cell function and repair. According to research conducted by scientists from the Buck Institute for Research on Aging and from McMaster University in Hamilton, Ontario, massage dampened the expression of inflammatory cytokines within muscle cells, and the pain reduction associated with massage may involve the same mechanism as those targeted by conventional antiinflammatory drugs. This study also found that massage had no effect on muscle metabolites (glycogen, lactate), further dispelling the myth that massage removes lactic acid from muscle tissue.

Krzysztof Kassolik and associates (2009) conducted research to determine whether massage in one part of the body influences other parts of the body. They identified an electrical as well as a mechanical response of muscles connected indirectly by structural elements within the muscle being massaged. This finding affirms the results of studies discussed earlier regarding tensegrity.

Overall, it appears that a general, full-body massage can directly or indirectly influence many structures and functions to help the individual, including the athlete, in coping and restoring function. We may not be able to identify the results of individual specific applications because massage contains many different elements. Benefits can be derived from the quiet nurturing presence of the massage therapist, as well as from how long the massage lasts, the massage environment, unlimited variations in methods, pressure, and speed, and so forth. The well-performed, full-body massage is more like a tasty and nutritious cookie—ingredients all mixed together in the right proportions, baked at the correct temperature for the right amount of time, and served in a relaxing environment with time to enjoy the experience. It is important to remember that athletes need this approach as much as and maybe even more than others. Outcomes resulting from a massage application of this type serve as the foundation for recovery post physical (and mental) exertion.

KEY POINTS

Research supports massage to manage anxiety related to pain and to mood alteration, as well as pain thresholds and perception of pain. These benefits are important for athletes and for all of us. This statement allows us to circle back to the initial topic in this section—"General Massage Benefits and Safety"—and to key points for that section. We can expand what we now know about massage somewhat. Massage

- Appears to reduce stress.
- Is pleasurable.
- Improves perception of quality of life.

- Changes the shape of fascia.
- May influence the entire body even if only one area is massaged.
- May help move fluids around.
- May affect cellular functions involved in inflammation and cell repair.
- Is safe when provided in a conservative and general manner with sufficient nonpainful pressure.

SPORT-SPECIFIC RESEARCH

Objective

5. Adapt massage for athletes based on research evidence.

So far we have described the research that supports massage in providing health benefits for all individuals. As previously stated, these benefits serve as the foundation for massage for those involved in specific sport and fitness activity. In addition, questions specific to massage and athletes need to be addressed, such as these: When is massage best performed for the athlete? Are there any methods that should be avoided, and if so, when? What is the evidence for stretching in general and specifically as a massage therapy intervention? What evidence is available for adjunct methods that the massage therapist may use in conjunction with massage?

WHEN IS MASSAGE BEST GIVEN FOR OPTIMAL PERFORMANCE?

The research does not consistently support pre-event massage or massage before a physical exertion activity. Pre-event massage or massage applied within a few hours of physical activity appears to negatively affect muscle performance. Possible reasons include the following:

- Increased parasympathetic nervous system activity and a psychological state of relaxation
- Decreased afferent input with resultant decreased motor unit activation, resulting in transient loss of muscle strength or a change in the muscle fiber tension-length relationship (Arroyo-Morales et al., 2008; Arroyo-Morales et al., 2009; Arroyo-Morales et al., 2001).

Massage as a pre-performance preparation strategy seems to impair performance when compared with a traditional warm-up, although its combination with a normal active warm-up seems to have no greater benefit than active warm-up alone. Therefore, massage use before competition is questionable because it appears to play no effective role in improving performance or preventing injury. Massage appears to achieve the greatest benefit when used post activity after the cool-down (Fletcher, 2010; Goodwin et al., 2007; Weerapong et al., 2005). Massage appears to achieve the greatest benefit when used post activity (Goodwin et al., 2007; Weerapong et al., 2005).

FLEXIBILITY

Flexibility training, commonly referred to as *stretching*, has been thought to prevent injury and enhance sports performance. Research results on the effectiveness of stretching in preventing injury and promoting performance are mixed. A variety of researchers have found no benefit for pre-competition stretching (Molacek et al., 2010; Goldman & Jones, 2011; Kay & Blazevich, 2009; O'Sullivan et al., 2009; Franco et al., 2008; Witvrouw et al., 2004; Yeung & Yeung, 2001), and that it actually decreases the amount of force a muscle can produce (Behm et al., 2001; Cramer et al., 2004; Siatras et al., 2008). Winchester et al. (2009) reported that a single 30-second static stretch when held at the limit of toleration caused an inhibition in muscle strength, and that additional stretching reduced strength even further (McHugh & Cosgrave, 2010; McHugh & Nesse, 2008; Siatras et al., 2008). McHugh and Cosgrave reported that the general consensus is that stretching in addition to warm-up does not affect the incidence of overuse injuries (2010). Whether stretching is beneficial or detrimental may depend on the performance requirements. Athletes who require increased flexibility such as gymnasts or ballet dancers appear to benefit from pre-exercise stretching. However, for sports in which exaggerated range of motion is not required for performance such as cycling, running, tennis, and many others, no scientific data show a positive effect of stretching (Gremion, 2005). Muscle endurance may be diminished or may not be helped by stretching (Gomes et al., 2010; Winchester et al., 2009; Franco et al., 2008). Resistance-trained athletes do not appear to be influenced negatively and performance is not enhanced if static or proprioceptive neuromuscular facilitation (PNF) stretching is used when adequate rest is allowed before performance (Molacek et al., 2010).

The recommendation based on the research is that massage with or without stretching should be used after competition and during the recovery period.

When an increase in range of motion is beneficial, PNF stretching programs have been shown to be the most effective stretching technique for increasing range of motion (ROM); this can be explained by an increase in stretch tolerance (Mahieu et al., 2009; Sharman et al., 2009). The PNF method does show decreased muscle endurance. Strength and conditioning professionals may want to consider avoiding PNF stretching before activities requiring local muscular endurance performance (Gomes et al., 2010; Simão et al., 2010).

Trigger point therapies and a self-stretching protocol resulted in superior short-term outcomes as compared with a self-stretching program alone in the treatment of patients with plantar heel pain (Renan-Ordine et al., 2011). Other studies have not reported an advantage of one type of stretching method over another (Decoster et al., 2010).

Based on the research and on clinical experience, the following recommendations have been put forth for the various forms of stretching (specifically those described in Chapter 12). Avoid stretching combined with massage before competition. The athlete alone or with the help of an athletic trainer can use pre-competition stretching of muscle groups that are vulnerable to injury based on the history of the individual athlete and the demands of the sport (e.g., adductor strains for a hockey player with a history of groin and adductor muscle group shortening). When stretching is incorporated into postcompetition massage, recovery massage, and generalized care of the athlete, each jointed area should be assessed during the massage for available range of motion. Only areas that are hypomobile should be stretched, and the stretch should target restoration of normal joint function while not seeking to increase joint range beyond normal parameters. Stretching should not be used on joints that are hypermobile or that move beyond the normal physiologic range. If an athlete participates in a sport that mandates increased joint movement beyond normal parameters, stretching methods as presented in Chapter 12 should be used to support performance demands in a targeted application-based performance. For example, a baseball pitcher may require increased shoulder motion in the pitching arm.

KINESIO TAPING

Kinesio taping is the use of a specially designed elastic tape that moves and recoils. This tape is applied using various patterns. Kinesio taping is theorized to be a sensory method that supports joint function by affecting muscle function, lymphatic flow and local circulation, and pain perception.

A variety of studies involving the effects of Kinesio taping have reported no benefit related to injury prevention (Briem et al., 2011) or to strength and function (Chang et al., 2010; Firth et al., 2010; Fu et al., 2008; Słupik et al., 2007). Some benefit may be derived from the use of Kinesio taping for shoulder impingement syndrome (Kaya et al., 2011; Hsu et al., 2009) and for whiplash (González-Iglesias et al., 2009). A few studies have found that the bioelectrical activity of muscle was increased for up to 48 hours, but that if the tape was then left in place, muscle tone decreased to previous levels, indicating no long-term benefit (Słupik et al., 2007). Range of motion may be increased for truck flexion (Yoshida & Kahanov, 2007), and some evidence suggests that Kinesio taping is supportive of lymphatic movement; however (Białoszewski et al., 2009; Tsai et al., 2009). Specific training in taping methods is recommended.

MAGNETIC THERAPY

Use of magnets as an adjunct to other methods has little scientific support. However, magnetic healing has been part of healing traditions for eons. Currently, low-frequency pulsed electromagnetic fields have been shown to alleviate pain in arthritis by protecting and stimulating cartilage formation, supporting antiinflammatory actions of the body, and stimulating bone remodeling. This form of magnetic therapy could be developed as a viable alternative to arthritis therapy (Ganesan et al., 2009; Shupak et al., 2006). Evidence indicates that electromagnetic fields alleviate pain and accelerate recovery from soft tissue injury and can accelerate healing after bone fracture (Grote et al., 2007). Data suggest that low-frequency pulsed electromagnetic fields stimulate mood improvement in subjects with bipolar disorder and depression treatments (Robertson et al., 2004). Michael Rohan and colleagues (2004) ask, "But does this translate to the effects of using a magnet on an area for pain control?" Maybe.

HYPERBARIC OXYGEN THERAPY

Athletes are using hyperbaric chambers to shorten healing time of injuries and to support recovery. Hyperbaric oxygen therapy (HBOT) is the therapeutic administration of 100% oxygen at environmental pressures greater than one atmosphere. A Cochrane systematic review (Bennett et al., 2005) did not find enough evidence from comparisons tested within randomized controlled trials to establish the effects of HBOT on ankle sprain or acute knee ligament injury, and on experimentally induced DOMS. Some evidence suggests that HBOT may increase interim pain in DOMS.

KEY POINTS

- Research does not support massage immediately before competition for other than anxiety reduction.
- Research results on the effectiveness of stretching to prevent injury and to promote performance are mixed, and appear to lean toward little or no benefit, especially before competition.
- When an increase in range of motion is beneficial, proprioceptive neuromuscular facilitation (PNF) stretching programs have been shown to be the most effective stretching technique to increase range of motion (ROM); this can be explained by an increase in stretch tolerance.
- Only areas that are hypomobile should be stretched; the stretch should target restoration of normal joint function and should not seek to increase joint range beyond normal parameters.
- Stretching should not be used on joints that are hypermobile or that move beyond the normal physiologic range.
- Kinesio taping is the use of a specially designed elastic tape that moves and recoils and is theorized to be a sensory method that supports joint function by affecting muscle function, lymphatic flow, and local circulation, as well as pain perception.
- Evidence indicates that Kinesio taping is supportive of lymphatic movement.
- Low-frequency pulsed electromagnetic fields may alleviate pain, stimulating cartilage formation, supporting antiinflammatory action of the body, and stimulating bone remodeling.

- Hyperbaric oxygen therapy (HBOT) is the therapeutic administration of 100% oxygen at environmental pressures greater than one atmosphere. Benefits are mixed with small support for shortening of healing time.

SUMMARY

It is necessary to work with the athletic population based on an evidence-informed platform. Increased valid research helps the massage therapist better understand what massage can do to support a variety of therapeutic outcomes for the sport and fitness population. Being aware of the research findings supports an ongoing multidisciplinary process with other health professionals involved in the performance and rehabilitation post-injury care of athletes. There remain many mysteries about the therapeutic interaction between massage therapist and client. Research is continuing to open avenues for understanding. Professionalism demands that the massage therapist remain current with the trends and validity of massage application and other adjunct methods such as magnets and Kinesio taping that affect this group of individuals. We also need to be prepared to accept the information provided by high-quality research even when findings conflict with prior learning and beliefs, and we must be sufficiently research literate to make decisions about the validity of the research that may influence our professional practice.

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evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1 List some research findings that support massage for relaxation. Example: Massage application is slow.
2 List some current commonly accepted effects of massage. Example: neural stimulation.
3 Name specific conditions in which massage has been found beneficial. Example: delayed onset of muscle soreness.
4 Describe the interaction of relaxation, improved breathing, and cardiorespiratory and vascular function, as well as changes in connective tissue pliability. Example: Massage produces feelings of well-being that reduce physical awareness.
5 Explain how massage can prevent injury. Example: increases tissue pliability.
6 List the four general outcomes discussed in this chapter and provide a case example of each. Example: Performance/recovery—Athlete is a 22-year-old female collegiate volleyball player. The team is poised to win the championship in its division. The coach has indicated that everyone has to "step up" performance and wants to see everyone's personal performance plan.
7 Using each of your four case studies, identify the list of physiology mechanisms best targeted to achieve the client's outcomes. Example: To support performance and recovery, the following would be targeted: Increase ground substance pliability and fluid movement using compression, torsion, and tension force application; reduce sympathetic dominance and support parasympathetic dominance through entrainment using rhythmic, rocking, and deep compression.

CHAPTER

4

Kinesiology

OUTLINE

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1. Apply principles of kinesiology to sports massage outcomes.
2. Describe the relationship of connective tissue to normal and abnormal movement.
3. Explain the role of fascia.
4. Define joints.
5. Demonstrate normal and abnormal range of motion.
6. Describe two types of joint stability.
7. Identify joint capsule fibrosis.
8. Explain response to synovial membrane injury.
9. Describe the structure and function of cartilage.
10. Identify the location of bursae and explain bursitis.
11. Explain joint degeneration.
12. Demonstrate joint mobilization.
13. Describe the structure and function of the muscle organ.
14. Demonstrate three types of muscle actions resulting in five types of function.
15. Explain the muscle length-tension relationship.
16. Describe five reflexive muscle actions.
17. Define kinetic chain and multiplanar movement.
18. Explain and locate four muscular functional subsystems.
19. Explain full-body pronation and supination.
20. Define serial distortion patterns and synergistic dominance.

KEY TERMS

Acceleration
Adhesions
Agility
Agonists
Antagonists
Arthrokinematic Reflex
Balance
Bursa
Cartilage
Co-contraction
Concentric
Coordination
Deceleration
Eccentric
Endurance
Fascia
Force Couples
Force Stability
Form Stability
Global Muscles
Guarding
Isometric
Joint Mobilization
Joint Stability
Kinesiology
Kinetic Chain
Local Muscles
Lower Crossed Syndrome
Multiplanar Movement
Muscle Organ
Neutralizer
Phasic/Mover Muscle Group
Piezoelectricity

KEY TERMS—continued

Pronation Distortion Syndrome
Reciprocal Inhibition
Serial Distortion Pattern
Stability
Stabilizers
Synergist
Synergistic Dominance
Tonic/Postural/Stabilizing Muscles
Upper Crossed Syndrome

KINESIOLOGY

Objective

1. Apply principles of kinesiology to sports massage outcomes.

Athletes move; therefore, the massage therapist who works with athletes needs to understand kinesiology. **Kinesiology** for the purposes of this text is the study of body movement and the factors that limit or enhance the capacity to move, which affects performance. Kinesiology is a multidisciplinary science encompassing anatomy, biomechanics, and physiology. An understanding of kinesiology will become an integral part of the assessment process for athletes, beginning with identifying fitness-based normal function as a foundation. This knowledge supports massage application during sport-specific training programs to develop optimal performance function. Finally, an understanding of kinesiology is necessary to identify pathologic movement, compensation caused by injury, and the effects that injury has on movement. This chapter targets functional relationships among bones, connective tissues, joints, fasciae, and muscles.

As mentioned in Chapter 1, it is expected that the fundamental elements of anatomy and physiology are in place, and that you, the reader, will take the next step toward understanding the real element of kinesiology, which is movement. Movement is a process for athletes. Athletic movement begins with a stable, strong, yet dynamic and flexible posture. Athletes are constantly balancing necessary stability and strength with flexibility and agility.

Kinesiology is the science of the study of movement and of active and passive structures involved, including bones, joints, muscle tissues, and all associated connective tissues. Elements of kinesiology include the following:

- **Stability** is required to provide a stable base for functioning. Usually, stability concerns are focused on proximal musculature in the trunk, shoulders, and hips to allow for movement of the extremities. Stability is required before there can be balance.
- **Balance** is the ability to execute complex patterns of movement with the right timing and sequencing. Balance is essential to motor function, as is the ability to maintain one's center of gravity over the available base of support.
- **Coordination** is the efficient execution of a movement. Usually, coordination involves motor learning and practice.
- **Endurance** (lasting power) is based on efficiency and stamina.
- **Agility** is the ability to move and change direction and position of the body quickly and effectively while under control.

An important development in biomechanics research is the concept of the kinetic chain (also known as the kinetic link). This concept came out of mechanical engineering in the 1970s and was applied to biomechanics. The kinetic chain describes the body as a linked system of interdependent segments. By understanding their relationships to each other, we can maximize the effectiveness of massage application with an understanding of the importance of whole-body massage rather than isolated spot work. The diagram in Figure 4-1 illustrates the common areas of interrelated kinetic chain function. Follow the colored line to locate the interconnections.

Beginning from the understanding that the body moves in an integrated fashion, let's consider some of the individual elements, beginning with the integrative tissue–connective tissue.

CONNECTIVE TISSUE

Objectives

2. Describe the relationship of connective tissue to normal and abnormal movement.
3. Explain the role of fascia.

Chapter 3 presented the research on fascia. Now we will review and explore the relevance of the connective tissue anatomy and physiology to massage therapy application.

Connective tissue is made up of ground substance and fibers. Connective tissue consists of hard and soft tissues. It forms the structure of the organs and blood vessels and binds joints together through ligaments and joint capsules. It transmits the pull of muscles through connective tissue surrounding the muscles and the tendons. It forms tensegretic tension lines that transverse the body in many directions.

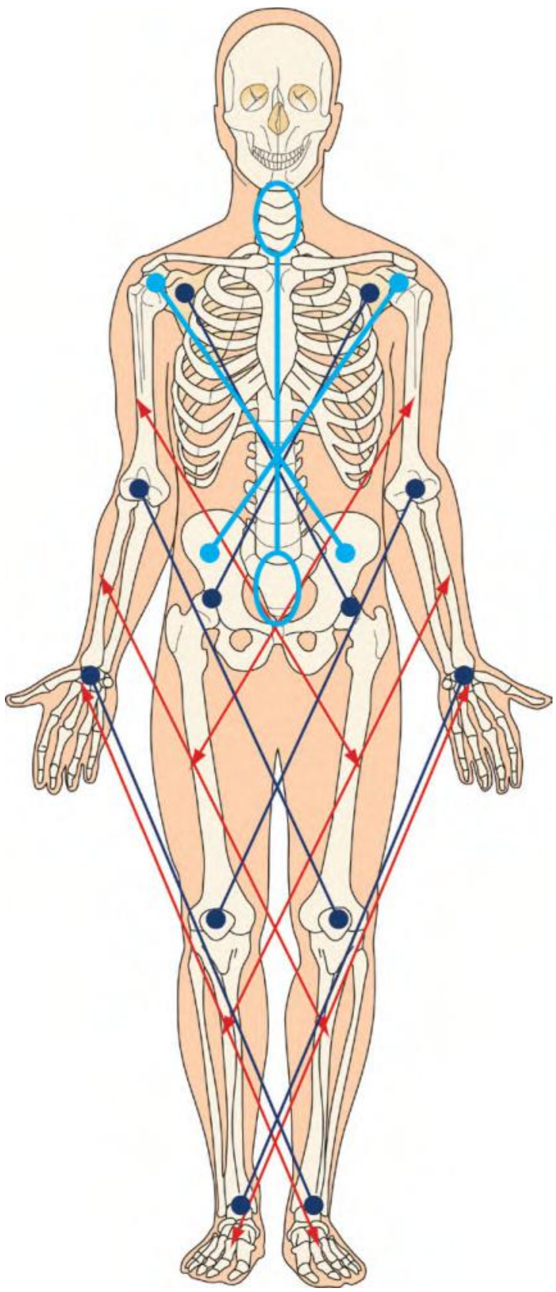


FIGURE 4-1 Areas of symmetry: arm-thigh; forearm-leg; hand-foot; shoulder-hip; elbow-knee; wrist-ankle; cervix-sacrum; shoulder girdle-pelvic girdle.

COLLAGEN

Collagen forms approximately 80% of tendons, ligaments, and joint capsules, and a large percentage of **cartilage** and bone, giving shape to the soft tissue. It forms the structural support of the skin, muscles, blood vessels, and nerve fibers. Normal stresses, in the form of exercise and activities of daily living, increase collagen synthesis and strengthen connective tissue. This is an important aspect of fitness, especially for the elderly.

Collagen stabilizes the joints through the ligaments, joint capsules, and periosteum by resisting the tension or pulling force transmitted through the joints by movement or gravity. Collagen transmits the pulling force of muscle contraction through the fascia within the muscle and the tendon attachment. The collagen fibers tend to orient to parallel and longitudinal alignment along the lines of mechanical stress imposed through loading of the tissue during activity. Normal gliding of collagen fibers is maintained by movement and lubrication from connective tissue ground substance.

Immobilization or lack of use decreases collagen production, leading to atrophy in the connective tissue and to osteoporosis in the bone. Without movement, collagen is laid down in a random orientation, with fibers packed close together and forming microadhesions. **Adhesions** are abnormal deposits of connective tissue between gliding surfaces (Figure 4-2). This atrophy with random orientation of fibers creates weakness in the tissue and instability of the associated joint. This condition is more common in those who are just beginning a fitness and performance regimen and increases injury potential. The aging process decreases the amount and quality of the collagen structure; therefore, exercise helps prevent age-related soft tissue dysfunction.

Excessive mechanical and repetitive stress results in excessive deposits of collagen, causing abnormal cross-fiber links and adhesions. The fibers pack closer together, lubrication is decreased, and the water content of ground substance is reduced. This in turn decreases the ability of fibers and fascicles to slide relative to each other. This condition is often called *fibrosis*. Adhesions and fibrosis create a resistance to normal electrical flow. This decrease in electrical currents conducted in the connective tissues interferes with the normal repair and rejuvenation process.

Athletes are prone to excessive mechanical stress during practices and performance activity and to repetitive strain from the athlete's specific activities, such as throwing, hitting, jumping, and running. Massage mechanically deforms the collagen fibers by introducing bind, shear, torsion, compression, and tension forces. **Piezoelectricity** is the ability of a tissue to generate electrical potentials in response to pressure of mechanical deformation. It is a property of most, if not all, living tissues. Piezoelectric potentials direct collagen fiber formation. Also, the negative charge in the soft tissue is increased, and this has a strong proliferative effect, stimulating the creation of new cells to repair an injured site.

Injury results in an acute inflammatory response. During the acute and subacute repair phases of the healing process, connective tissue fibers are laid down in a random orientation, instead of along normal lines of force. In essentially the same process of fibrotic change discussed earlier, the fibers pack closer together, forming abnormal cross-fiber links and adhesions. These adhesions can occur at every level of the soft tissue, including in the ligament or tendon adhering to the bone or between the fascicles, the fibers themselves, or individual muscle layers. In athletes, it is common to find first- and second-layer

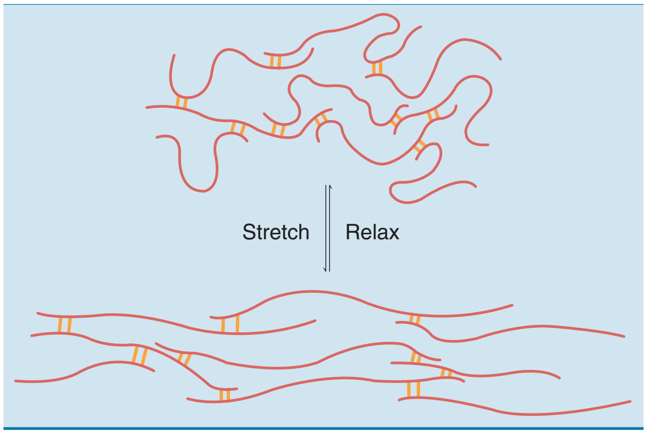


FIGURE 4-2 Adhesions are abnormal deposits of connective tissue between gliding surfaces. (From Meisenberg G: *Principles of medical biochemistry*, ed 3, St Louis, 2012, Saunders.)

muscle adhesions, such as gastrocnemius/soleus and pectoralis major/pectoralis minor.

Because adhesions decrease tissue extensibility, the tissue becomes less elastic, thicker, and shorter. Clients often feel stiff in the area of adhered and fibrotic tissue.

TENDONS

Tendons represent a continuation of connective tissue within the muscle. Tendons consist of long, spiraling bundles of parallel collagen fibers, oriented in a longitudinal pattern along the line of force stress; they are embedded in ground substance with a small number of fibroblasts. Tendons have a microscopic "crimp" or wave-like structure that acts like a spring, enabling them to withstand large internal forces. The junction where the muscle fibers end and the connective tissue that forms the tendon begins is called the *musculotendinous junction*. This area is vulnerable to injury.

Tendons may be cord-like, as in the Achilles tendon; may be seen as a flattened band of tissue, as in the rotator cuff; or may appear as a broad sheet of tissue called an *aponeurosis*, as in the attachment of the latissimus dorsi. They are surrounded by a loose connective tissue sheath. In areas of high pressure or friction, such as where tendons rub over the bones of the wrist and ankle, the tendon sheath is lined with a synovial layer to facilitate gliding. Tendon attaches to bone by weaving into the connective tissue covering of the bone called the *periosteum*. Tendons attach muscle to bone and transmit the force of muscle contraction to the bone, thereby producing motion of the joint. They also help to stabilize the joint and act as a sensory receptor through the Golgi tendon organs.

A strain is an injury to the tendon. It is a tearing of the collagen fibers at the musculotendinous junction, at the tenoperiosteal junction, or within the body of the tendon. Loss of normal motion in a tendon through injury or immobilization creates loss of collagen fibers and formation of adhesions between the tendon and surrounding structures, including the tendon sheath.

LIGAMENTS

Ligaments attach bones at joints, help to stabilize joints, help to guide joint motion, prevent excessive motion, and act as sensory receptors. Ligaments are composed of dense, white, short bands of nearly parallel bundles of collagen fibers embedded in a matrix of ground substance and a small number of fibroblasts. They contain some elastic fibers and a "crimp" structure, giving them greater elasticity, and are pliable and flexible. All ligaments surrounding the joints contain proprioceptors, mechanoreceptors, and pain receptors that provide information about posture and movement, which plays an important role in joint function by directing joint movement.

Under normal conditions, when the joint moves, the ligament is stretched and the crimp in the tissue straightens out. The ligament returns to its normal length when the joint returns to a neutral position. If tension or force is slowly applied to a ligament consistently and is sustained, the tissue will assume the new length because of its viscous nature. This condition can lead to overstretched, or lax, ligaments and compromises stability of the joint. Because ligaments stabilize joints and act as neurosensory structures, injuries to ligaments can create dysfunction of the joint and surrounding soft tissue. A reflex connection exists between the ligaments of a joint and surrounding muscles; this connection affects the motor tone of muscles. In the case of lax ligaments, tone in muscles reflexively increases to provide joint stability. Ligaments function to transmit mechanical forces created by muscle contraction; they cross the joint, supporting integrated function.

The joint capsule and ligaments typically respond to an injury by becoming stretched, with resulting joint instability. These structures can also shorten, creating loss of a joint's normal range of motion and joint stiffness. Immobilization causes ligaments to atrophy and weaken, changing the normal gliding motion of the joint. Ligaments can twist into abnormal positions. Irritation or injury of the ligaments usually causes a reflexive contraction or inhibition in the surrounding muscles. Muscle energy methods that address gait and firing pattern sequences can help restore normal function temporarily because the muscle is connected to the ligaments through a neurologic reflex. The condition will continue to occur because the instability of the joint is the underlying causal factor.

Injured ligaments can become thick and fibrous from increased collagen, abnormal cross-fiber links, and adhesions. This is especially common if inflammatory responses are slow to resolve or have remained chronic.

Massage applied to ligaments that have developed adhesions is performed across the direction of fibers to increase pliability and realign fiber structure. If ligaments are too lax, exercise rehabilitation can stimulate the production of new collagen and help restore normal integrity. Friction massage can be used to create small, controlled inflammation in the ligament structure to stimulate collagen production as well.

PERIOSTEUM

Periosteum is a dense, fibrous connective tissue sheath covering the bones. The outer layer consists of collagen fibers parallel to the bone and contains arteries, veins, lymphatics, and sensory nerves. The inner layer contains osteoblasts (cells that generate new bone formation). Repetitive stress can stimulate the inner layer of the periosteum to create bone outgrowths called *spurs*. This often occurs at the heel when the plantar fascia is short.

The periosteum weaves into ligaments and the joint capsule. Stretching of the periosteum provides mechanoreceptor information regarding joint function.

The periosteum also blends with the tendons, forming the tenoperiosteal junction, where the muscle pulls on the bone during joint movement. The sensory nerves in the periosteum are sensitive to tension forces. The periosteum also functions to transmit mechanical forces created by muscle contraction, supporting integrated function.

A common site of soft tissue injury is the tenoperiosteal junction. An acute tear or cumulative microtearing of the periosteum can cause the orientation of the collagen in the area to become random, leading to the development of abnormal cross-fiber links and adhesions. Massage can address this abnormal fibrotic developed at the tenoperiosteal junction. Friction is used to introduce small amounts of controlled inflammation. This results in an active acute healing process. When coupled with appropriate rehabilitation, more functional healing is the outcome.

FASCIA

Fascia is a fibrous connective tissue arranged as sheets or tubes. Fascia can be thick and dense, or it can consist of thin, filmy membranes. Fascia is connected throughout the body, creating a unified form. You can conceptualize fascia as duct tape or plastic wrap (Figure 4-3). However, we must remember that we now know that fascia is not a passive tissue. Research shows that fascia responds to and sends nerve signals. Recent research (see Chapter 3) indicates that there may be a proprioceptive component, as well as an active contractile component, to fascia based on myofibroblast cells and sensory receptors embedded in the fascia. We now know that fascia tone is more than thickness or thinness of the tissue and is controlled through neuroendocrine mechanisms. The implications for massage therapists, particularly sports practitioners, are significant because our approach to connective tissue function and dysfunction would be expanded. Along with methods used to produce increased pliability, length and slide application of massage would include nervous system functions as well. It is important to understand that at the same time that massage application is introducing mechanical forces such as tension and torsion forces into the tissues to change the more passive elements of fascia (i.e., ground substance, fiber alignment), the nervous system is also being stimulated.

Fascia functions by connecting, unifying, and separating structure while acting as a communication network based on the interconnect tensegric structure. Muscle fibers are embedded in fascia, not just wrapped in it, and a single muscle structure becomes a unified functional unit consisting of multiple muscles in an intertwined chain of a variety of fascia wrappings, tendons, ligaments, joint capsule structures, and periosteum, which are located up and down, spiral around, and flow through the body. Through these interconnected structures, the forehead is connected to the bottoms of the feet, the left wrist connects to the right ankle (and vice versa), and the left shoulder is connected to the right hip and down through the knee. Tom Myers calls these chains *myofascial meridians* (Myers, 2008).

Information from the Stecco group describes the chains as myofascial units that function as uniting elements between unidirectional myofascial units (myofascial sequences), and as connecting elements between body joints through myofascial expansions and retinacula (myofascial spirals; Stecco at http://www.fascialmanipulation.com/englishhome32.html).

Functionally, muscle cells bundled together rarely transmit full contraction force directly via tendons into the skeleton. Instead, contractile or tensional forces caused by muscle action are distributed onto fascia sheets. These sheets transmit forces to synergistic and antagonistic muscles, affecting not only the target joint, but also distant sites within the myofascial unit.

For example, the muscles gluteus maximus and tensor fascia lata both insert into the dense fascia sheet along the lateral thigh, called the *iliotibial tract*, which is part of the fascial sleeve of the thigh, called the *fascia lata.* The latissimus dorsi on the opposite side weaves into the lumbar dorsal fascia, creating the connection to the opposite shoulder. This interconnected myofascial unit influences low back stability, shoulder motion, and stiffness of the lateral hamstrings and quadriceps, while stabilizing and guiding knee motion and finally stabilizing the foot though the plantar fascia and other connective tissue structures that support the arches of the foot and the elastic spring action of the foot during walking, running, and jumping. How then can we say that the quadriceps primarily extends the knee when the entire unit works together? An expanded understanding of fascia/muscle units challenges the typical study of muscles based on origin, insertion, and function. This being said, we can still benefit from studying the forms and function of the myofascial component of the body.

Superficial fascia lies under the dermis of the skin and is composed of loose, fatty connective tissues. Deep fascia is dense connective tissue that surrounds muscles and

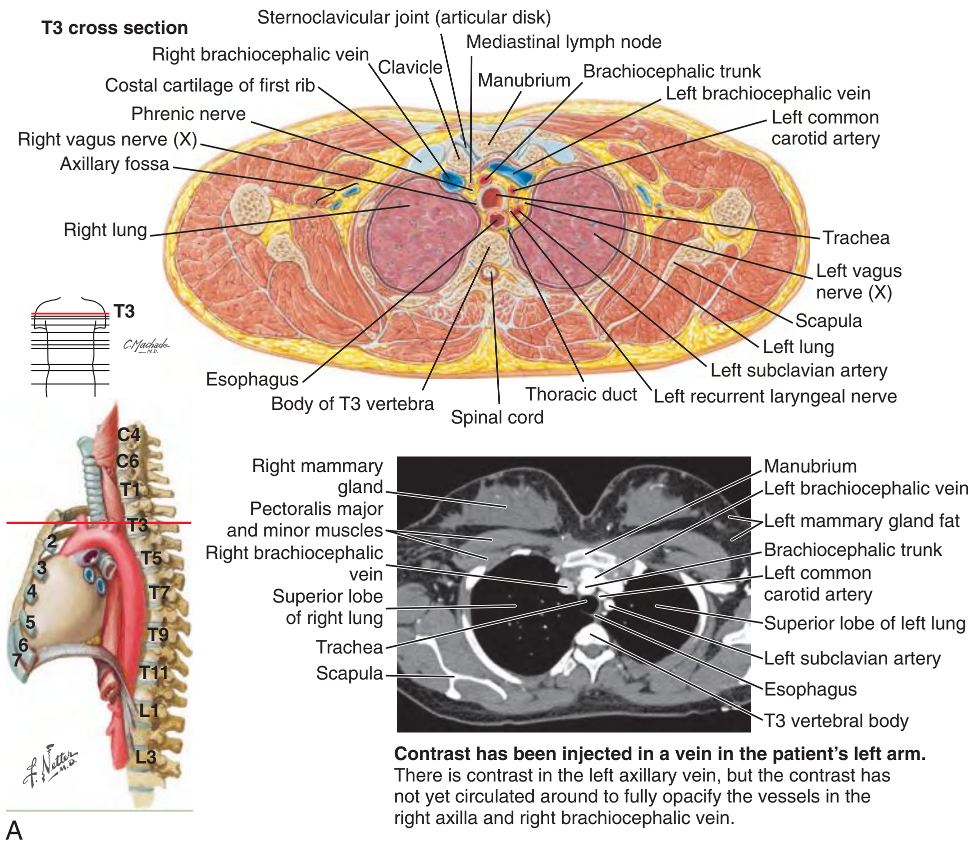


FIGURE 4-3 Fascia is connected throughout the body, creating a unified form. From head to foot, a continuum and unity are noted. **A,** Transverse view through thorax.

forms fascial compartments called *septa*, which contain muscles with similar functions. These compartments are well lubricated in the healthy state, allowing the muscles inside to move freely. At the same time, each layer is connected to the layer above and below by microscopic filaments with a wavy configuration that allow the sliding yet maintain connection and integrity between layers.

Fascia can tear, adhere, torque, shorten, or become lax, just as other connective tissue structures can, and it responds well to connective tissue massage methods, as described in Unit Two of this book.

Common sources of musculoskeletal pain are the deep somatic tissues, including periosteum, joint capsule, ligaments, tendons, muscles, and fascia. The most pain-sensitive tissues are the periosteum and the joint capsule. Tendons and ligaments are moderately sensitive, and muscle is less sensitive. This is an important awareness for massage therapists, who often are overly focused on muscle function as opposed to the total soft tissue system.

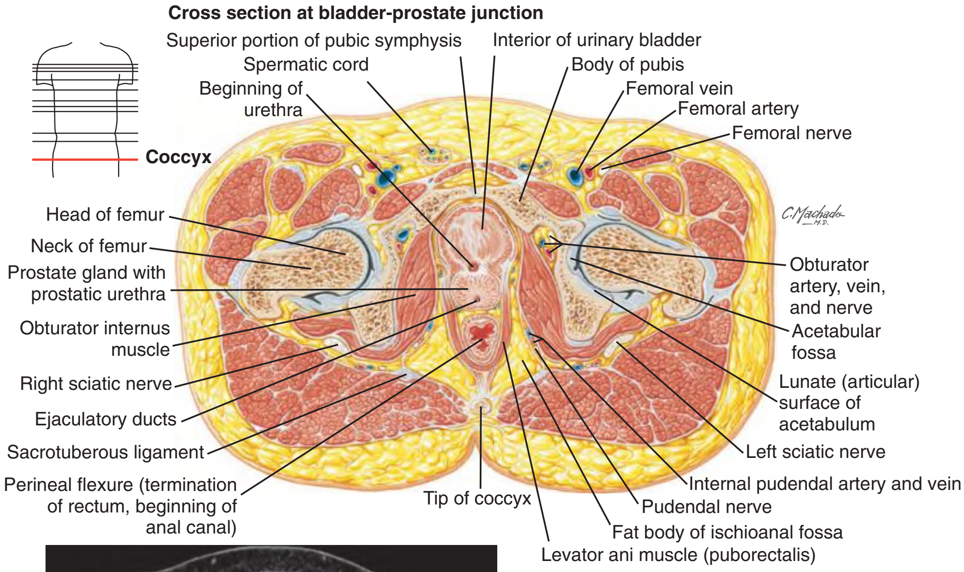
In general, mechanical forces applied during massage create heat within the tissues. This heat stimulates cellular activity and improves the lubrication of fibers by making the ground substance more fluid. Specific application of a massage approach to generate heat in the tissue can be used as a part of a warm-up activity. Strains and sprains of muscles, tendons, and ligaments are common in athletic activity and damage connective tissue. Fascial tone increases as part of protective guarding. With disuse and immobilization, the tissues become cool and the ground substance becomes thicker and more gel-like. Stiffness and aching, decreased circulation and nutrition, and decreased lubrication may result. Massage therapy can change the viscosity of ground substance from a gel to a more fluid state through the introduction of mechanical forces—that is, bend, shear, tension, compression, and torsion.

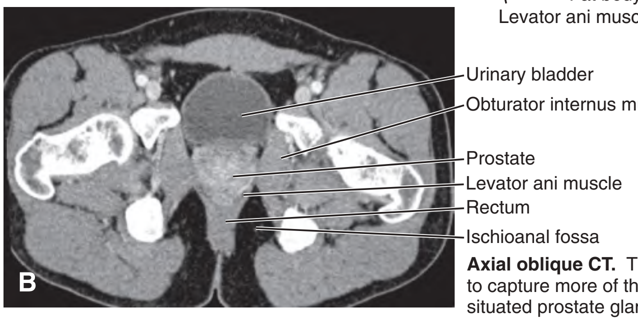
The active and passive tissue movement of massage stimulates the synthesis of ground substance and glycosaminoglycans (GAGs), promotes the circulation of blood and lymph, and supports ground substance pliability, creating greater lubrication to the tissue. Tissue movement also facilitates transport of nutrients and promotes the exchange of waste products.

Massage changes the shape of the fascia, which triggers response from the myofibroblasts; they contract similarly to smooth muscle cells and draw together, pulling the fascia taut and increasing stiffness.

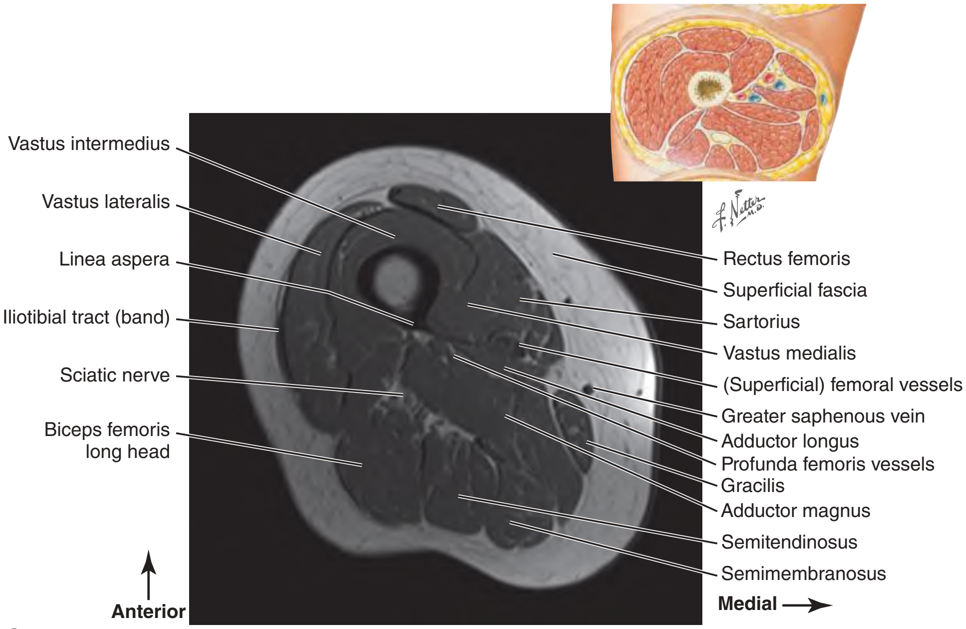
Effectively focused massage can do the following:

- Stimulate fibroblasts to repair the injured collagen
- Introduce mechanical forces to realign the collagen fibers to their normal parallel alignment





Axial oblique CT. The oblique angle is required to capture more of the bladder with the inferiorly situated prostate gland.



Middle right thigh MRI

FIGURE 4-3, cont'd **B,** Transverse view through hips and pelvis. **C,** Transverse view through thigh. (Netter illustration from www.netterimages.com. ©Elsevier Inc. All rights reserved.)

BOX 4-1 Normal Range of Motion for Each Joint

Remember that each person is unique, and that many factors influence available range of motion. Just because a joint does not have the textbook range of motion does not mean that what is displayed is abnormal. Abnormality is indicated by nonoptimal function. This can be a limit or an exaggeration in the "textbook normal" range of motion.

Available range of motion is measured from the neutral anatomic position (0). If 0 is listed first, this means that movement is away from neutral. If 0 is listed second, it means that the joint is moving toward neutral.

NORMAL VALUES (IN DEGREES)

Hip flexion 0-125
Hip extension 115-0
Hip hyperextension 0-15
Hip abduction 0-45
Hip adduction 45-0
Hip lateral (external) rotation 0-45
Hip medial (internal) rotation 0-45
Knee flexion 0-130
Knee extension 120-0
Ankle plantar flexion (movement downward) 0-50
Ankle dorsiflexion (movement upward) 0-20
Foot inversion (turned inward) 0-35
Foot eversion (turned outward) 0-25
Shoulder flexion 0-90
Shoulder extension 0-50
Shoulder abduction 0-90
Shoulder adduction 90-0
Shoulder lateral (external) rotation 0-90
Shoulder medial (internal) rotation 0-90
Elbow flexion 0-160
Elbow extension 145-0
Elbow pronation 0-90
Elbow supination 0-90
Wrist flexion 0-90
Wrist extension 0-70
Wrist abduction 0-25
Wrist adduction 0-65

From Fritz S: *Mosby's essential sciences for therapeutic massage,* ed 4, St Louis, 2013, Mosby.

- Introduce mechanical forces to separate tissue layers to support sliding
- Heat the tissue, affecting the fluidity of the ground substance
- Stimulate fluid distribution throughout tissue layering to promote normal tissue gliding
- Lengthen shortened tissue and increase ground substance pliability
- Create controlled focused inflammation to increase collagen proliferation, especially in lax structures. Proper rehabilitation must be combined with this approach for a beneficial outcome. Otherwise, the result can be increased adherence and scar tissue formation.
- Influence fascia tone related to myofibroblast contraction by changing the shape of tissue and altering autonomic nervous system function.

JOINTS

Objectives

4. Define joints.
5. Demonstrate normal and abnormal range of motion.

A joint, or articulation, is the junction between two or more bones of the skeleton that allows movement. Depending on joint type, the movement can be very small, as in cranial sutures and most evident in infants, or large, as in the ball and socket joint of the shoulder. The focus of this text will be on the synovial or freely movable joints of the body. Joint movement depends on the shape of the bones and articular surfaces where the bones meet, how ligaments cross the joint, and what type of movement is produced by muscles crossing the joint.

Simply, contraction of muscles crossing the joint causes the joint to move throughout its range of motion. Each specific joint has a normal range of motion that is expressed in degrees (Box 4-1). However, we now know that it is not that simple. The pulling forces created by contracting muscle cells are embedded in connected functional units unified by spans of connective tissue structures that are individually called *fascia*, *aponeuroses*, *tendons*, *ligaments*, and so forth. More than individual muscles, joint movements are caused by the distribution of force throughout these tissues.

Limited range of motion refers to a joint that has reduced ability to move. The reduced motion may signify a mechanical problem within specific joint structures; more often, it reflects some sort of binding within the myofascial continuum. Although limited joint function can be caused by diseases such as osteoarthritis and other types of arthritis, in the athlete, limits typically begin with changes in soft tissue, which ultimately can deteriorate, resulting in the pain, swelling, and stiffness associated with osteoarthritis and eventually degenerative joint disease.

Reflex control of muscles surrounding the joint is called the **arthrokinematic reflex**. The CNS (central nervous system) creates contraction or relaxation of the muscles to protect the joint. The arthrokinematic reflex coordinates agonists, antagonists, and synergists around the joint, as well as in other jointed areas, for gross movements and fine muscular control. Proper function of these reflex mechanisms is extremely important in posture, coordination, and balance; direction and speed of movement; position of the joint and body; and pain in the joint.

Irritation of pain receptors and mechanoreceptors typically causes the flexors of the joint to be facilitated and become short, tight, and hypertonic, whereas the extensors of the joint become inhibited or weak and long.

Irritation of joint receptors can lead to abnormalities in posture, muscle coordination, control of movement, balance, and awareness of body position. This is a major issue for athletes. Assessment and treatment of gait patterns and firing patterns and use of massage, including muscle energy methods, can support normal reflex functions (see Chapter 10).

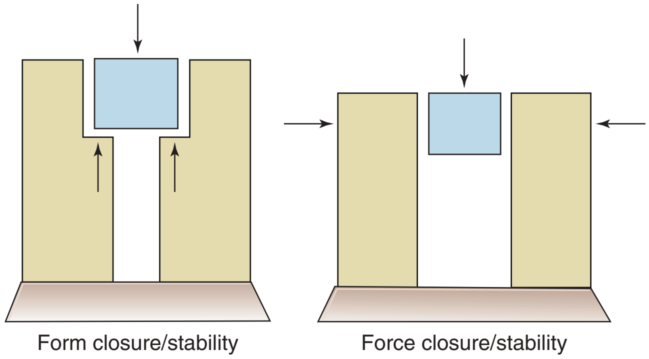


FIGURE 4-4 Form and force stability.

- Form closure/stability is dependent on the shape of the bones of the joint and the way everything fits together.
- Force closure/stability is the action of muscle contraction to stabilize the joint.
- Excessive form stability results in a stuck or fixed joint.
- Excessive force stability can result in excess form stability by jamming the joint surfaces.
- Decreased form stability results in increased muscle contraction to produce force stability.
- Decreased force stability results in strain on the joint capsule.

(From Fritz S: *Mosby's essentials of therapeutic massage,* ed 4, St Louis, 2013, Mosby.)

JOINT STABILITY

Objective

6. Describe two types of joint stability.

For a joint to perform a full and painless range of motion, it must first be stable. A rule to follow is stability before mobility, mobility before agility. Otherwise, abnormal forces move through the joint, leading to excessive wear and tear on articular surfaces. **Joint stability** is determined by

- The shape of the bones that make up the joint. This is **form stability**.
- Passive stability provided by the ligaments and joint capsule. This is also **form stability**.
- Dynamic stability provided by the muscles to produce stability. This is **force stability**.

If instability in the joint is caused by the form (bones, ligaments), then soft tissue methods will be only palliative. However, if force instability occurs in the joint as a result of muscle dysfunction, exercise and massage can be valuable (Figure 4-4).

It is important that muscle structures that cross a joint are balanced with appropriate contraction ability; otherwise, forces on the joint will create uneven stresses, leading to dysfunction and eventual degeneration of the cartilage.

When a joint is in the close-packed position, the capsule and the ligaments are tightest. In the least-packed position, the joint is most open, and the capsule and the ligaments are somewhat lax. Generally, extension closes and flexion opens the joint surfaces. Midrange of the joint is typically the least-packed position and is most vulnerable to joint injury (Tables 4-1 and 4-2).

John Mennell introduced the concept of *joint play*, which describes movements in a joint that can be produced passively but not voluntarily. In most joint positions, a joint has some "play" in it that is essential for normal joint function. (See joint play methods for assessment and correction of joint play dysfunction in Unit Two.)

JOINT CAPSULE PATHOLOGY

Objectives

7. Identify joint capsule fibrosis.
8. Explain response to synovial membrane injury.

Fibrosis or thickening of the outer layer of the joint capsule is caused by acute inflammation, irritation, inflammation caused by imbalanced stresses on the joint, and/or immobilization. A tight, fibrotic joint capsule results in compression of certain areas of the cartilage and degeneration of the joint surfaces.

The capsule and supporting ligaments may be stretched because of injury or excessive stretching during activity such as dancing and gymnastics. If loss of adequate motion results from immobilization, the fibrous layer of the joint capsule atrophies, and joint instability results.

The synovial membrane can become injured or dysfunctional because of acute trauma to the joint, cumulative stresses from chronic irritation caused by imbalanced forces on the joint, or immobilization. Although arthroscopic surgery may be performed to vastly improve results in a variety of joint injury treatments, the surgical procedure itself can involve trauma to the joint capsule when surgical instruments are inserted into the joint. Joint swelling occurs during inflammation. The swelling typically causes abnormal muscle function in controlling the joint. Immobilization, on the other hand, thickens the synovial fluid and causes an eventual decrease in the

TABLE 4-1 Least-Packed Positions of Joints

Joint(s)	Position
Spine	Midway between flexion and extension
Temporomandibular	Mouth slightly open
Glenohumeral	55° abduction, 30° horizontal adduction
Acromioclavicular	Arm resting by side in normal physiologic position
Sternoclavicular	Arm resting by side in normal physiologic position
Elbow	70° flexion, 10° supination
Radiohumeral	Full extension and full supination
Proximal radioulnar	70° flexion, 35° supination
Distal radioulnar	10° supination
Wrist	Neutral with slight ulnar deviation
Carpometacarpal	Midway between abduction/adduction and flexion/extension
Thumb	Slight flexion
Interphalangeal	Slight flexion
Hip	30° flexion, 30° abduction and slight lateral rotation
Knee	25° flexion
Ankle	10° plantar flexion, midway between maximum inversion and eversion
Subtalar	Midway between extremes of range of motion
Midtarsal	Midway between extremes of range of motion
Tarsometatarsal	Midway between extremes of range of motion
Metatarsophalangeal	Neutral
Interphalangeal	Slight flexion

From Magee DJ: *Orthopedic physical assessment*, ed 4, Philadelphia, 2002, Saunders.

TABLE 4-2 Close-Packed Positions of Joints

Joint(s)	Position
Spine	Extension
Temporomandibular	Clenched teeth
Glenohumeral	Abduction and lateral rotation
Acromioclavicular	Arm abducted to 30°
Sternoclavicular	Maximum shoulder elevation
Elbow	Extension
Radiohumeral	Elbow flexed 90°, forearm supinated 5°
Proximal radioulnar	5° supination
Distal radioulnar	5° supination
Wrist	Extension with ulnar deviation
Carpometacarpal	Full flexion
Thumb	Full opposition
Interphalangeal	Full extension and medial rotation*
Hip	Full extension and lateral rotation of femur
Knee	Maximum extension
Ankle	10° plantar flexion, midway between maximum inversion and eversion
Subtalar	Supination
Midtarsal	Supination
Tarsometatarsal	Supination
Metatarsophalangeal	Full extension
Interphalangeal	Full extension

*Some authors include abduction.
From Magee DJ: *Orthopedic physical assessment*, ed 4, Philadelphia, 2002, Saunders.

amount of synovial fluid. This leads to adhesions between capsule and articular cartilage, tendon sheaths, and bursae, contributing to stiffness and joint degeneration.

A fibrotic joint capsule is addressed by using massage to introduce mechanical forces into the tissue to increase pliability. The fibrotic capsule is treated with manual pressure into the structures of the capsule itself. Massage strokes are applied in all directions, addressing the irregular alignment of the collagen. Active and passive movement and stretching are used to reduce intraarticular adhesions.

A capsule that is too loose needs exercise rehabilitation to help lay down new collagen fibers and proprioception exercises to help restore neurologic function. Appropriate friction massage can stimulate an acute inflammatory response that stimulates collagen formation, although results may take a long time to manifest.

For an acute, swollen joint capsule with fluid accumulating inside the capsule, treat with gentle rhythmic compression and decompression of the joint and lymphatic drain to pump excess fluid out of the capsule. Pain-free, passive range of motion is used in the flexion/extension plane to act as a mechanical pump.

If too little fluid is found in the joint, passive and active movement may help stimulate the synovial membrane, increasing synovial fluid and thereby assisting lubrication and nutrition. An artificial joint fluid can be injected into the joint space and can support movement with reduced pain.

Fluid can also accumulate outside the capsule and around the knee. Common causes of this condition include patellar tendonitis. Irritation or injury to the capsule can create muscle contractions designed to protect the joint. This is called **guarding**. During the subacute healing phase, the guarding response begins to resolve. General massage in the area can support return to normal. If the guarding does not resolve, more specific methods such as muscle energy techniques to support focused stretching can be used to restore normal resting length and tone.

CARTILAGE

Objective

9. Describe the structure and function of cartilage.

Cartilage is the tough but flexible tissue that covers the ends of bones at a joint. Healthy cartilage allows movement by permitting bone ends to glide over each other. It protects bones by preventing them from rubbing against each other. Injured, inflamed, or damaged cartilage can cause symptoms such as pain and limited movement. It can also lead to joint damage and deformity. Osteoarthritis results from breakdown of cartilage.

Cartilage is elastic and porous and has the capacity to absorb and bind synovial fluid. Intermittent compression and decompression creates a pumping action, which causes the movement of synovial fluid into and out of the cartilage, which is self-lubricating as long as the joint moves. Normal joint movements open and close the joint surfaces, compress and decompress the cartilage, and tighten and loosen the joint capsule and ligaments, all of which supports joint lubrication and nutrition.

Fibrocartilage consists of white fibrous connective tissue arranged in dense bundles or layered sheets. Fibrocartilage has great tensile strength combined with considerable elasticity. It functions to deepen a joint space, such as the labrum of the hip and shoulder, the menisci of the knee, and the intervertebral discs of the spine. It lines bone grooves for tendons, as in the bicipital groove for the long head of the biceps brachii. Common sport injuries include various types of fibrocartilage damage, often when these structures become pinched or torn. A common knee injury is a torn meniscus.

Synovial joints generate compression and decompression through movement, intermittent contraction of the muscles, and twisting and untwisting of the joint capsule. Massage application that includes passive and active forms of joint movement introduces compression and decompression and supports joint health.

Athletes are particularly prone to cartilage damage. An arthritic joint is a joint with degeneration of the cartilage (Figure 4-5). Damage to articular cartilage may be caused by acute trauma or cumulative stresses. These stresses are often the result of imbalances in the muscles surrounding the joint, a tight joint capsule, or a loose joint capsule. A tight capsule creates a high-contact area in the cartilage and decreased lubrication. A loose capsule allows inappropriate joint laxity and rubbing of the bone surfaces, damaging the cartilage on the bone ends. All muscles around the joint shorten to increase stability. Flexor, adductor, and internal rotator muscles are larger and therefore will create an uneven pull on the joint structures because the extensors, abductors, and external rotators cannot exert enough force to counterbalance. Imbalanced muscles that move the joint create excessive pressure on the cartilage. The cartilage degenerates, beginning with fracturing of the collagen fibers and depletion of the ground substance.

Recent studies show that cartilage cells can create new cartilage. The joint must be moved to stimulate the synthesis of chondrocytes and the secretion of synovial fluid. Compressing and decompressing the joint capsule pumps synovial fluid into and out of the cartilage, rehydrating the cartilage. In addition to appropriate exercise, massage including muscle energy methods supports joint health using the following methods: contract/relax/antagonist contract, pulsed muscle, or a combination of these methods. Both active and passive movements of the joint, as well as compression and decompression (traction), promote fluid exchange.

BURSA

Objective

10. Identify the location of bursae and explain bursitis.

A **bursa**, a synovia-filled sac lined with a synovial membrane, is found in areas of increased friction. The function of bursae is to secrete synovial fluid, which decreases friction in the area.

Bursitis typically is caused by excessive friction of the muscles and connective tissues (tendons and fascia) that overlie the bursa. Massage can lengthen structures that are rubbing and can drain excessive fluid from the area through lymphatic drain methods. For example, lengthening the supraspinatus muscle/tendon can relieve pressure placed on the subacromial/subdeltoid bursa, which is sandwiched between the supraspinatus and the acromion process.

JOINT DEGENERATION

Objectives

11. Explain joint degeneration.
12. Demonstrate joint mobilization.

One common cause of joint degeneration is loss of normal function of the joint. This altered function can occur as a result of prior trauma or cumulative stress on the joint and is common in athletic performance.

Most conditions called arthritis are in fact noninflammatory and should be referred to as *arthrosis*, meaning "joint degeneration." The terms *osteoarthritis* and *degenerative joint disease* are typically used interchangeably to describe chronic degeneration of a joint, although osteoarthritis may be used to describe an inflammatory condition, and the markers of inflammation (i.e., heat, redness, pain, and swelling) will be present. Arthrosis occurs when joint structures can no longer create an inflammatory response. Many athletes will develop arthritis and arthrosis.

Appropriate massage addresses adhesions and tightening of the joint capsule or ligaments, sustained contraction of the muscle surrounding the joint, muscle imbalances

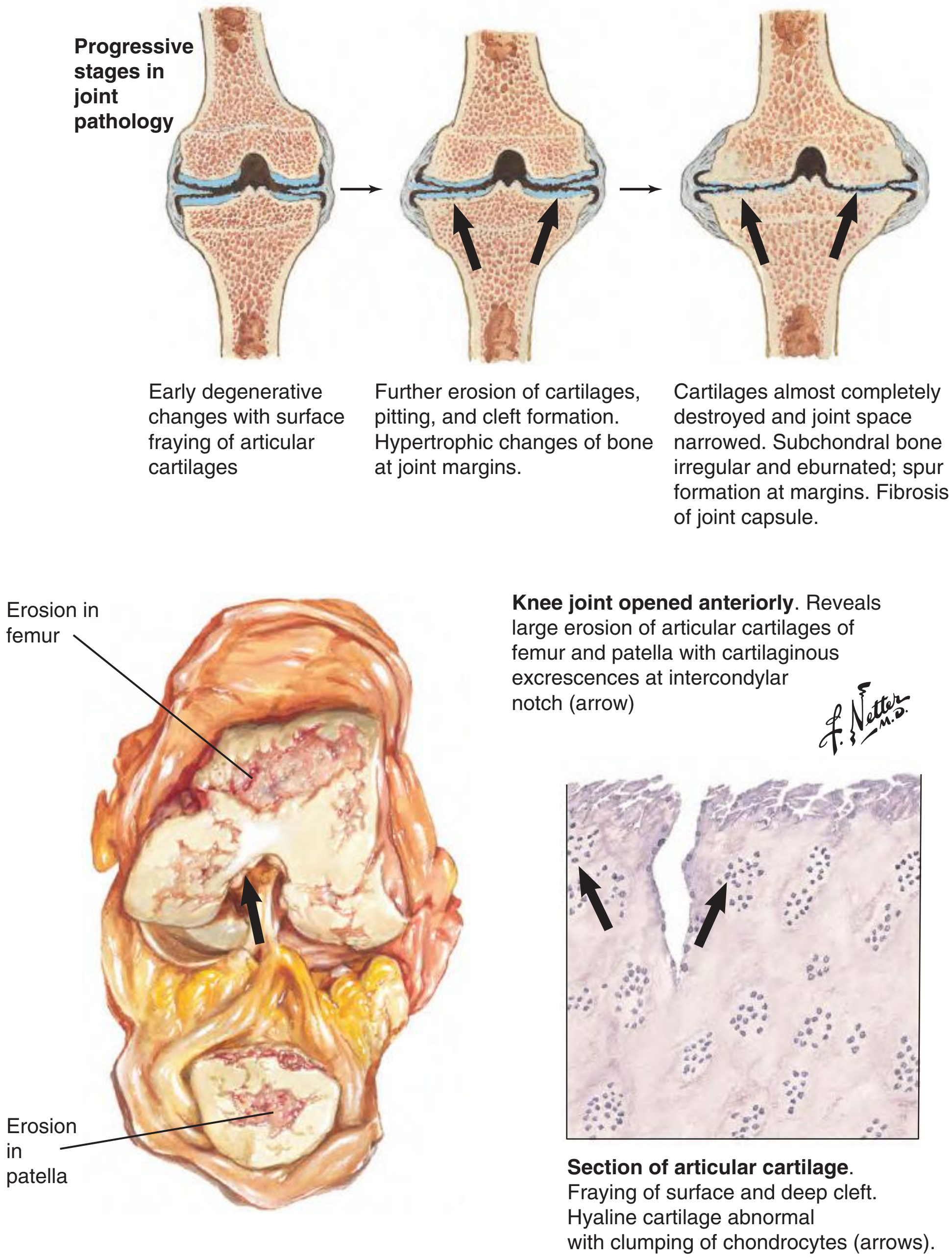


FIGURE 4-5 Arthritic degeneration of cartilage. (Netter illustration from www.netterimages.com. ©Elsevier Inc. All rights reserved.)

across a joint, and irregular firing patterns of the muscles moving the joint.

Short and tight muscles must be lengthened and relaxed, and muscles that are weak and inhibited need to be reeducated and exercised to regain their normal strength. Muscle activation firing pattern sequences need to be normalized (all discussed in future chapters).

Joint mobilization is any active or passive attempt to increase movement at a joint. Joint mobilization within the normal range of motion is within the scope of practice for the massage therapist. The movement must not be forcefully abrupt or painful.

Goals of joint mobilization are as follows:
- Restore the normal joint play.
- Promote joint repair and regeneration.
- Stimulate normal lubrication by stimulating synovial membranes to promote rehydration of articular cartilage.
- Normalize neurologic function.
- Decrease swelling.
- Reduce pain.

Joint manipulation can be valuable. The chiropractor, physical therapist, or other specialist can manipulate the joint structure.

IN MY EXPERIENCE

I believe that a joint that can swell is less dysfunctional than one that cannot. I work with a lot of knee pain. Athletes often will come to me with a knee swollen up like a balloon. Because it looks so bad, they are understandably concerned. Of course, if inflammation is present, then something is wrong, but at least the structures of the knee can still produce a healing response. In contrast, a knee that grinds, crunches, and is stiff and hurts inside the joint capsule without swelling is a pretty rotten knee. I will explain that the inflamed swollen knee can usually be fixed. It may require arthroscopic surgery to repair damage with follow-up rehabilitation. Sometimes physical therapy, general massage, ice, and rest will do the trick. However, the worn-out knee is probably going to eventually need to be replaced. Fortunately, medical procedures can be performed to replace damaged joint structures (usually cartilage), thereby extending joint function.

MUSCLE

Objective

13. Describe the structure and function of the muscle organ.

A skeletal muscle is the organ of the muscular system composed of skeletal muscle tissue, nerves, blood and lymph vessels, and connective tissue. When we think of a muscle, we typically think of the muscle organ. The hamstrings, triceps, and fibularis all are examples of the muscle organ. You can isolate an individual muscle organ through dissection that artificially cuts the functional muscle units apart. Anatomic and physiologic understanding of the muscular system is changing primarily because of expansion of understanding of the fascia muscle connection and how the entire bone, joint, muscle, and associated connective tissues act as an interconnected functional unit. However, this understanding is not currently reflected in how we describe muscular function, and the terminology is confusing. The accuracy of saying that the gluteus maximus extends the hip and attaches to the external surface of the ala of the ilium, including the iliac crest, dorsal surfaces of the sacrum and coccyx, and the sacrotuberous ligament, with distal attachments at the iliotibial tract and the gluteal tuberosity of the femur, can be challenged.

For instance, the gluteus maximus acting alone could not complete the hip extension action or the proximal attachment limit to the iliac crest, sacrum, and coccyx. More correctly, to describe hip extension and attachments, we need to include the bones and joint structures involved, the local and distant fascial network, synergistic and antagonistic functions of other muscles, and associated movements, including coordination between upper and lower limbs, innervation and reflex patterns, circulation to and from the structures, and more. This understanding does not mean that we do not need to understand the location and function of individual muscles (more correctly, muscle organs, composed of muscle tissue, connective tissue, and nerve tissue that contract to produce a particular movement). To read and write, we need to understand the individual letters; however, meaning occurs only when letters are united into words that are united into sentences and eventually into an expression of a thought or the telling of a story.

Muscle tissue is composed of sheets or bundles of cells that contract to produce movement or to increase tension. Simply, muscle cells contain filaments made of the proteins actin and myosin, which lie parallel to each other. When muscle tissue is signaled to contract, actin and myosin filaments slide past each other in an overlapping pattern. Muscle tissues aligned to produce a similar pull direction are wrapped in fascia. All these units are wrapped and then wrapped again until a large grouping forms what we think of as a muscle (more correctly a muscle organ). Muscles are then bound together by fascia into compartments of muscles that produce similar movement within a plane of function (Figure 4-6).

All of these connective tissue layers are lubricated in the healthy state. Muscle layers and bound units operating in different functional planes should slide over each other in relationship to each other; when this does not happen, function is altered. This commonly occurs in athletes and as part of the aging process.

Muscles are dynamic stabilizers of the joints because they actively hold the joints in a stable position for posture and movement. Muscles sense joint movement and body position.

Muscles are connected to nerves in the skin and to nerves in the capsule and ligaments of neighboring joints through neurologic reflexes. If the skin or joint is irritated or injured, the muscle may go into a reflexive spasm or into inhibition. Muscles have pain receptors that fire with chemical or mechanical irritation.

Muscles act as a musculovenous pump because the contracting skeletal muscle compresses the veins and moves blood toward the heart. A similar process assists lymphatic movement.

MUSCLE FUNCTION TYPES

Objective

14. Demonstrate three types of muscle actions resulting in five types of function.

Muscles exert a pull when the actin/myosin is stimulated to contract. Three types of muscle actions are known, all involving contraction:

1. Isometric–In an **isometric** contraction, the muscle contracts, but its constant length is maintained. The main outcome is stabilization.
2. Concentric–**Concentric** contraction is the shortening of muscle fibers while the muscle contracts. The main outcome is movement/acceleration.

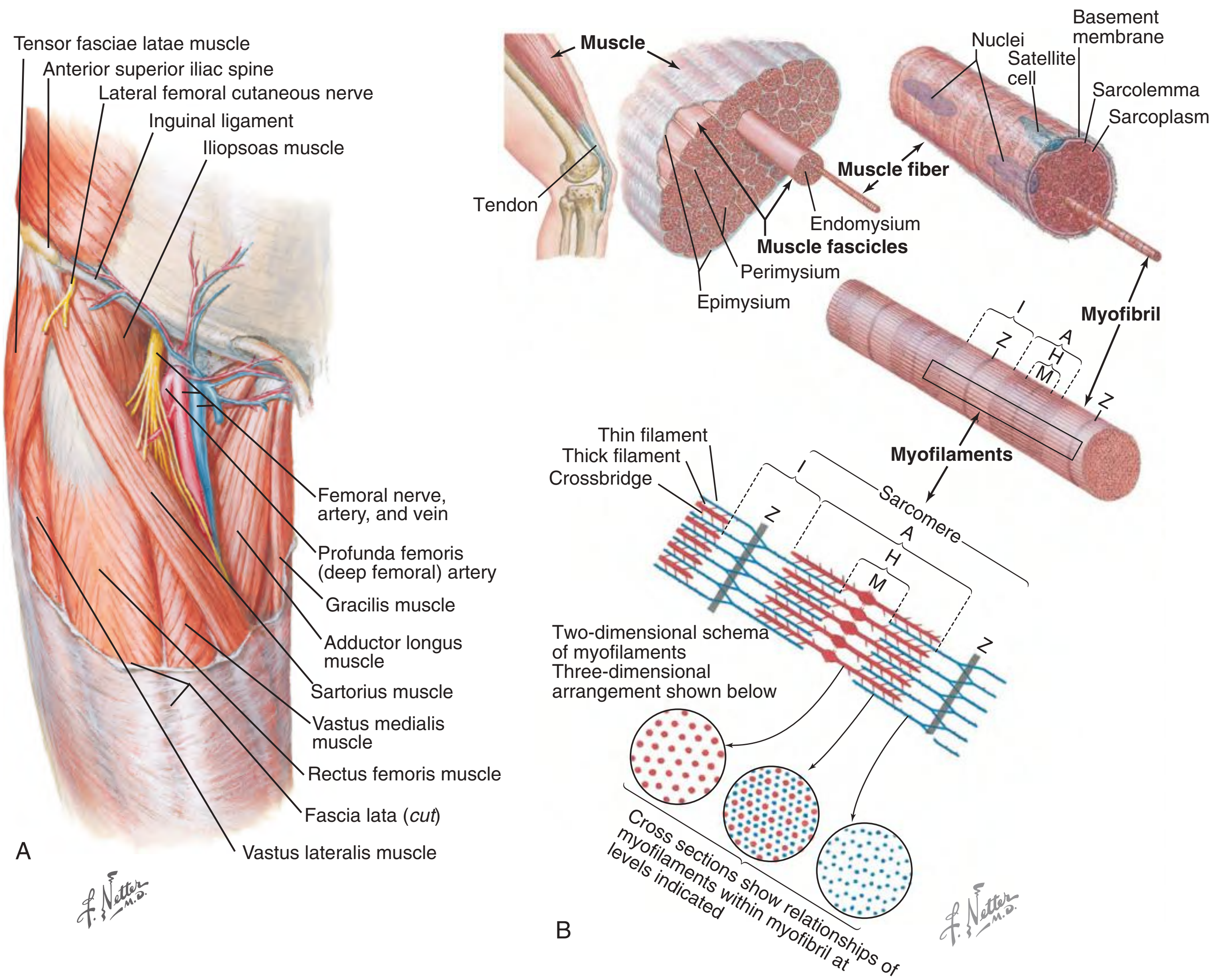


FIGURE 4-6 The muscle organ. **A,** Muscles bound with fascia. *(From Cochard L, et al:* Netter's introduction to imaging, *St Louis, 2012, Saunders.)* **B,** Organization of skeletal muscle. Skeletal muscle is composed of fascicles, which in turn comprise multinucleated muscle fibers. These fibers are composed of smaller myofibrils, which contain sarcomeres, the site at which sliding of actin and myosin filaments produces contraction. The organization of sarcomeres within the skeletal muscle produces its striated appearance. The Z line marks the boundary between two sarcomeres. The I band contains only the actin thin filaments, which extend from the Z line toward the center of the sarcomere. Myosin thick filaments are found in the dark A band. At the H zone, no overlap is noted between actin and myosin. The M line is at the center of the sarcomere and is the site at which the thick filaments are linked with each other. (Netter illustration from *www.netterimages.com*. ©Elsevier Inc. All rights reserved.)

3. Eccentric–**Eccentric** function is the moving apart of proximal and distal attachments while muscle fibers contract, yet the entire structure lengthens. The main outcome is control of movement and deceleration.

Muscles that contract concentrically to perform a certain movement are called **agonists**. This action is called **acceleration**, and the muscle is called the prime mover. For example, the biceps muscle is an agonist for elbow flexion. Muscles that perform the opposite movements of the agonists are called the **antagonists**; they provide control through **deceleration** during eccentric function. The triceps is the antagonist for the biceps because the triceps extends the elbow. The muscle that works with another muscle to accomplish a particular motion is called a **synergist**. **Stabilizers** typically are acting more with isometric function to hold a body part immobile while another body part is moving.

In most normal activities, proximal joints are stabilized by muscle contractions during movement of more distal joints. A **neutralizer** helps counteract unwanted motions that a muscle can perform, so a specific motion can occur.

Typically, when the agonist is working concentrically, the antagonist is functioning eccentrically. Sherrington's law of reciprocal inhibition states that there is a neurologic inhibition of the antagonist when the agonist is working. When we contract the biceps to flex the elbow, the triceps is being neurologically inhibited, which allows it to lengthen during elbow flexion. Co-contraction is an exception to this rule. **Co-contraction** occurs when the agonist and the antagonist are working together. For example, when you make a fist, the flexors and extensors of the wrist are co-contracting to keep the wrist in a position that ensures the greatest strength of the fingers. Co-contraction also occurs during the protective guarding response.

Human movement seldom involves pure forms of isolated concentric, eccentric, or isometric actions because the body segments are periodically subjected to impact forces, as in running or jumping, or because some external force such as gravity causes the muscle to lengthen. In many situations, the muscles first act eccentrically, with a concentric action following immediately, mixed in with isometric stability function.

MUSCLE LENGTH-TENSION RELATIONSHIP

Objective

15. Explain the muscle length-tension relationship.

A muscle develops its maximum strength or tension at its resting length or just short of its resting length because the actin and myosin filaments have the maximum ability to slide. When a muscle is excessively shortened or lengthened, it loses its ability to perform a strong contraction. This is called the *length-tension relationship* (Figure 4-7). A muscle can develop only moderate tension in the lengthened position and minimum tension in the shortened position. Often athletes overtrain, thinking it will make them stronger, but what really happens is that the length-tension relationship is disturbed and strength is decreased. Massage can effectively normalize this situation.

REFLEXIVE MUSCLE ACTION

Objective

16. Describe five reflexive muscle actions.

Protective coordinated reflexive muscle action is an important consideration when massage is provided; it is influenced by the following reflexive actions:

- Withdrawal reflexes, such as pulling away from a hot stove, involve instantaneous muscle contraction.
- Righting reflexes, such as tonic neck reflex and oculopelvic reflexes from the eyes, ears, ligaments, and joint capsules, communicate with the muscle and stimulate instantaneous contraction for protection of the joint and associated soft tissue; they also support upright posture.
- Arthrokinematic reflexes are unconscious muscle contractions of muscles surrounding a joint that are caused by irritation in the joint.
- Splinting, guarding, and involuntary muscle contraction can be caused by a muscle injury.
- Emotional or psychological stress creates excessive and sustained muscle tension.
- Viscerosomatic reflexes occur when an irritation or inflammation in a visceral organ causes a muscle spasm.

Muscles have properties and are able to function in multiple ways to meet various tasks such as maintaining balance. Most daily activities require the coordination of complex neuromuscular interactions. Sometimes muscles are required to function for long periods without fatiguing; at other times, muscles must provide maximal effort for only a few seconds. As described, muscles have three major actions: isometric, concentric, and eccentric. Muscles must be able to shorten and lengthen to provide range of motion at joints, yet they must generate enough power to move a load at each end of the range. Muscles must be able to hold a static position to provide stability. The nervous system accomplishes fine control of muscle contraction

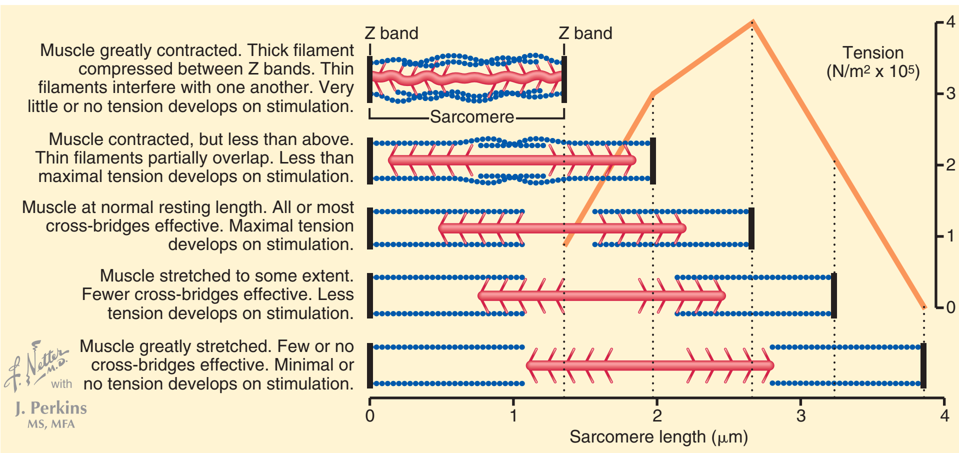


FIGURE 4-7 A length-tension relationship is seen, whereby greater resting sarcomere length (stretch of the muscle before contraction) is associated with greater force of contraction, up to NORMAL resting length. (Netter illustration from *www.netterimages.com*. ©Elsevier Inc. All rights reserved.)

over a wide range of lengths, tensions, speeds, and loads. When giving a massage, we have to assess for these functions. Massage application depends on accurate functional assessment.

We can observe as a muscle contracts through its range of motion. When a muscle moves a joint, its ability to stabilize is decreased, and vice versa. Muscles that span a long distance, such as the biceps brachii of the arm, are most efficient in supplying movement through a longer range of motion. Other muscles are more effective at stabilizing the joint than moving it. The coracobrachialis of the shoulder joint is a good example; its line of pull is mostly vertical and close to the axis of the shoulder joint. Therefore, the coracobrachialis has a short range of motion, which makes this muscle more effective at stabilizing than flexing the shoulder joint. Opposing muscle groups generate parallel forces to provide stability; this is achieved through co-contraction.

When considering the effect of the massage outcome, it is important to consider the function of the structure addressed. For example, it may be important to lengthen and stretch a muscle that spans a distance and is primarily a mover muscle. A muscle that functions primarily as a stabilizer may develop trigger points to help keep the muscle short and to support the stabilizing function necessary for balance. Because the trigger point is assisting stabilization of a joint, it is important during the massage to address the trigger point while not interfering with the stabilization function of the muscles.

KINETIC CHAIN

Objectives

17. Define kinetic chain and multiplanar movement.
18. Explain and locate four muscular functional subsystems.

As mentioned, muscles do not function independently; instead, a body-wide interactive network is involved. This network is called the **kinetic chain** (Figure 4-8). The kinetic chain influences training, conditioning, rehabilitation, and massage application. It consists of the muscular/fascia system (functional anatomy), the articular joint system (functional biomechanics), and the neural/chemical system (motor behavior).

Each of these systems works interdependently to allow structural and functional efficiency. If any of these systems does not work efficiently, compensations and adaptation occur in the other systems. These compensations and adaptation lead to tissue overload, decreased performance, and predictable patterns of injury.

Normal or maximally efficient function is an effectively integrated, **multiplanar** (frontal, sagittal, transverse) **movement** process that involves acceleration, deceleration, and stabilization of muscle and fascial tissue and joint structures. Many strength and conditioning programs involve only uniplanar force movement. Very little time is spent on core stabilization, neuromuscular stabilization, and eccentric training in all three planes of motion (sagittal, frontal, and transverse) (Figure 4-9). This situation predisposes an athlete to neuromuscular dysfunction. The massage professional can manage or assist in reversal of the dysfunctional patterns that occur from these types of exercise and training regimens. Conditioning programs and fitness protocols need to follow a sequence. Stability must develop before effective mobility. The core is considered the lumbar-pelvic-hip complex, thoracic spine, and cervical spine. The core operates as an integrated functional unit to dynamically stabilize the body during functional movements. The stabilization system has to function optimally to effectively utilize the strength and power in the prime movers. Many low back pain and hamstring problems are directly related to problems with core stability.

Many types of strength are known, including maximal strength, absolute strength, relative strength, strength endurance (stamina), speed strength, stabilization strength, and functional strength.

During movement, muscles must eccentrically function to decelerate gravity, ground reaction forces, and momentum, before concentric contraction causes acceleration to produce movement. Stabilization strength, core strength,

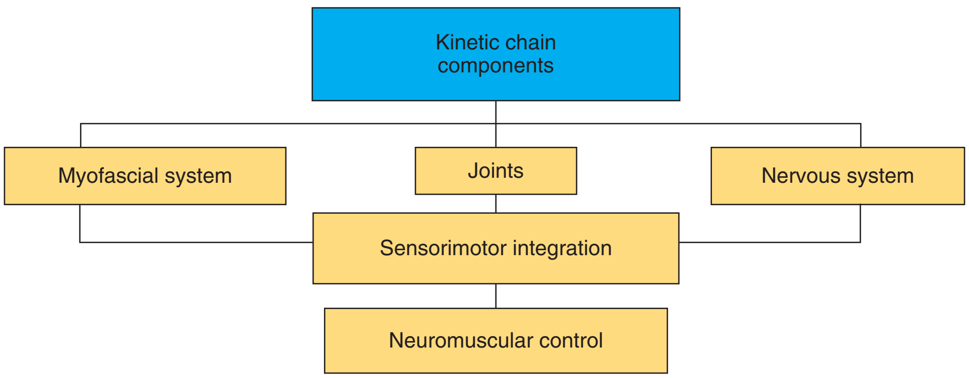


FIGURE 4-8 Kinetic chain components. (Modified from Fritz S: *Mosby's essential sciences for therapeutic massage: anatomy, physiology, biomechanics, and pathology*, ed 2, St Louis, 2004, Mosby.)

FIGURE 4-9 Examples of multiplanar movement. Example: hip joint. **A,** Frontal plane—abduction. **B,** Frontal plane—adduction. **C,** Sagittal plane—flexion. **D,** Sagittal plane—extension. Transverse movement. **E,** Internal rotation. **F,** External rotation.

and neuromuscular efficiency control the time between the eccentric function and the preceding concentric contraction. Therefore, eccentric neuromuscular control and stabilization strength exercises should begin to make up a larger portion of any fitness program. Because eccentric movement has a greater potential to result in delayed-onset muscle soreness, the massage application needs to effectively manage this response to exercise and training and must ensure that compliance and performance are sustained. Functional movement patterns involve acceleration, stabilization, and deceleration, which occur at every joint.

Muscles must adjust to gravity, momentum, ground reaction forces, and forces created by other functioning muscles. During functional movement, the transversus abdominis, internal oblique, multifidus, and deep erector spinae muscles stabilize the lumbar-pelvic-hip complex, whereas the prime movers perform the actual functional activities.

Muscles function synergistically in groups called *force couples* to produce force, reduce force, and dynamically stabilize the kinetic chain. **Force couples** are integrated muscle groups that provide neuromuscular control during functional movements.

When movement of the body is viewed as an integrated functional system, muscles can be classified as local or global. Muscles that cross one joint are considered **local muscles** and form the inner unit. **Global muscles** cross multiple joints and form the outer unit.

The local musculature and connective tissue (inner unit) structurally consists of soft tissue that is predominantly involved in joint support or stabilization. The joint support system of the core (lumbar-pelvic-hip complex) consists of muscles that may originate from or insert into the lumbar spine, including the transversus abdominis, lumbar, multifidus, and internal oblique muscles, the diaphragm, and the muscles of the pelvic floor.

Local musculature also forms peripheral joint support systems of the shoulder, pelvic girdles, and limbs that consist of muscles that are not movement-specific but provide stability to allow movement of a joint. They also have attachments to the joint's passive elements, such as ligaments and capsules, which makes them ideal for increasing joint stability. A common example of a peripheral joint support system (local muscles/inner unit) is the rotator cuff of the glenohumeral joint, which provides dynamic stabilization for the humeral head in relation to the glenoid fossa during movement. Other joint support systems include the posterior fibers of the gluteus medius and the external rotators of the hip, which perform pelvic-femoral stabilization, and the vastus medialis oblique muscles, which provide patellar stabilization at the knee.

The global muscles (outer unit) cross multiple joints and are predominantly responsible for movement. This group consists of more superficial muscles. The outer unit muscles are predominantly larger and are associated with movement of the trunk and limbs and equalize external loads placed upon the body. Major ones include the rectus abdominis, external oblique, erector spinae, gluteus maximus, latissimus dorsi, adductors, hamstrings, quadriceps, and biceps and triceps brachii. They also are important because they work together in complementary patterns to transfer and absorb forces from the upper and lower extremities to the pelvis.

The outer unit musculature has been broken down and described as force couples working in four subsystems. As described by Mike Clark (2000), these subsystems include the deep longitudinal, posterior oblique, anterior oblique, and lateral. Tom Myers (2008) describes similar patterns as myofascial unit meridians. Regardless, these muscle/fascial groups operate as an integrated functional unit because the central nervous system processes patterns of movement, not isolated muscles, and massage needs to address the system, not individual muscles.

DEEP LONGITUDINAL SUBSYSTEM

The major soft tissue components of the deep longitudinal subsystem are the erector spinae and biceps femoris muscles, thoracolumbar fascia, and sacrotuberous ligament. The long head of the biceps femoris attaches to the sacrotuberous ligament at the ischium. The sacrotuberous ligament in turn attaches from the ischium to the sacrum. The erector spinae attaches from the sacrum and ilium up to the ribs and cervical spine. Activation of the biceps femoris increases tension in the sacrotuberous ligament, which transmits force across the sacrum, stabilizing the sacroiliac joint, and allows force transference up through the erector spinae to the upper body. The functional interaction provides one pathway of force transmission longitudinally from the trunk to the ground. This muscle and fascia system functions mostly in the sagittal plane.

This transfer of force is necessary for normal gait. Prior to heel strike, the biceps femoris activates to eccentrically decelerate hip flexion and knee extension. Just after heel strike, the biceps femoris is further loaded through the lower leg via inferior movement of the fibula. This tension from the lower leg, up through the biceps femoris, into the sacrotuberous ligament and up the erector spinae, creates a force that assists in stabilizing the sacroiliac joint.

Another group of muscles acting as a force couple consists of the superficial erector spinae, psoas, transversus abdominis, lumbar, multifidus, and internal obliques and the muscles of the diaphragm and pelvic floor. Dysfunction of any structure can lead to sacroiliac joint instability and low back pain. Weakening of the gluteus maximus (often inhibited by the psoas and other related muscles) and structures of the deep longitudinal subsystem and/or latissimus dorsi may also lead to increased tension in the hamstring, thereby causing recurring hamstring strains.

Dysfunction in any of these structures can lead to sacroiliac joint instability and low back pain. These areas need to be addressed as one functional unit, not as individual muscles.

POSTERIOR OBLIQUE SUBSYSTEM

The muscles and fascia of the posterior oblique subsystem function in the transverse plane. Major muscles are the latissimus dorsi and gluteus maximus. When the contralateral gluteus maximus and latissimus dorsi muscles contract, this creates a stabilizing force for the sacroiliac joint.

Just before heel strike, the latissimus dorsi and the contralateral gluteus maximus are eccentrically loaded. At heel strike, each muscle accelerates its respective limb and creates tension in the thoracolumbar fascia. This tension creates a force couple that assists in maintaining the stability of the sacroiliac joint.

The posterior oblique subsystem is important for other rotation activities such as swinging a golf club or a baseball bat and throwing a ball.

ANTERIOR OBLIQUE SUBSYSTEM

The anterior oblique subsystem functions in a transverse plane orientation very similarly to the posterior oblique subsystem but on the front of the body. Functional muscles include the internal and external oblique muscles, the adductor complex muscle, and the hip external rotators. These muscles function as an aid in stability and rotation of the pelvis, as well as contributing to leg swing. The pelvis must rotate in the transverse plane to create a swinging motion for the legs. This rotation comes in part from the posterior muscle and anterior muscle groups. The fiber arrangements of the muscles involved–latissimus dorsi, gluteus maximus, internal and external obliques, adductors, and hip rotators–indicate this type of function. Oblique and adductor complexes produce rotational and flexion movements and stabilize the lumbar-pelvic-hip complex.

LATERAL SUBSYSTEM

The lateral subsystem, which is composed of the gluteus medius, tensor fasciae latae, adductor complex, and quadratus lumborum muscles, creates frontal plane stability. This system is responsible for pelvic femoral stability, as during single leg functional movements when walking or climbing stairs. The ipsilateral gluteus medius, tensor fasciae latae, and adductors combine with the contralateral quadratus lumborum to control the pelvis and the femur in the frontal plane.

Dysfunction in the lateral subsystem increases pronation (flexion, internal rotation, and adduction) of the knee, hip, and/or feet during walking, squats, and lunges, or when climbing stairs.

KINETIC CHAIN INFLUENCES

Objective

19. Explain full-body pronation and supination.
20. Define serial distortion patterns and synergistic dominance.

When in a closed kinetic chain, full body *pronation* is multiplanar (frontal, sagittal, and transverse) synchronized joint motion that occurs with eccentric muscle function. *Supination* is multiplanar (frontal, sagittal, and transverse) synchronized joint motion that occurs with concentric muscle function (Box 4-2). This means that for one joint pattern to move effectively, all involved joints have to move. Movement can be initiated at any joint in the pattern, and restriction of any joint in the pattern will restrict motion or increase motion in interconnected joints.

To briefly describe functional biomechanics, the gait cycle is reviewed here. During walking or other locomotor activities such as running, motion at the subtalar joint is linked to the transverse plane rotations of the bone segments of the entire lower extremity. During the initial contact phase of the gait cycle, the subtalar joint pronates, which creates internal rotation of the tibia, femur, and pelvis. At midstance, the subtalar joint supinates, which creates external rotation of the tibia, femur, and pelvis. Poor control of pronation decreases the ability to eccentrically decelerate multisegmental motion and can lead to muscle imbalance, joint dysfunction, and injury. Poor production of supination decreases the ability of the kinetic chain to concentrically produce appropriate force during functional activities and can lead to synergistic dominance. During functional movement patterns, almost every muscle has the same synergistic function: to eccentrically decelerate pronation or to concentrically accelerate supination. The CNS recruits the appropriate muscles in an optimal muscle activator firing pattern sequence during specific movement patterns.

Joint arthrokinematics refers to roll, slide, glide, and translation movements that occur between two articular partners. *Joint play* is defined as the involuntary movement that occurs between articular surfaces that are separate from the range of motion of a joint produced by muscles. It is an essential component of joint motion and must occur for normal functioning of the joint. Predictable patterns of joint arthrokinematics occur during normal movement patterns. Optimum length-tension and force couple relationships ensure maintenance of normal joint kinematics.

Optimal posture enables the development of high levels of functional strength and neuromuscular efficiency. Functional strength is the ability of the neuromuscular system to perform dynamic eccentric, isometric, and concentric actions efficiently in a multiplanar environment. This process allows the appropriate motor program (muscle activator sequence) to be chosen to perform an activity, thus ensuring that the right muscle contracts at the right joint, with the right amount of force, and at the right time. If any component of the kinetic chain is dysfunctional (such as short muscle, weak muscle, joint dysfunction), neuromuscular control is altered. This decreases force production, force reduction, and stabilization. If the kinetic chain is out of alignment, the individual will have decreased structural efficiency, functional efficiency, and performance. For example, if one muscle is tight (altered length-tension relationships), the force couples around that particular joint are altered. If the force couples are altered, the normal arthrokinematics is altered.

Arthrokinematic inhibition is the neuromuscular phenomenon that occurs when a joint dysfunction inhibits the

BOX 4-2 Joint Movement Involved with Pronation and Supination

Pronation	Supination
Foot	*Foot*
1. Dorsiflexion	1. Plantarflexion
2. Eversion	2. Inversion
3. Abduction	3. Adduction
Ankle	*Ankle*
1. Dorsiflexion	1. Plantarflexion
2. Eversion	2. Inversion
3. Abduction	3. Adduction
Knee	*Knee*
1. Flexion	1. Extension
2. Adduction	2. Abduction
3. Internal rotation	3. External rotation
Hip	*Hip*
1. Flexion	1. Extension
2. Adduction	2. Abduction
3. Internal rotation	3. External rotation

muscles that surround the joint. For example, a sacroiliac joint dysfunction causes arthrokinematic inhibition of the deep stabilization mechanism of the lumbo-pelvic-hip complex (transversus abdominis, internal oblique, multifidus, and lumbar transversospinalis). All of these neuromuscular phenomena occur secondary to postural dysfunction.

DEVELOPMENT OF KINETIC CHAIN–RELATED MUSCLE IMBALANCES

Muscle imbalances are caused by postural stress, pattern overload, repetitive movement, lack of core stability, and lack of neuromuscular efficiency. Kinetic chain dysfunction typically results in predictable patterns. Although each individual will display the pattern somewhat differently, the following information provides a conceptual way of understanding integrated function and dysfunction. These dysfunctional patterns can be called *serial distortion patterns* and *synergistic dominance*.

Vladimir Janda discovered that muscles react to pain or excessive stress in predictable patterns. He found that certain muscles tend to become overactive, short, and tight, and describes these muscles as having a postural or stabilizing function. He found that other muscles tend to become inhibited and weak, and noticed that most of these muscles were concerned with movement rather than stability. Muscles of the body can be classified on the basis of which muscles have primarily a stabilizing role, and which muscles have primarily movement roles. Many terms are used to describe these muscle functions. Two more accurate terms that have been suggested for these groups are tightness-prone stabilizer (postural) and inhibition-prone mover (phasic). These categorizations are controversial because most muscles can function in both roles (Box 4-3). **Tonic/postural/stabilizing muscles** play a primary role in maintenance of posture and joint stability. The primary role of the phasic/mover muscles is quick movement. Tonic/postural/stabilizing muscles react to stress by becoming short and tight, and phasic/mover muscles react to stress by becoming inhibited and weak.

The **phasic/mover muscle group** is characterized as being prone to developing tightness; it is readily activated during most functional movements and is overactive in fatigue situations or during new movement patterns. The stabilization group is prone to weakness and inhibition, is less activated in most functional movement patterns, and fatigues easily during dynamic activities. If the phasic/mover group is prone to tightness and overuse, this can cause reciprocal inhibition of its functional antagonists. This inhibition leads to poor neuromuscular efficiency and further postural dysfunction. Furthermore, if the stabilization group is prone to weakness, synergistic dominance (discussed later) can result.

An important difference between the two muscle groups is that a small reduction in strength of an inhibition-prone muscle initiates a disproportionately larger contraction of the antagonist tightness-prone muscle. Because work and recreational activities favor tightness-prone muscles getting stronger, tighter, and shorter as inhibition-prone muscles become weaker and more inhibited, unless fitness programs are balanced, dysfunctional patterns are exacerbated, and the length-tension relationship becomes important. Some muscles, such as the quadratus lumborum and scalenes, can react with tightness or weakness.

In addition to the causes of muscle dysfunction listed previously, muscle injury, training protocols, reduced recovery time, chronic pain, and inflammation create disturbances in normal muscle function and may stimulate a neurologically based tightness or weakness in a muscle. In a force couple relationship, muscles work together to produce movement or dynamic force joint stability. Serial distortion patterns in the kinetic chain disrupt force couple relationships.

A **serial distortion pattern** is the state in which the functional and structural integrity of the kinetic chain is altered and in which compensations and adaptations occur (Figure 4-10). These distortion patterns can be described as follows:

- **Upper crossed syndrome** (Figure 4-11)
- **Lower crossed syndrome** (Figure 4-12)
- Pronation distortion syndrome (Figure 4-13)

A short, tight muscle is held in a sustained contraction. The muscle is constantly working, consumes more oxygen and energy, and generates more waste products than a muscle at rest. Circulation is decreased because the muscle is not performing its normal function as a pump, which

BOX 4-3 Movers and Stabilizers in Muscles of the Human Body

Movement Group	Stabilization Group
Gastrocnemius/soleus	Peroneals
Adductors	Anterior tibialis
Hamstrings	Posterior tibialis
Psoas	Vastus medialis oblique
Tensor fasciae latae	Gluteus maximus/medius
Rectus femoris	Transversus abdominis
Piriformis	Internal oblique
Erector spinae	Multifidus
Pectoralis minor/major	Deep erector spinae
Latissimus dorsi	Transversospinalis
Teres major	Serratus anterior
Upper trapezius	Middle/lower trapezius
Levator scapulae	Rhomboids
Sternocleidomastoid	Teres minor
Scalenes	Infraspinatus
Teres major	Posterior deltoid
	Longus colli/capitis
	Deep cervical stabilizers

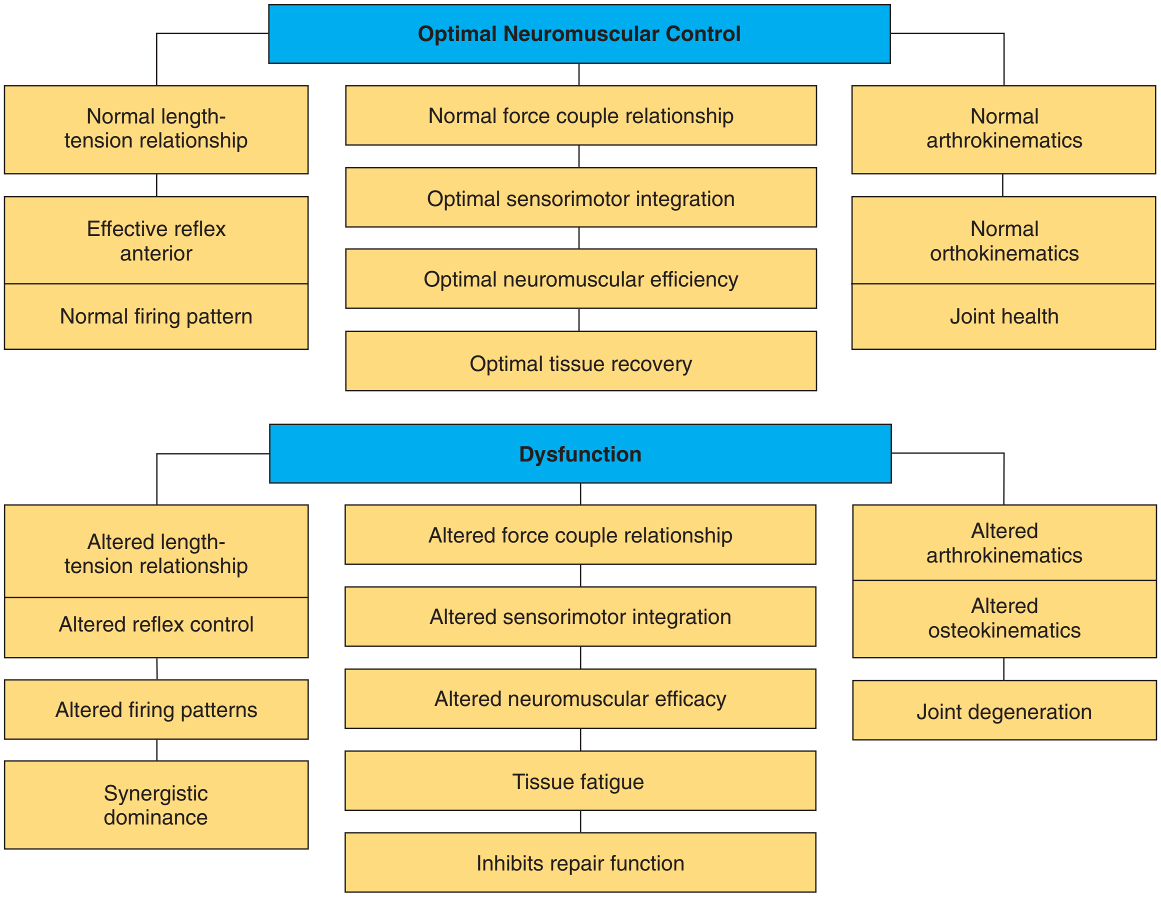


FIGURE 4-10 Overview of neuromuscular control. (Data from Chaitow L, DeLany JW: *Clinical applications of neuromuscular techniques,* vol 1, *The upper body,* Edinburgh, 2001, Churchill Livingstone.)

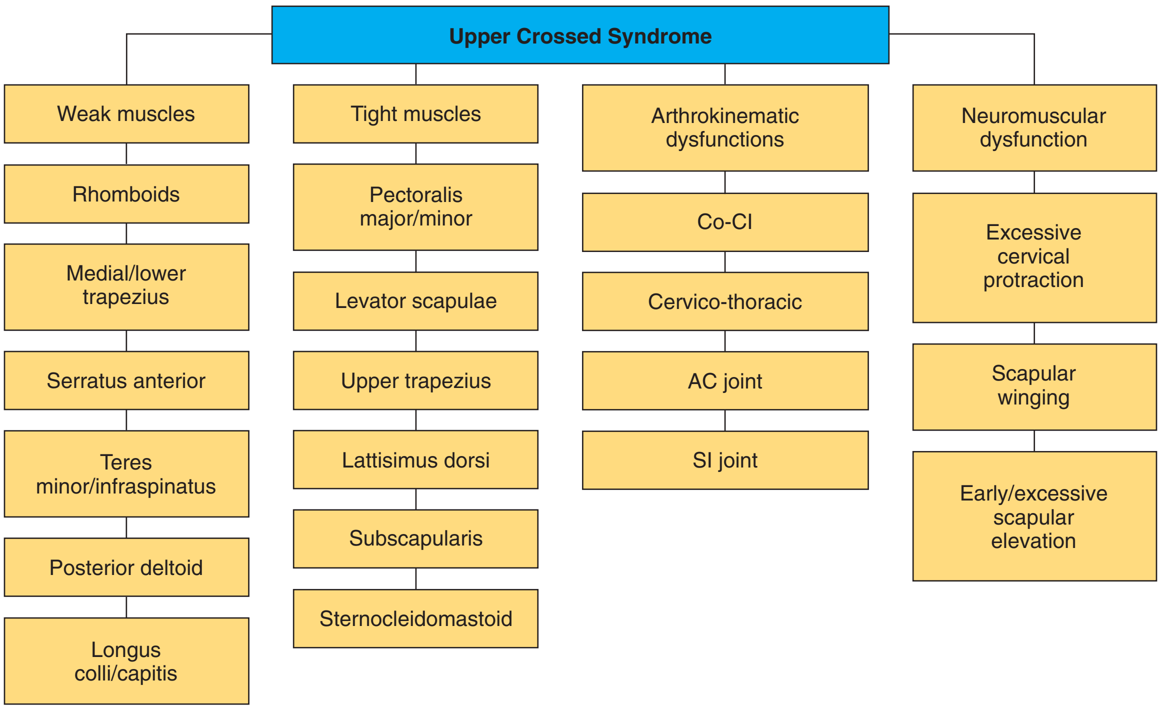


FIGURE 4-11 Upper crossed syndrome flow chart. (Data from Chaitow L, DeLany JW: *Clinical applications of neuromuscular techniques,* vol 1, *The upper body,* Edinburgh, 2001, Churchill Livingstone.)

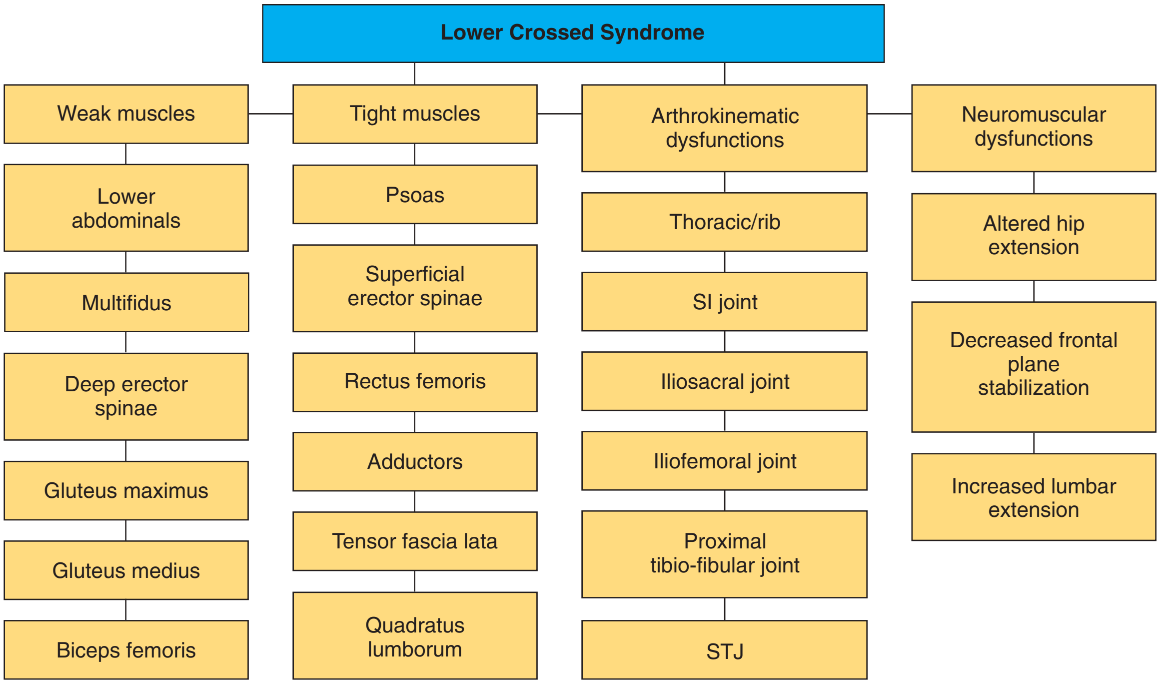


FIGURE 4-12 Lower crossed syndrome flow chart. (Data from Chaitow L, DeLany JW: *Clinical applications of neuromuscular techniques*, vol 1, *The upper body*, Edinburgh, 2001, Churchill Livingstone.)

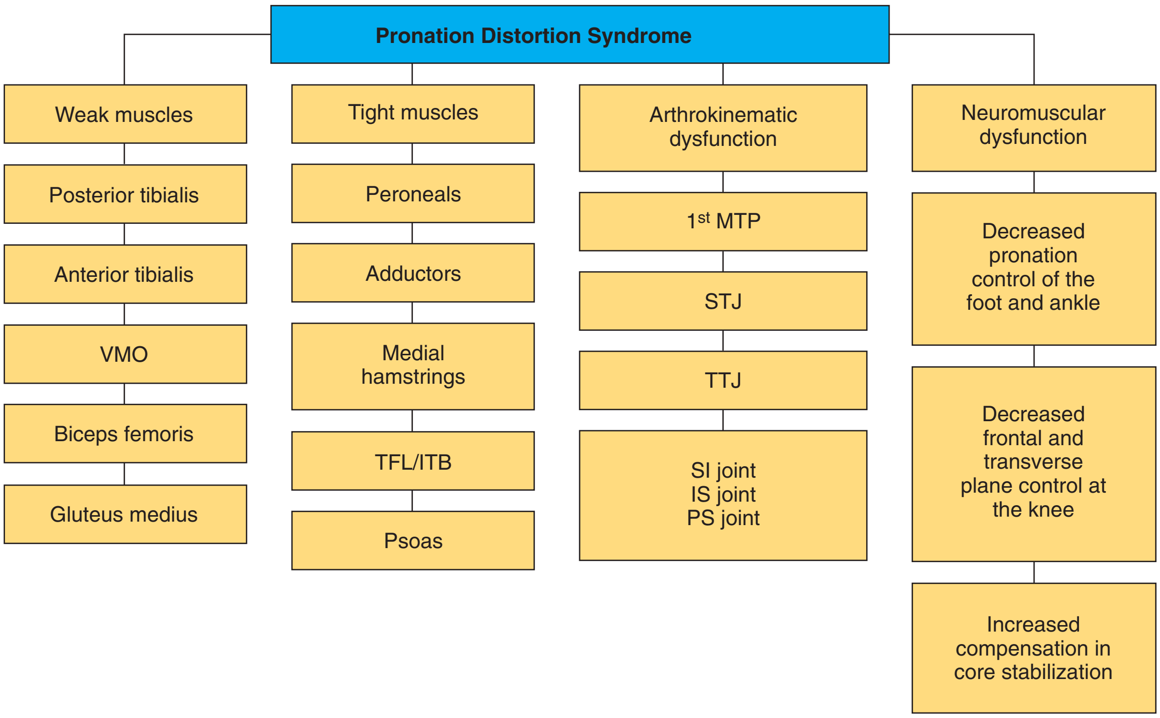


FIGURE 4-13 Pronation distortion syndrome flow chart. (From Chaitow L, DeLany JW: *Clinical applications of neuromuscular techniques*, vol 1, *The upper body*, Edinburgh, 2001, Churchill Livingstone.)

can lead to ischemia and may cause the pain receptors to fire. Sustained tension in the muscle pulls on its attachments to the periosteum, joint capsule, and ligaments, creating increased pressure, uneven forces, and excessive wear in the joint. Short, tight muscles often compress nerves between muscles or through a muscle; this is a form of impingement syndrome.

Long weak muscles are unable to support joint stability and contribute to poor posture, excessive tension and compression, and abnormal joint movements. Muscle activator firing pattern sequences and gait reflexes are disturbed.

Inhibited muscles interfere with vascular and lymphatic movement.

Massage application as described in this book is particularly effective in dealing with these conditions and supports other professional treatments. Massage lengthens short tight muscles, normalizes firing patterns, and increases tissue pliability. These benefits support therapeutic exercise to treat long weak and inhibited muscles. In other words, treatment involves massage and stretching of short tight muscles and exercise for long weak muscles.

Reciprocal inhibition is the process whereby a short muscle with increased tone, the psoas for example, causes decreased neural stimulus in its functional antagonist, the gluteus maximus. This process results in decreased force production by the prime mover and leads to compensation by the synergists, a process called *synergistic dominance*. This process leads to altered movement patterns and is assessed and treated with muscle activator firing pattern sequences. Synergistic dominance often occurs as the result of improper training, including overtraining, and fatigue. Athletes may complain of heavy or labored movement if **synergistic dominance** is occurring.

As an example of synergistic dominance, if a client has a weak gluteus medius, then synergists (tensor fasciae latae, adductor complex, and quadratus lumborum) become dominant to compensate for the weakness. This alters normal joint alignment, which further alters normal length-tension relationships around the joint where the muscles attach. The combination of poor posture and muscle imbalances causing reciprocal inhibition and synergistic dominance leads to altered joint alignment. Altered joint alignment is the result of muscle shortening and muscle weakness. Altered arthrokinematics (joint movement) is further altered secondary to altered force couple relationships. If synergists are dominant, normal joint movements are altered because muscles are firing out of sequence. This is a continuous and cyclic process. Muscle shortening, muscle weakness, joint dysfunction, and decreased neuromuscular efficiency can all initiate this dysfunctional pattern.

Consider the knee as one of the most used and abused joints in athletic activity. An injury to the knee typically causes the joint to be held in sustained flexion during the acute phase. This position is the least-packed joint position, can accommodate increased fluid, and is the most comfortable. This position pulls the soft tissue on the medial and lateral aspects of the knee into an abnormal posterior alignment with the posterior short and anterior long. This misalignment creates abnormal torsion in the skin, muscles, tendons, and ligaments of the medial and lateral aspects of the knee, shortening of structures at the back of the knee, and weakening of the medial quadriceps, particularly the vastus medialis oblique at the distal end of this muscle. Increased torsion causes a decreased flow of fluids in the area, leading to a decreased ability for repair and the tendency for tissue layers to stick together and form adhesions. The sustained position eventually becomes fibrotic, and the knee ends up stuck in flexion and unable to fully extend. At the very least, performance is diminished. Compromised patterns body-wide will begin to occur, and reinjury is likely. Also, compensation patterns in other parts of the body become prone to injury, including a tendency for tissue layers to stick together and for adhesions to develop. So what is the next step? No recipe has been defined; clinical reasoning is essential and revolves around the following.

KEY POINTS

- Apply therapeutic massage with an intelligent focus.
- Normalize soft tissue structures by increasing pliability and separation of the tissue layers.

Massage can potentially do the following:

- Create a mechanical force—tension, bind, shear, or torsion—on the fibers to encourage relaxation
- Reintroduce controlled acute inflammation to signal regeneration of connective tissue structures
- Create a piezoelectric effect (mechanical energy is transformed into electrical energy). The piezoelectric effect increases cellular activity, tissue repair, and alignment.
- Normalize fluid movement, rhythmic cycles of joint compression and decompression (traction), rocking, and specific methods such as lymphatic drain to restore the natural rhythmic movement of the body's fluids
- Normalize autonomic nervous system, neurotransmitter, and endocrine functions. Deliberate use of stimulation or inhibition and pressure levels encourages appropriate neurochemical function.

SUMMARY

Massage targets both connective tissue and the neuromuscular aspect of muscle tissue function because tension in a muscle and its fascia is created by both active and passive elements. Passive elements include collagen fibers and ground substance, which are influenced by introduction of various mechanical forces through massage. Because muscle contains ground substance, it demonstrates viscous behavior. It becomes thicker and stiff when it is stretched quickly, is cold, or is immobilized. It becomes more fluid-like when it is stretched slowly or when it is heated. Active components include the contractile proteins actin and myosin and the nerves' massage interactions with the neurochemical stimulus.

The most important signs of impaired muscle function are the following:

- Increased muscle motor tone: occurs when muscles are held in a sustained contraction
- Muscle inhibition: a muscle may be functionally weak, which creates joint instability and causes others to become hypertonic in compensation
- Muscle imbalance: this change in function in the muscles crossing a joint occurs when certain muscles react to stress by getting shorter and tight and others become longer and weak. This is an important factor in chronic pain syndromes because this imbalance alters the movement pattern of the joint.
- Joint dysfunction: muscle dysfunction creates an uneven distribution of forces on the weight-bearing surfaces of the joint.
- Abnormal muscle firing pattern sequences: muscle dysfunction is often expressed by improper contraction sequences.

The reader is strongly encouraged to maintain active study of anatomy and physiology. Unit Two discusses this information in relation to massage benefits, assessment, and treatment plan development. Unit Three explores the related issues of sport pathology and uses this base to build treatment plans.

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Clark M: *Integrated training for the new millennium*, Thousand Oaks, Calif, 2000, National Academy of Sports Medicine.

Myers TW: *Anatomy trains: myofascial meridians for manual and movement therapists*, ed 2, Edinburgh, 2008, Churchill Livingstone.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1. Using the index, locate and summarize various contents in this book related to connective tissue and function. Include concepts of assessment, treatment outcomes, contraindications, and benefits (list page numbers).
2. Using the index locate and summarize content in this book related to joint function. Include concepts of assessment, treatment outcomes, contraindications, and benefits (list page numbers).
3. Using the index, locate and summarize the content in this book related to muscular function. Include concepts of assessment, treatment outcomes, contraindications, and benefits (list page numbers).

CHAPTER

5 Fitness First

OUTLINE

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1. Define fitness.
2. List the benefits of exercise.
3. Describe how exercise is part of a fitness program.
4. Explain the importance of proper breathing to fitness.
5. List and explain the components of a fitness program.
6. Explain intensity, duration, and frequency as these terms relate to a conditioning program.
7. Explain why it is important to include endurance, aerobic exercise, adaptation, and training stimulus threshold in a therapeutic exercise program.
8. Explain the importance of core strength as it relates to functional training.
9. List the major energy-producing systems in the body and their implications for fitness programs.
10. Identify the physiologic changes that occur with exercise.
11. List and describe the three main components of an exercise program that targets fitness.
12. Incorporate strength training into physical fitness.
13. Describe how flexibility supports an exercise program.
14. Explain the transition from fitness training to sport-specific training.

KEY TERMS

Adaptation
Aerobic (Oxygen) System
Aerobic Exercise
Aerobic Exercise Training
Anaerobic Glycolytic System
Breathing Dysfunction
Circuit Training
Circuit-Interval Training
Conditioning
Continuous Training
Cool-down
Core Strength
Core Training
Deconditioning
Duration
Endurance
Energy
Energy Systems
Exercise
Exercise Intensity
Flexibility
Force
Frequency
Functional Training
Interval Training
Overload Principle
Phosphagen System
Physical Fitness Program
Specificity Principle
Strength Training
Stretching
Therapeutic Exercise
Torque
Warm-up

Fitness is essential. Regular physical activity helps keep us healthy, mobile, strong, and flexible. The outcome of appropriate exercise, proper nutrition, and emotional and spiritual balance is the foundation for fitness.

Benefits from physical activity include the following:

- Decreased risk of death from coronary heart disease and of developing hypertension, colon cancer, and diabetes
- Improved muscle strength and stamina
- Improved mood and increased general feeling of well-being
- Decreased symptoms of anxiety and depression
- Increased control of pain and joint swelling associated with arthritis/arthrosis

BEING FIT

Objectives

1. Define fitness.
2. List the benefits of exercise.
3. Describe how exercise is part of a fitness program.

Fitness is about improving physical abilities, health, and well-being. Physical fitness, the target of this chapter, can be described as the capacity to perform physical activity. Because athletic performance is a physical activity, it makes sense that the foundation of physical performance is physical fitness. Exercise is essential in maintaining the body's overall well-being. Even modest amounts of exercise can substantially diminish the chances of dying from heart problems, cancer, or other diseases. Performing physical work requires cardiorespiratory functioning, muscular strength and endurance, and musculoskeletal flexibility. To become physically fit, individuals must participate regularly in **therapeutic exercise**–that is, some form of physical activity that challenges all large muscle groups and the cardiorespiratory system, and promotes postural balance.

Any exercise and stretching program must begin slowly. Activity levels can be increased gradually each week. It takes about 8 weeks for those who are new to a program to reach a level of comfort. Additional activities may be added gradually once the body adapts. Whether a person is a competing athlete, is exercising as part of a weight reduction program, or is using exercise to support a wellness lifestyle, massage can assist in achieving and maintaining fitness. Peak athletic performance is achieved from a base of physical fitness.

Deconditioning occurs with prolonged inactivity. Its effects are frequently seen in someone who has had an extended illness. These effects are also seen, although possibly to a lesser degree, in the individual who is sedentary because of lifestyle or increasing age. Decreases in maximal oxygen consumption, cardiac output, and muscular strength occur very rapidly. Balance is needed between training and recovery to prevent both overtraining and deconditioning. People with disabilities require regular physical activity just as much as others without disabilities.

Additional benefits are especially important for people with disabilities because regular physical activity can lessen the probability of developing other physical or mental conditions associated with the disability. These secondary conditions include obesity, pressure sores, infection, fatigue, depression, and osteoporosis. Such conditions can lead to further disability and possible loss of physical independence.

Many people with disabilities are more prone than the general population to underuse, overuse, or misuse of various muscle groups. For instance, a person who uses a wheelchair may have very well-developed anterior muscles from pushing the chair but may need to develop the upper back muscles. Structured exercise and massage can help to balance out these differences. Because of adaptation of the body to compensate for a disability, other body areas are overused. If the lower extremities are affected, fluid movement (circulation and lymphatic) is compromised. Massage can target both of these areas and can support the fitness program.

Developing the physical capacity and strength to move around and perform daily life activities can assist those with disabilities to accomplish or sustain their independence. **Physical fitness programs** can also help lessen or even reverse some of the physiologic changes that are associated with aging, including loss of the following:

- Lean muscle tissue and strength
- Aerobic capacity
- Flexibility
- Balance
- Bone density
- Cognitive functions, especially the speed of memory

Staying active often helps if activity is limited because of medical conditions such as arthritis/arthrosis or osteoporosis, which may impair the individual's ability to perform important daily activities such as driving, walking up stairs, and lifting groceries more comfortably.

Regular physical activity can prevent and in some cases reverse some of these changes. It can also help to prevent many conditions associated with aging, such as coronary artery disease, high blood pressure, stroke, diabetes, depression, and some cancers.

What used to be considered diseases of middle age are now showing up in adolescents. This is a major concern. These problems usually occur in conjunction with childhood and adolescent obesity.

Certain well-known risk factors lead to heart disease, including obesity, high blood pressure, high cholesterol, low levels of "good" (high-density lipoprotein [HDL]) and high levels of "bad" (low-density lipoprotein [LDL]) cholesterol, diabetes, cigarette smoking, and family history of heart disease. Exercise has a dramatic effect on almost all of these risk factors by

- Promoting weight loss as a result of increasing calories burned
- Controlling blood pressure through exercise and diet

- Improving cholesterol levels. In particular, aerobic exercise raises blood levels of HDL cholesterol. HDL cholesterol carries LDL cholesterol to the liver, preventing it from clogging arteries.
- Reducing the tendency for smoking and other detrimental behaviors, because exercise calms nervous tension

Any muscle, including the heart, is strengthened by exercise. A well-conditioned heart has a low resting heart rate. The fewer times it has to beat each minute, the longer it rests between beats, and the less strain is put on it.

Conditioning the heart involves identifying a safe and normal heart rate and determining an appropriate training range. The predicted maximum heart rate is the highest number of beats per minute that is safe during the exercise session. This rate can be determined in two ways. An exercise stress test can determine the heart rate by calculating it with a simple formula: 220 minus the person's age. For example, a person 30 years old would have a predicted maximum heart rate of 190 beats per minute.

During exercise, the heart rate must be brought into the training range, which is 70% to 85% of the maximum rate. This is the heart rate that best conditions the heart. The 30-year-old individual with a predicted maximum heart rate of 190 would have a training range of 125 to 160 beats per minute.

Heart rate monitors are available, or you can take the pulse manually. The easiest place to take the pulse rate during exercise is at the side of the throat on the carotid artery. Place the index and middle fingers at the base of the neck on either side of the windpipe, and count the heartbeats for 15 seconds. Multiply this number by 4. This yields the number of heartbeats per minute.

The type of aerobic activity makes no difference as long as a training range is reached. Ideally, the heart rate is maintained in the training range for at least 20 minutes 3 times a week. However, research shows that even less exercise–10 minutes 3 times a week–can produce health benefits. A little exercise is better than none at all.

Log on to your Evolve website for more information about weight management and physical activity guidelines.

BREATHING

Objective

4. Explain the importance of proper breathing to fitness.

OVERVIEW OF BREATHING FUNCTION

Proper breathing at all times is important. If breathing is not effective, the ability to exercise is compromised. Breathing patterns, both functional and dysfunctional, serve as a direct link to altering autonomic nervous system patterns, which in turn affect endocrine function and mood, feelings, and behavior. Especially when working with athletes, the breathing function may be a causal factor in many soft tissue symptoms (Figure 5-1).

The shoulders should not move during normal relaxed breathing. The accessory muscles of respiration located in the neck area should be active only when increased oxygen is required during physical activity. These muscles (transverse, sternocleidomastoid, serratus posterior superior, levator scapulae, rhomboids, abdominals, and transverse lumborum) may be constantly activated for breathing when forced inhalation and expiration are not needed. This will result in dysfunctional muscle patterns and therefore dysfunctional breathing. This is the pattern for *sympathetic dominance* breathing.

If the athlete does not balance oxygen/carbon dioxide levels through increased activity levels, overbreathing in excess of physical demand can occur. Patterns of **breathing dysfunction** (overbreathing) are quite common in the athletic population. This can occur for a variety of reasons, including inability to achieve *parasympathetic dominance* (relaxation) after training or competition; dysfunction of respiratory muscles (Box 5-1); or restricted structure, particularly of the ribs and thoracic vertebrae.

Appropriate massage is effective in treating soft tissue dysfunction, whereas joint manipulation of some type (e.g., chiropractic) may be necessary for treating facet and costal rib restrictions.

Overbreathing affects performance and decision making. Chronic breathing dysfunction patterns interfere with training by causing fatigue and interfering with sleep and recovery. Because overbreathing perpetuates the fight-or-flight response (sympathetic dominance), any performance or cognitive process requiring controlled and calculated movement and decision making is compromised. Athletes in general may have difficulty managing aggressive behavior. Sympathetic dominance may result in behavior such as a golfer hitting a putt too hard, a football player jumping offside because his timing is off, a quarterback overthrowing to receivers, and a receiver being a little ahead of the football. Baseball pitchers, fielders, and batters are affected when visual perceptions are altered. Basketball players are especially vulnerable, and shooting accuracy is affected by sympathetic dominance and overbreathing.

Assessment for functional breathing problems is very important. If breathing issues are apparent, the athlete should be referred to his or her physician for evaluation to rule out a serious pathology such as asthma, chronic bronchitis, and cardiac and endocrine disorders. Those with cardiac and/or respiratory conditions are prone to breathing dysfunction. To recognize and then develop an appropriate treatment plan, a brief overview of breathing functions is presented here, and an assessment and treatment plan are suggested with a basic protocol in Unit Two. It is strongly suggested that the text *Multidisciplinary Approaches to Breathing Pattern Disorders*[1] be obtained and studied thoroughly.

1. Chaitow L, Bradley D, Gilbert C: *Multidisciplinary approaches to breathing pattern disorders*, Edinburgh, 2002, Churchill Livingstone.

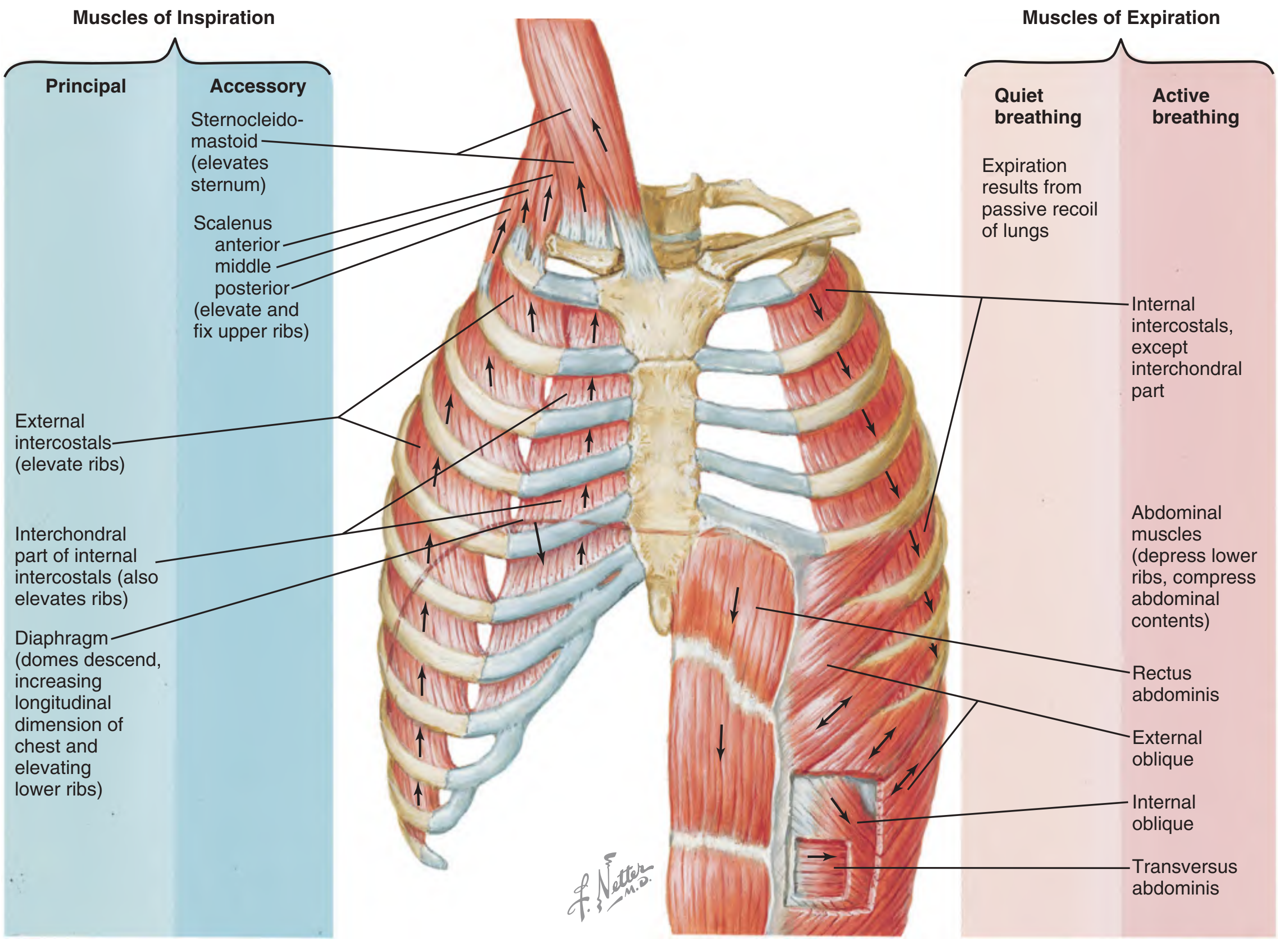


FIGURE 5-1 Respiratory muscles. Contraction of the diaphragm is the main factor producing inspiration during normal, quiet breathing; expiration is a passive process in this type of breathing, caused by passive recoil of the lungs. Active breathing requires the activity of additional muscles and involves energy expenditure for both inspiration and expiration. (Netter illustration from www.netterimages.com. ©Elsevier Inc. All rights reserved.)

PHASES OF BREATHING

Breathing includes three categories of the phase of inspiration (bringing air into the body) and two categories of the phase of expiration (moving air out of the body).

Quiet inspiration takes place when an individual is resting or is sitting quietly. The diaphragm and external intercostals are the prime movers. When *deep inspiration* occurs, the actions of quiet inspiration are intensified. When people need more oxygen, they breathe harder. Any muscles that can pull the ribs up are called into action. *Forced inspiration* occurs when an individual is working very hard and needs a great deal of oxygen, such as during aerobic exercise. Not only are the muscles of quiet and deep inspiration working, but the muscles that stabilize and/or elevate the shoulder girdle to lift the ribs directly or indirectly are working as well. The expiration phase is divided into two categories: quiet expiration and forced expiration. *Quiet expiration* is mostly passive. It occurs through relaxation of the external intercostals and elastic recoil of the thoracic wall and tissues of the lungs and bronchi, with gravity pulling the rib cage down from its elevated position. Essentially no muscle action is occurring. *Forced expiration* uses muscles that can pull down the ribs and muscles that can compress the abdomen, forcing the diaphragm upward.

Normal breathing consists of a shorter inhale in relation to a longer exhale. The ratio of inhale to exhale is 1 count inhale and 4 counts exhale. The ideal pattern ranges between 2 and 4 counts for the inhale and between 8 and 16 counts for the exhale. Reversal of this pattern, in which the exhale is shorter and the inhale longer, serves as the basis of breathing pattern dysfunction. Massage methods, along with retraining breathing, can help restore normal function.

Observation indicates whether the client is using accessory muscles to breathe; in this case, chest movement is concentrated in the upper chest instead of in the lower ribs and abdomen. The shoulders should not move up and down during relaxed breathing. Accessory breathing muscles will show increased tension and a tendency toward the development of trigger points if the breathing pattern is dysfunctional. These situations can be identified by

BOX 5-1 Breathing Pattern Disorder

Breathing pattern disorder is a complex set of behaviors that leads to overbreathing despite the absence of a pathologic condition. It is considered a functional syndrome because all parts are working effectively; therefore, a specific pathologic condition does not exist. Instead, the breathing pattern is inappropriate for the situation, resulting in confused signals to the CNS, which set up a whole chain of events.

Increased ventilation is a common component of fight-or-flight responses. However, when our breathing rate increases but our actions and movements are restricted or do not increase accordingly, we are breathing in excess of our metabolic needs. Blood levels of carbon dioxide (CO_2) fall, and symptoms may occur. Because we exhale too much CO_2 too quickly, our blood becomes more acidotic. These biochemical changes can cause many of the following signs and symptoms:

Cardiovascular: palpitations, missed beats, tachycardia, sharp or dull atypical chest pain, "angina," vasomotor instability, cold extremities, Raynaud's phenomenon, blotchy flushing or blush area, capillary vasoconstriction (face, arms, hands)

Neurologic: dizziness; unsteadiness or instability; sensation of faintness or giddiness (rarely actual fainting); visual disturbances (blurred or tunnel vision); headache (often migraine); paresthesia (numbness, uselessness, heaviness, pins and needles, burning, limbs feeling out of proportion or as if they "don't belong"), commonly of hands, feet, or face, but sometimes of scalp or whole body; intolerance to light or noise; enlarged pupils (wearing dark glasses on a dull day)

Respiratory: shortness of breath, typically after exertion; irritable cough; tightness or oppression of chest; difficulty breathing, "asthma"; air hunger; inability to take a satisfying breath; excessive sighing, yawning, and sniffing

Gastrointestinal: difficulty swallowing, dry mouth and throat, acid regurgitation, heartburn; hiatal hernia; nausea, flatulence, belching, air swallowing, abdominal discomfort, bloating

Muscular: cramps, muscle pain (particularly occipital, neck, shoulders, and between scapulae; less commonly the lower back and limbs), tremors, twitching, weakness, stiffness, tetany (seizing up)

Psychological: tension, anxiety, "unreal" feelings, depersonalization, feeling "out of body," hallucinations, fear of insanity, panic, phobias, agoraphobia

General: feelings of weakness, exhaustion; impaired concentration, memory, and performance; disturbed sleep, including nightmares; emotional sweating (axillae, palms, and sometimes whole body); woolly or thick head

Cerebrovascular constriction: a primary response to breathing pattern disorder; can reduce oxygen available to the brain by about one-half. Among resulting symptoms are dizziness, blurring of consciousness, and, possibly because of a decrease in cortical inhibition, tearfulness and emotional instability.

Other effects of breathing pattern disorder that therapists should watch for are generalized body tension and chronic inability to relax. In addition, individuals with breathing pattern disorder are particularly prone to spasm (tetany) in muscles involved in "attack posture"; they hunch their shoulders, thrust the head and neck forward, scowl, and clench their teeth.

(From Fritz S: *Mosby's fundamentals of therapeutic massage*, ed 5, St Louis, 2013, Mosby.)

palpation. Connective tissue changes are common because breathing dysfunction is often chronic.

Therapeutic massage can normalize many of these conditions and support more effective breathing. It is difficult to breathe well if the mechanical mechanisms are not working efficiently. Many who have attempted breathing retraining have become frustrated by their inability to accomplish the exercises. They may have more success after the soft tissue and the mechanisms of breathing are more normal. Specific protocols that can be used to assess and address breathing dysfunction are discussed in Unit Three.

THE PHYSICAL FITNESS PROGRAM

Objective

5. List and explain the components of a fitness program.

Exercise and stretching programs are important parts of any comprehensive fitness program because they provide the activity the body was designed to perform. Exercise has become an essential purpose unto itself. A physical fitness program needs to be appropriate; it is important to modify exercise systems and stretching programs to fit individual needs. Age, maturation, body composition, muscular strength, cardiovascular endurance, state of heat acclimation, nutritional status, and psychological and emotional condition should all be considered when designing programs for different populations.

A physical examination should be conducted before an exercise program is begun. The increase in energy requirements during exercise requires circulatory and respiratory adjustments to meet the increased need for oxygen and nutrients; to remove the end products of metabolism, such as carbon dioxide and lactic acid; and to dissipate excess heat. The shift in body metabolism occurs through coordinated activity of all systems of the body—neuromuscular, respiratory, cardiovascular, metabolic, and hormonal.

Age is not as much a risk as is straining an unconditioned heart. If a sedentary person's heart is only borderline healthy, a conditioning program could put him or her at risk for a heart attack. Appropriate exercise prescriptions should be developed and monitored by those with specialized training such as exercise physiologists and athletic trainers. The massage therapist does not develop specific therapeutic exercise protocols but does need to understand the aspects of an exercise program and to support the process with appropriate massage application.

When beginning an exercise program, the client should start slowly and gradually increase the duration of exercise up to 20 minutes or more during each session. The exercise should not be a long, strenuous workout on the very first day. Often people will overtrain, or attempt to proceed too fast. If this happens, risks for fatigue, muscle injury, and stress are increased. These individuals find, instead of benefits, that they are sore and become discouraged. It is common for the person to seek massage for these symptoms. However, because the problem is related to incorrect exercise plan implementation, the massage therapist may find it necessary to refer the client to an exercise physiologist or athletic trainer.

Overtraining may decrease immune function, which increases susceptibility to colds and infections. Several studies have shown that intense daily training reduces resistance to infectious diseases such as colds and the flu. The massage therapist should be aware that infection is a symptom of overtraining.

Long training sessions can decrease exercise effectiveness. Although exercise is a great way to reduce stress and anxiety and to lift mood, high-intensity training may counteract the pleasurable and mood-normalizing effects. Research has shown that increased training intensity can create feelings of tenseness, depression, and anger.

Those who are deconditioned; are rehabilitating from an injury, cardiac event, or stroke; or have experienced prolonged inactivity have to regain fitness.

CONDITIONING

Objectives

6. Explain intensity, duration, and frequency as these terms relate to a conditioning program.
7. Explain why it is important to include endurance, aerobic exercise, adaptation, and training stimulus threshold in a therapeutic exercise program.
8. Explain the importance of core strength as it relates to functional training.

Conditioning is improving the physical state with a program of exercise. Fitness supports general health and wellness for everyone. **Conditioning** builds on fitness to prepare the athlete for specific sport performance. The goal of conditioning is to optimize the performance of the athlete while minimizing the risks of injury and illness.

A strength and conditioning coach is often responsible for the conditioning program. All sports differ in the relative importance of the agility, speed, aerobic endurance, anaerobic power and capacity, strength, flexibility, balance, and coordination required to excel. These factors must be taken into account when successful conditioning programs are designed for individual athletes. A conditioning program should prioritize the importance of each of these athletic demands.

An important aspect of the conditioning program is **functional training.** Functional training involves activities that target integrated movement patterns performed in everyday life that can improve balance, core stabilization, strength, and flexibility.

Functional training is designed so that balance and stability are increased by requiring the athlete to control body weight in all movement planes while being challenged with unstable conditions such as wobble boards, exercise balls, slant boards, and so forth.

The exercises are multijoint, multiplanar, proprioceptive-based activities that involve deceleration (force reduction), acceleration (force production), and stabilization; controlled amounts of instability; and management of gravity, ground reaction forces, and momentum. For example, an athlete will be standing on a wobble board while throwing and catching a ball. Another example of functional training is sitting on an exercise ball and maintaining balance while alternately lifting one foot off the floor.

CORE STRENGTH

All people need **core strength**, or core stabilization training, to achieve physical fitness. The athlete's success is related to how strong and flexible his or her muscles are in the midsection. Core strengthening should be an essential part of all fitness programs. The trunk is the platform around which all multijoint and multiplanar motions occur. Exercising with a weak or dynamically unstable core is like running on a surface covered with marbles. Being out of control or off balance in the trunk increases the need for compensatory strained motions in adjacent joints. Recent evidence suggests that female athletes with a weak core are more likely to sustain tears of the anterior cruciate ligament. Lack of core strength is a cause of falls leading to injury in the elderly.

A strength-training program cannot be effective without training core muscles in the body. The body is an integrated system, not just an accumulation of parts and pieces that can be individually sport-trained.

CORE TRAINING

Core training is essential for fitness and performance. **Core training** is an attempt to centralize the strength, flexibility, coordination, and power of the body into the most powerful region of the body—the hips and torso. The intent is to strengthen muscle groups that stabilize the skeletal structure. These are primarily muscles in the thoracic area that determine posture and link the upper and lower body. Muscle groups that are strengthened with core training generally do not have the range of motion needed for movement, but they are the stable "platform" from which the arms and legs work.

When the abdominal muscles work in isolation, they bend the spine forward and flex it or twist it to one side, but when they work in conjunction with the powerful hips and extensor muscles of the back, they create spine stability. When the muscles of the hips and trunk work together, they form a functionally stabilizing unit.

Core training is not about strength. Rather, it is about stability, stamina, and coordination. Strength is the ability to produce force, whereas stability is the act of controlling force. This is an extremely important distinction. The word *core* represents the central part of the body—the torso and hips. The core is the powerhouse of the body. Even though the abdominal muscles are an important part of the core, core training is not about abdominal conditioning. The abdominals should never be totally isolated in training because they are never totally isolated in movement. Abdominal muscles work in coordination with the adductor and hip muscles during activity.

The center of mass, the midsection, is the point of stability. When the midsection is off balance, the body is off balance. If this area is strong and stable, the body has a platform from which to generate coordinated activity.

If mobility and stability are inadequate, the core will compensate in some way. The core functions through reflex reactions based on movement, balance, and task. These reflexes cannot function normally if the core must compensate for hip tightness, poor abdominal strength, poor balance when standing on one foot, or tightness with torso rotation.

Examples of core training include basic yoga and the mat work developed by Joseph Pilates. These are basic, no-nonsense approaches that demand more strength from the core than from the extremities if done correctly. Many athletes are able to move large amounts of weight in relationship to their body weight but have a very hard time getting through some of the basic core movements of yoga or Pilates. It may appear that this happens because of lack of flexibility, but actually core stability is the determining factor. These people are not weak, and they have been successful in the weight room, but they are unsuccessful in balancing the body by developing the core. The strength of the extremities is not supposed to exceed the strength of the core. The core is the foundation of power and strength.

Almost every movement in sports requires a transfer of energy—from arm to arm, from arm to leg, from leg to arm, or from leg to leg—and the core is the common denominator. Core training should lay the foundation for strength, power, speed, and agility training. The core balances the network of forces acting on the body and redistributes those forces appropriately. The core attempts to compensate for differences between right and left shoulder flexibility, right and left hip flexibility, and poor flexibility in the spine. Without proper flexibility, the core ends up absorbing some of those forces. This can cause injury and loss of power. Serious athletes cannot afford either.

The definition of stability is the ability to control movement and force, not the production of movement or the generation of force. Therefore, the best core training programs require the spine to be held in a natural or neutral position while breathing and while moving the arms and legs in motions that mimic the functional ways in which the core will be stressed in a given sport or activity.

Core training targets individual muscles and small groups of muscles. Awareness of specific muscles or muscle groups is the first step in improving various posture and form issues. Massage supports core training by reducing tension in muscles that may be sending reciprocal inhibition signals to the core muscles. Massage that lengthens the short muscles reduces inhibition signals, allowing exercise to be effective.

Core training focuses on muscular areas of the abdominals, including obliques and transverse abdominals, upper and lower back muscles, hips (gluteals, hip flexors, psoas), outer and inner thighs (abductors and adductors), hamstrings, and even pectoralis and triceps.

When a person is riding a bike, gravity dictates that all downward force generated at maximum output is limited to the person's body weight and the opposing force of pulling up by the opposite crank arm. An additional downward force can be created by pulling up on the handlebars, thus opposing the tendency for the body to rise as the legs push down on the pedals with the quads. Because the legs are attached at the hips, and not at the arms, the stable platform the arms create must be extended to the hips and legs through a stable torso.

Similar dynamic examples apply to running and swimming. Having a strong torso helps hold the form together in the latter stages of an endurance effort when fatigue occurs.

One misconception about core stability concerns the activity of the rectus abdominis. Because it is not a major core muscle, if it is or was dominant, it can inhibit the obliques and the transversus abdominis, setting up a chain of events as follows:

1. Rectus abdominis is dominant, which results in inhibition of abdominal obliques and transversus abdominis.
2. Psoas shortens and inhibits gluteus maximus.
3. Hamstring and lumbar muscles must dominate in hip extension—hamstrings shorten and become injury prone.
4. Calf muscles, particularly gastrocnemius, shorten.
5. Tension increases in Achilles tendon and plantar fascia.

This is a fairly consistent pattern. The massage professional can support core training effectiveness by using massage to inhibit inappropriate muscle dominance patterns and by assessing and treating muscle activation firing pattern sequences.

A short sequence of core movements is shown in Figure 5-2. These can all be done without any special equipment; only a floor with a little padding is needed. The ball is a beneficial addition to core training.

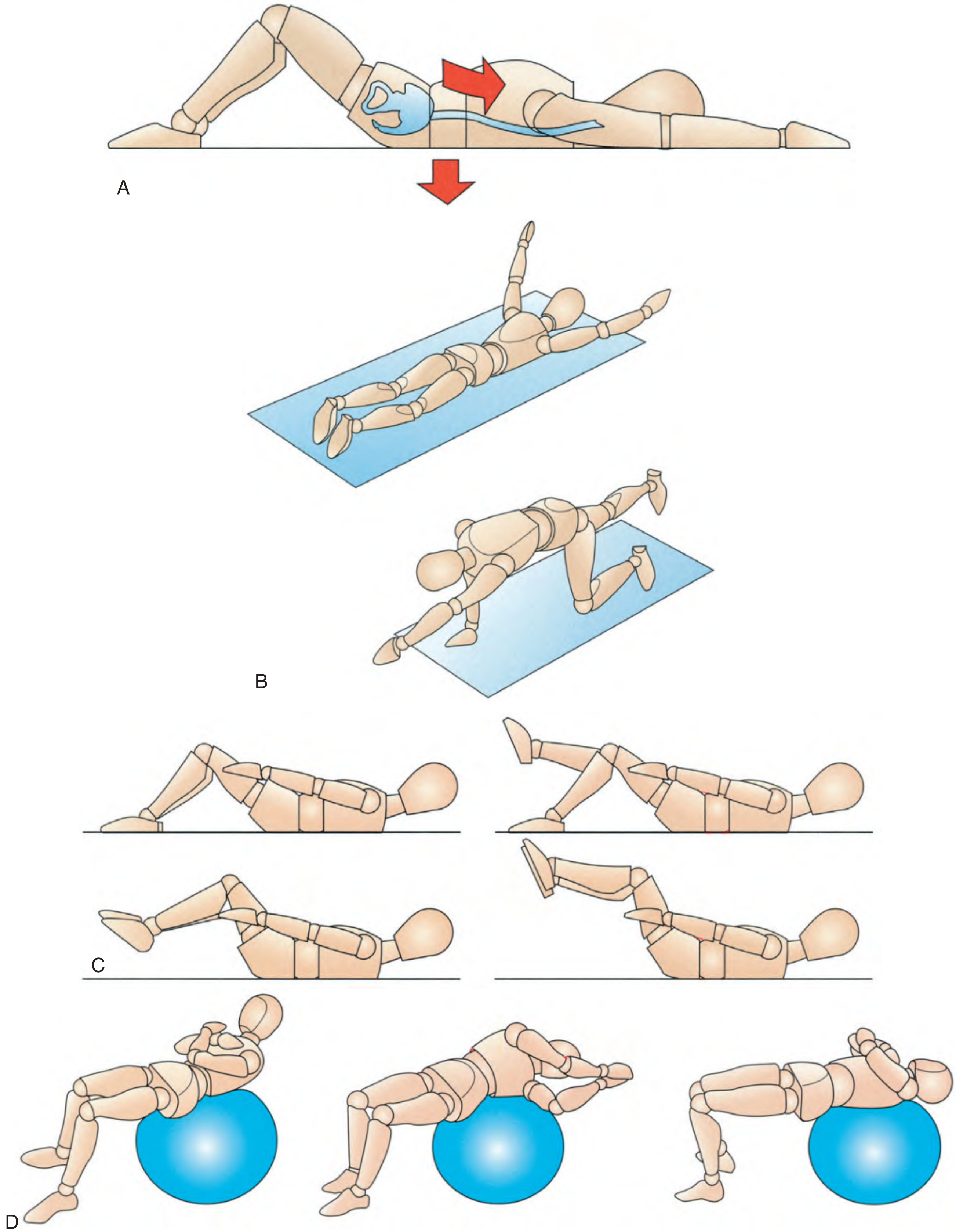


FIGURE 5-2 **A,** Draw-in maneuver. **B,** Prone core exercises. **C,** Supine core exercises. **D,** Ball curl exercises. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 4, St Louis, 2013, Mosby.)

Also recommended is the draw-in maneuver, in which the abdomen is “hollowed” by drawing the obliques toward the lumbar area.

ENDURANCE

Endurance is the ability to work for prolonged periods of time and to resist fatigue. *Stamina* is another term used to describe endurance. It includes muscular endurance and cardiovascular endurance. Muscular endurance refers to the ability of an isolated muscle group to perform repeated contractions over a period of time, whereas cardiovascular endurance refers to the ability to perform large-muscle dynamic exercise, such as walking, running, swimming, and biking, for long periods of time.

Effective endurance training must produce a conditioning, or cardiovascular, response that is dependent on three critical elements of exercise: intensity, duration, and frequency.

Exercise is any and all activity involving force generation by activated skeletal muscles. Exercise consists of physical concepts of force, work, power, torque, and energy.

Force changes or tends to change the state of rest or motion in matter, or it changes or tends to change the velocity of an object. In sport, the object may be an opposing player or a ball. In rehabilitation programs, the object may be a weight machine. Force may increase or decrease velocity in a moving object, initiate movement in a stationary object, or decrease an object’s velocity to zero.

Torque is a force to produce rotation of an object about an axis. Torque is an important concept in understanding all body movements because each joint serves as an axis of rotation. The principal purpose of a muscle is to produce torque about the joint(s) over which it functions. This concept is rather simple when applied to the knee and elbow joints, which perform in similar fashion to a door hinge. Assessment becomes more complicated when a joint such as the shoulder, which is capable of a variety of movements, or the vertebral column, in which many muscles and numerous adjacent joints are involved, is analyzed.

Energy is needed to produce work or heat. During exercise, all energy released in the muscle that does not produce work results in heat. The energy of physical exercise can be considered in terms of the potential energy of the biochemical substances utilized for muscular actions (adenosine triphosphate [ATP], carbohydrate, and fat). The actual release of this energy occurs as muscle cells develop force; heat is generated and kinetic energy works on the human body or on objects used in an exercise routine or in a competitive sport.

AEROBIC EXERCISE TRAINING

Aerobic exercise training is an exercise program focused on increasing cardiorespiratory fitness and endurance. Training is dependent on exercise of sufficient intensity, duration, and frequency to produce cardiovascular and muscular adaptation in an individual’s endurance. This is different from training for a particular sport or event, in which an individual improves in the exercise task used and may not improve in other tasks or in whole-body conditioning.

ADAPTATION

Adaptation results in increased efficiency of body function and represents a variety of neurologic, physical, and biochemical changes within the cardiovascular, neuromuscular, and myofascial systems. Athletic performance will improve as a result of these changes, and these systems will adapt to the training stimulus over time. Significant changes in fitness can be measured in 10 to 12 weeks.

Adaptation is dependent on the following:

- The ability of the organism to change
- The training stimulus threshold (the stimulus that elicits a training response)

The person with a low level of fitness will have greater potential to improve than the one who has a high level of fitness. However, the adaptive capacity of the former may be strained, so change usually needs to occur gradually.

The higher the initial level of fitness, the greater the intensity of exercise needed to elicit a significant change. Here again, the person with a low level of fitness will have greater potential to improve than the one who has high levels of fitness. For example, a person who has not engaged in regular exercise and now is exercising to manage blood pressure will adapt more readily than an active tennis player getting ready for competition.

Regardless, fitness must be achieved before performance. In some instances, an athlete may be overtraining and undermining fitness. An athletic trainer, exercise physiologist, or physical therapist is best qualified to assess for the appropriate training threshold. These specialists can also monitor progression in achieving fitness and then can indicate when the athlete is ready for performance-based training.

ENERGY USE AND RECOVERY

Objective

9. List the major energy-producing systems in the body and their implications for fitness programs.

Individuals engaging in physical activity expend **energy**. Activities can be categorized as light or heavy by determining the energy cost. Most daily activities are light and aerobic (oxygen-based) because they require little power but occur over prolonged periods. Heavy work usually requires energy supplied by both the aerobic and anaerobic systems (non–oxygen-based).

Energy systems are metabolic systems involving a series of biochemical reactions resulting in the formation of ATP, carbon dioxide, and water. The cell uses energy produced from the conversion of ATP to adenosine diphosphate (ADP) and phosphate to perform metabolic activities. Muscle cells use this energy for actin-myosin cross-bridge formation when contracting.

During fitness and performance training, three major energy systems are activated. These are the phosphagen system, the aerobic (oxygen) system, and the "in-between" system (anaerobic glycolytic system). The intensity and duration of activity determine when and to what extent each metabolic system contributes.

The body functions somewhat like an internal combustion engine. It burns fuel (nutrients) and oxygen for energy just as a car engine burns gasoline mixed with oxygen and gives off heat as it burns energy. Temperature rises during exercise, and waste products are produced as the body uses energy.

The body uses carbohydrates in the diet as its energy source. It converts complex carbohydrates and sugars in the diet to a fuel substance called *glycogen*. Glycogen is found in large amounts in the liver, as well as in muscle cells. The glycogen in muscles combines with oxygen, brought in by circulating blood from the lungs, and releases energy; this is known as the *aerobic energy cycle*. The waste products are carbon dioxide and water.

Once the muscle glycogen is exhausted from prolonged exercise, reserve glycogen is released from the liver and is carried to muscle cells so that they can continue working. This glycogen release continues until the body's supply of glycogen is totally depleted. At this point, if demand continues, the body changes fuels and begins to burn fat instead of glycogen. This is a whole new energy cycle, called the *anaerobic energy cycle*. The waste product produced is lactic acid.

The body can easily rid itself of carbon dioxide and water, but it has difficulty getting rid of lactic acid. As exercise continues, lactic acid begins to build up in the muscles, causing fatigue. This buildup of lactic acid is what causes the burning pain in exhausted muscles. When exercise ends, the lactic acid is dissipated.

THE PHOSPHAGEN SYSTEM

The **phosphagen system** supplies energy for brief, high-power events such as sprints, jumps, vaults, and throws in track and field; batting, base-running, and fielding in baseball; power lifting and Olympic weight lifting; and much of the blocking and tackling done by linemen in football. Each of these activities lasts only a few seconds, and the energy is provided mostly by the breakdown of phosphocreatine stored in the muscles. Oxygen is not required during the exertion, so the energy is supplied anaerobically.

If the athlete is using mostly the phosphagen system, the focus of strength and conditioning is brief, near-maximal exertion. Massage targets breathing and fluid movement and parasympathetic dominance to support recovery.

THE AEROBIC (OXYGEN) SYSTEM

The **aerobic (oxygen) system** provides most of the energy for activities that last longer than a couple of minutes and for recovery between repeats of brief, high-intensity activities. Daily life activities are aerobic. Other than sprints at the beginning and end of the race, distance runners and swimmers and road cyclists rely almost entirely on aerobic metabolism.

The aerobic system has the following characteristics:

- Glycogen, fats, and proteins are fuel sources.
- Oxygen is required.
- ATP is resynthesized in the mitochondria of the muscle cell. The ability to metabolize oxygen and other substrates is related to the numbers and concentrations of mitochondria and cells.
- The system predominates over other energy systems after the second minute of exercise.

Aerobic activity focuses on the cardiovascular system and the aerobic capacity of the muscles to perform longer-duration activities that require less than maximal intensities of exertion. In the weight room, focus should be on lifting relatively light weights and performing a greater number of repetitions. This type of fitness program is used for cardiorespiratory rehabilitation and weight management. Again, massage should support recovery. The focus of massage would include parasympathetic dominance and arterial circulation.

ANAEROBIC GLYCOGEN BREAKDOWN: THE "IN-BETWEEN" SYSTEM

For activities that last longer than about 10 seconds but less than 2 minutes, most of the energy is supplied by the anaerobic breakdown of glycogen (a carbohydrate) stored in the muscles. This is sometimes called the "lactic acid" system or the **anaerobic glycolytic system**. Events such as a 400-meter run in track, a 50-meter swim, a series of fast breaks in basketball, or a series of sprints down the soccer or football field would require energy from this system. Strength and conditioning activities would be intermediate between those recommended for the phosphagen system and those for the aerobic system.

The anaerobic glycolytic system has the following characteristics:

- Glycogen (glucose) is the fuel source.
- No oxygen is required.
- ATP is resynthesized in the muscle cell.
- Lactic acid is produced.
- The system provides energy for activity of moderate intensity and short duration.
- It is the major source of energy from the 30th to the 90th second of exercise.

In sports such as soccer, basketball, wrestling, lacrosse, rugby, tennis, ice hockey, field hockey, and rollerblading, and during daily life activities, people use both anaerobic and aerobic metabolism to produce energy. This means that optimal training for fitness should include a combination of brief, high-intensity activities along with more prolonged, lesser-intensity exertion.

To improve fitness, it is important to increase the supply of oxygen to the muscles and prevent exhaustion of glycogen reserves.

Recruitment of muscle motor units is dependent on the rate of work. Fibers are recruited selectively during exercise. Slow-twitch fibers type I are characterized by a slow contractile response, are rich in myoglobin and mitochondria, have a high oxidative capacity and a low anaerobic capacity, and are recruited for activities demanding endurance. These fibers are supplied by small neurons with a low threshold of activation and are used preferentially in low-intensity exercise.

Fast-twitch fibers type IIb are characterized by a fast contractile response, have low myoglobin content and few mitochondria, have a high glycolytic capacity, and are recruited for activities requiring power.

Fast-twitch fibers type IIa have characteristics of both type I and type IIb fibers and are recruited for both anaerobic and aerobic activities.

FUNCTIONAL IMPLICATIONS

Bursts of intense activity lasting up to 50 seconds develop muscle strength and stronger tendons and ligaments. ATP is supplied by the phosphagen system.

Intense activity for 1 to 2 minutes, repeated after 4 minutes of rest or mild exercise, provides anaerobic power. ATP is supplied by the phosphagen and anaerobic glycolytic system.

Activity using the large muscles at less than maximal intensity for 3 to 5 minutes, repeated after rest or mild exercise of similar duration, may develop aerobic power and endurance capabilities. ATP is supplied by the phosphagen, anaerobic glycolytic, and aerobic systems.

Activity of submaximal intensity, lasting 30 minutes or longer, taxes a high percentage of the aerobic system and develops endurance.

An understanding of the metabolic demands imposed by the sport and the biomechanics of every task executed by the athlete is necessary. A particular sport does not usually fall cleanly into one energy system category or another but rather involves all three (phosphagen system, glycolytic system, oxidative system) to a greater or lesser extent. In soccer, for example, all three energy systems are used. Soccer players must explode to the ball or mark an opposing player or go up high for a header, but they also must cover a total distance of approximately 6 miles by the end of the game, with rest periods of about 3 seconds every 2 minutes of play.

The energy system that is primarily used will determine the optimal types of conditioning and strength training for the sport. For example, jumpers and vaulters do not need to spend a lot of time running distances over 400 meters or doing multiple sets in the weight room of 12 and 15 repetitions. The combinations of sets and repetitions used in strength training should be consistent with the energy requirements and movement patterns of the sport or desired activity; dictating that strength and conditioning programs for an offensive tackle in football, a shortstop in baseball, and an elderly woman struggling with daily care activities are very different. For the offensive tackle, conditioning should develop strength, muscle mass, power, quickness, three-step speed, and anaerobic conditioning capacity. For the baseball shortstop, strength and muscle mass are not so critical. His or her training should improve speed, explosive power and quickness, and the ability to change movement direction instantly. The elderly woman needs balance and leg strength to prevent falling.

The physical therapist or strength and conditioning and positional coaches make decisions regarding the appropriate type of training and implement these programs. The athlete's training history is crucial. An individual who has never followed any kind of strength and conditioning program must be brought along much more slowly and carefully than an athlete with advanced training experience. Each athlete is unique; therefore, performance segments need to be individually developed. Massage can support the athlete by managing any discomfort that accompanies an exercise training program.

PHYSIOLOGIC CHANGES THAT OCCUR WITH EXERCISE

Objective

10. Identify the physiologic changes that occur with exercise.

The cardiovascular system and the muscles used will adapt to the training stimulus over time. Significant changes can be measured at a minimum of 10 to 12 weeks. Adaptation results in increased efficiency of the cardiovascular system and of active muscles. Adaptation represents a variety of neurologic, physical, and biochemical changes within the cardiovascular and muscular systems. Performance improves as a result of these changes.

Changes in the cardiovascular and respiratory systems as well as changes in muscle metabolism occur with exercise. These changes happen at rest and during exercise. It is important to note that all of the following training effects cannot result from one training program. A regular ongoing process of exercise with a variety of activities is necessary to achieve and maintain fitness.

CARDIOVASCULAR RESPONSE TO EXERCISE

Stimulation of small myelinated and unmyelinated fibers in skeletal muscle involves a sympathetic nervous system response. The sympathetic nervous system response includes generalized peripheral vasoconstriction and increased myocardial contractility, increased heart rate, and hypertension. This results in a marked increase and redistribution of cardiac output.

Frequency of sinoatrial node depolarization increases and heart rate increases; a decrease in vagal stimuli occurs, as well as an increase in sympathetic stimulation. Generalized vasoconstriction allows blood to be shunted from nonworking muscles, kidneys, liver, and spleen to working muscles. The veins of working and nonworking muscles remain constricted.

Cardiac output increases because of the increase in myocardial contractility, heart rate, and blood flow through the working muscle.

A change at rest involves a reduction in the resting pulse rate with a decrease in sympathetic dominance and lower levels of norepinephrine and epinephrine. An increase in parasympathetic restoration mechanisms is noted. A decrease in blood pressure can occur. Often, blood volume and hemoglobin are increased; this enhances the oxygen delivery capacity of the system.

During exercise, the pulse rate is reduced and norepinephrine and epinephrine are decreased. An increase in cardiac function is noted, along with increased extraction of oxygen by the working muscle.

RESPIRATORY RESPONSE TO EXERCISE

Respiratory changes occur rapidly, with an increase in gas exchange by the first or second breath, an increase in body temperature, increased epinephrine levels, and increased stimulation of receptors of the joints and muscles. Baroreceptor reflexes, protective reflexes, pain, emotion, and voluntary control of respiration may also contribute to the increase in respiration.

Alveolar ventilation, occurring with diffusion of gases across the capillary-alveolar membrane, increases 10-fold to 20-fold in heavy exercise to supply the additional oxygen needed and to excrete the excess carbon dioxide produced.

Increased blood flow to the working muscle as previously discussed provides additional oxygen. Also, more oxygen is extracted from each liter of blood.

Changes that happen at rest include larger lung volumes because of improved pulmonary function. Changes with exercise occur because of a larger diffusion capacity in the lungs resulting from larger lung volumes and a greater alveolar-capillary surface area. Breathing is deeper and more efficient.

METABOLIC CHANGES

Muscle hypertrophy and increased capillary density are observed at rest and with exercise following endurance training. A noticeable increase in the number and size of mitochondria increases the capacity to generate ATP aerobically.

A decreased rate of depletion of muscle glycogen and lower blood lactate levels at submaximal work levels are the result of an increased capacity to mobilize and oxidize.

OTHER SYSTEM CHANGES

Changes in other systems that occur with exercise training include the following:

- A decrease in body fat, blood cholesterol, and triglyceride levels and an increase in heat acclimatization
- An increase in breaking strength of bones, ligaments, and tendons

THE EXERCISE PROGRAM

Objective

11. List and describe the three main components of an exercise program that targets fitness.

Benefits of the exercise program are determined by intensity, duration, frequency, and maintenance of the exercise program. The exercise program has three components: (1) warm-up, (2) aerobic exercise, and (3) cool-down. Performance training for athletes can occur as part of the aerobic portion of the program or directly following it.

EXERCISE INTENSITY

Exercise intensity is based on the **overload principle**, which refers to stress on an organism that is greater than that regularly encountered during everyday life. To improve cardiovascular and muscular endurance, an overload must be applied to these systems. For adaptation to occur, the exercise intensity load must be just above the training stimulus threshold. Once adaptation to a given load has taken place, for the individual to achieve further improvement, training intensity (exercise load) must be increased. Increasing intensity too quickly can result in injury. Training stimulus thresholds are variable, depending on the individual's level of health, level of activity, age, and gender.

Appropriate intensity during exercise does result in conditions that may be uncomfortable for the average person. Delayed-onset muscle soreness, general stiffness, and mild fatigue are common and expected. Massage can be used to minimize the discomfort and therefore supports training.

DURATION

The optimal **duration** of exercise for cardiovascular conditioning is dependent on the total work done, exercise intensity and frequency, and fitness level. Generally speaking, the greater the intensity of the exercise, the shorter the duration needed for adaptation; the lower the intensity of exercise, the longer the duration needed. A 20- to 30-minute session is generally optimal at 70% of maximum heart rate. When the intensity is below the heart rate threshold, a 45-minute continuous exercise period may provide the appropriate overload. With high-intensity exercise, 10- to 15-minute exercise periods are adequate. Three 5-minute periods daily may be effective in someone who is deconditioned. Exercise for periods longer than 45 minutes increases the risk of musculoskeletal injury and soreness. If the duration must exceed 45 minutes, massage can minimize the discomfort at least temporarily through symptom management of pain, aching, and stiffness.

FREQUENCY

Optimal **frequency** of fitness training is generally 3 to 4 times a week. Frequency varies, dependent on the health and age of the person. If training is at a low intensity, greater frequency may be beneficial. Frequency of 2 times a week does not generally evoke cardiovascular changes, although individuals who are deconditioned may initially benefit from a program of that frequency. For those who are in good general health, exercising 30 to 45 minutes at least 3 times a week appears to protect against coronary heart disease. As frequency increases beyond the optimal range, the risk of musculoskeletal injury and soreness increases. This may occur during initial stages of rehabilitation protocols. The competing athlete will often exercise and train every day, which actually works contrary to achieving fitness and increases injury potential.

Many types of activities provide the stimulus for improving cardiovascular and cardiorespiratory fitness. The important factor is exercise that involves large muscle groups that are activated in a rhythmic, aerobic way. For specific aerobic activities such as cycling and running, the overload must use the muscles required by the activity and must stress the cardiorespiratory system (specificity principle). If endurance of the upper extremities is needed to perform activities, the upper extremity muscles must be targeted in the exercise program. The muscles trained develop a greater oxidative capacity, with an increase in blood flow to the area. The increase in blood flow is due to increased microcirculation and more effective distribution of cardiac output. Training benefits are optimized when programs are planned to meet the individual needs and capacities of participants. The skill of the individual, variations among individuals in competitiveness and aggressiveness, and variations in environmental conditions all must be considered.

MAINTAINING FITNESS

The frequency or duration of physical activity required to maintain a certain level of aerobic fitness is less than that required to improve it. The beneficial effects of exercise training are reversible. The process of deconditioning occurs rapidly when a person stops exercising. After only 2 weeks of reduced activity, significant reductions in work capacity can be measured, and improvements can be lost within several months. A progressive reconditioning program is required. This is the task of the strength and conditioning coach.

WARM-UP

The purpose of the **warm-up** period is to enhance the numerous physiologic adjustments that must take place before physical activity. Physiologically, a time lag exists between initiation of activity and the need for bodily adjustments to meet the physical requirements of the body.

Warm-up results in an increase in muscle temperature. The higher temperature increases the efficiency of muscular contraction by reducing connective tissue viscosity and increasing the rate of nerve conduction.

Warm-up literally means warming up muscle fibers by increasing body temperature. When breaking into a sweat, body temperature is elevated by about 2° F, which is appropriate for warming. This leads to a wide variety of beneficial physiologic changes:

- The warmer muscle fibers get, the softer and more fluid they become. They are then able to stretch more easily and to contract more rapidly. The faster a muscle contracts, the stronger it is.
- The higher the temperature of muscle cells, the faster they are able to metabolize the oxygen and fuel they need.
- As muscles warm, the response to nerve impulses quickens, causing faster contraction and, therefore, a quicker response.
- Warming joints lubricates them, allowing them to move more freely with less energy expended. This protects the joints from excessive wear.
- Warm-up gradually increases heart rate and prevents abnormal heart rhythms. Sudden strenuous exercise can cause the heart to demand more oxygen than the circulatory system can provide, resulting in a strain on the heart. Studies show that warming up may help prevent heart attacks that result from abnormal heart rhythms.
- Oxygen extraction from hemoglobin is greater at higher muscle temperatures, supporting the aerobic process. Dilation of constricted capillaries, which improves the circulation, increases oxygen delivery to the active muscles and minimizes oxygen deficit and formation of lactic acid. An increase in venous return occurs. Adaptation in sensitivity of the neural respiratory center increases respiratory rate.

Warm-up activities include rhythmic movement of large muscles of the body and should be related to sport performance requirements. Regardless of whether a person is engaging in fitness or wishes to increase or maintain athletic performance, the warm-up period is critical for preventing injury and supporting training per performance during competition.

Massage as Part of Warm-up

Massage before a workout can make athletes feel weak and unmotivated. They may not even want to do the workout after the session, so be cautious. Work to increase flexibility and range of motion. Shaking, rolling tissue gently, and using muscle energy techniques can be appropriate. Duration is short–about 15 to 20 minutes.

AEROBIC EXERCISE

The **aerobic exercise** period is the conditioning part of the exercise program. Attention to intensity, frequency, and duration will have an impact on the program's effectiveness. The main considerations when a specific method of training is chosen include the following:

- Stimulates increased cardiac output
- Enhances local circulation
- Increases aerobic metabolism within appropriate muscle groups
- Does not cause injury
- Is weight-bearing, to support bone health
- Is above the threshold level for adaptation to occur
- Is below the level of exercise that evokes fatigue symptoms

In aerobic exercise, submaximal, rhythmic, repetitive, dynamic exercise of large muscle groups is emphasized. Four methods of training will condition the aerobic system: continuous, interval, circuit, and circuit-interval (Box 5-2).

Massage as Part of Aerobic Training

Massage may be used during aerobic training in targeted areas that interfere with the ability to exercise. Examples are localized muscle cramp and isolated muscle tension.

COOL-DOWN

A **cool-down** period is necessary following the aerobic exercise and performance-training period. The cool-down period prevents pooling of blood in the extremities by continuing to use the muscles to maintain venous return. It enhances the recovery period with oxidation of metabolic waste and replacement of energy stores and prevents myocardial ischemia, arrhythmia, and other cardiovascular conditions.

Characteristics of the cool-down period are similar to those of the warm-up period. A total-body exercise such as calisthenics or brisk walking that decreases in intensity is appropriate. The cool-down period should last for 5 to 10 minutes. Flexibility programs are used after the cool-down period. Cool-down massage is used after the cool-down and can be part of a flexibility program if stretching is included in the massage.

STRENGTH TRAINING

Objective

12. Incorporate strength training into physical fitness.

Strength training involves muscle contraction against resistance. Many forms of strength training are available, including weight machines, free weights, and resistance bands. To prevent injury, it is important for the participant to be properly trained in whatever strength program is used.

Most sports require overall strength training, but exercise programs should be adjusted to meet the specific requirements of a given sport. In football, linebackers and defensive backs make most of the tackles and need to improve upper body as well as lower body strength.

BOX 5-2 Aerobic Training Types

CONTINUOUS TRAINING

Continuous training involves a submaximal energy requirement sustained throughout the exercise period. Once steady state is achieved, the muscle obtains energy by means of aerobic metabolism. Stress is placed primarily on slow-twitch muscle fibers. The activity can be prolonged for 20 to 60 minutes without exhausting the oxygen transport system. Work rate is increased progressively as training improvements are achieved. Overload can be accomplished by increasing the exercise duration. In the healthy individual, continuous training is the most effective way to improve endurance. Brisk walking is an excellent example of continuous training.

INTERVAL TRAINING

In this type of exercise program, the exercise period is interspersed with a relief interval. **Interval training** is generally less demanding than continuous training. In the healthy individual, interval training tends to improve strength and power to a greater extent than endurance. The relief interval may be a rest relief (passive recovery) or a work relief (active recovery), and its duration ranges from a few seconds to several minutes. Work recovery involves continuing the exercise, but at a reduced level from that of the work period. During the relief period, a portion of the muscular stores of ATP and the oxygen associated with myoglobin that were depleted during the work period are replenished by the aerobic system.

The longer and more intense the work interval, the more the aerobic system is stressed. With a short work interval, the duration of the rest interval is critical. A rest interval equal to one and a half times the work interval allows the succeeding exercise interval to begin before recovery is complete and stresses the aerobic system.

A significant amount of high-intensity exercise can be achieved with interval or intermittent work if work relief intervals are appropriately spaced. Examples include lap swimming with rest periods and race walking or sprinting short distances with periods of slower walking interspersed.

CIRCUIT TRAINING

Circuit training employs a series of exercise activities. At the end of the last activity, the individual starts again from the beginning and again moves through the circuit. The series of activities is repeated several times. Several exercise modes involving large and small muscle groups and a mix of static or dynamic effort can be used.

Use of circuit training can improve strength and endurance by stressing both aerobic and anaerobic systems. Often a combination of aerobic activities and weight training is included in the exercise program. Core training that strengthens the postural muscles of the torso can be included in circuit training. Activities using various sizes of exercise balls promote postural balance and core strength.

CIRCUIT-INTERVAL TRAINING

Circuit-interval training, in which the two types are combined, is effective because of the interaction of aerobic and anaerobic production of ATP. In addition to the aerobic and anaerobic systems being stressed by various activities, with the relief interval, a delay in the need for anaerobic processes and in the production of lactic acid occurs because the rest period allows blood oxygen levels to be replenished.

Running backs and wide receivers should concentrate on lower body strength training to develop their legs.

Similarly, runners, dancers, and soccer players need lower body strength; baseball players, golfers, swimmers, and gymnasts need to work more on upper body strength; and basketball players and wrestlers need both upper and lower body strength.

Tennis players require lower body strength to develop their legs but also need to pay particular attention to upper body strength. Strengthening the shoulder helps prevent rotator cuff injuries. If tennis players would strengthen their forearm and wrist muscles, they would not be as prone to tennis elbow.

Typically, strength training programs target different muscles on different days and intersperse light and heavy repetitions. For example, follow a light "Day 1" program on Monday and a light "Day 2" program on Tuesday; rest on Wednesday; on Thursday and Friday, alternate heavy programs.

STRENGTH TRAINING INFLUENCES ON CHILDREN

Traditionally, sports experts believed that strength training by children did not accomplish anything. Both boys and girls supposedly lacked the boost of testosterone in their blood needed to add muscle bulk. It was believed that until a child had gone through puberty and had developed secondary sexual characteristics, there was no point in strength training. Strength training was also thought to put undue stress on the growth plate in a young child's bones and to stunt the child's growth. By speeding up maturation, strength training theoretically would prevent the bones from growing to their full, natural length.

It is now known that preteens, even though they lack the testosterone necessary to increase muscle bulk, can increase their strength without injuring themselves. A major study by the Sports Medicine section of the American Academy of Orthopedic Surgeons proved that strength training does not injure the growth plate or stunt a child's growth. The American Academy of Pediatrics now agrees that children as young as 11 years of age can begin a well-supervised weight-training program.

Unfortunately, all too frequently 6- and 7-year-olds are being pushed into weight training by their overeager parents. Young children typically lack sufficient concentration and regimentation for weight training to be beneficial. They often do themselves harm because they do not have the coordination to handle weights and are not mature enough to understand what they are doing or why. Any child interested in strength training needs to be closely supervised.

Starting around age 12, a child can begin lifting light weights with many repetitions to learn the proper techniques. More weight can be added as the child gets stronger and grows. With an adequately supervised program, there is room for great improvement in a child's strength without the threat of injury.

STRENGTH TRAINING FOR WOMEN

Strength training is essential for women. The big difference between a man's strength and a woman's strength is seen in the upper body. In fact, a woman's lower body strength is pound-for-pound about the same as a man's. Woman runners know that the longer the distance to be covered, the more closely they can compete with men because they do not have to propel as much weight.

MASSAGE AS PART OF STRENGTH TRAINING

Strength training involves both concentric and eccentric movements, increasing the potential for delayed-onset muscle soreness. Lymph drain–type massage is helpful. Do not use deep compression after strength training. The tissues are taut from increased blood and lymph in the areas. This is a fluid issue, not a tensor issue. Deep compression can damage fluid-filled tissue.

FLEXIBILITY TRAINING

Objective

13. Describe how flexibility supports an exercise program.

Flexibility is the ability to move a single joint or a series of joints through a normal, unrestricted, pain-free range of motion. It is dependent upon the extensibility of muscle, which allows muscles that cross a joint to relax, lengthen, and yield to a stretch force. The arthrokinematics of the moving joint and the ability of connective tissues associated with the joint to deform also affect joint range of motion (ROM), and an individual's overall flexibility.

Dynamic flexibility refers to the active ROM of a joint. This aspect of flexibility is dependent on the degree to which a joint can be moved by a muscle contraction and the amount of tissue resistance met during active movement. *Passive flexibility* is the degree to which a joint can be passively moved through the available ROM and is dependent on the extensibility of muscles and connective tissues that cross and surround a joint. Passive flexibility is a prerequisite for, but does not ensure, dynamic flexibility.

Muscle tissue and fascial shortening cause a change in the length-tension relationship of the muscle. As the muscle shortens, it is no longer able to produce peak tension. The result is a muscle that is weak but short and tight. Loss of flexibility, for whatever reason, can cause pain arising from muscle, connective tissue, or the periosteum. This in turn decreases muscle strength.

Flexibility is the ability to elongate a muscle, as when the hamstrings are stretched during a forward bend; however, mobility is a broader concept. Mobility involves muscle and joint freedom of movement. A good example of mobility is the ability to keep the heels flat while squatting past the point where the thighs are parallel to the floor. Note that a squat involves multiple joints and muscles. Strength can be defined as the ability to produce force or movement; stability is the ability to control force or movement. In most cases, stability is a precursor to strength. When stability and strength are functioning, mobility is possible.

STRETCHING

Stretching is a general term that describes any therapeutic modality designed to lengthen (elongate) pathologically shortened soft tissue, particularly connective tissue structures, to increase range of motion. The end result is increased flexibility.

The main components of a flexibility program include a controlled sustained load on the muscles and connective tissue components that do not strain the joint structure. Many types of flexibility programs are available. Yoga is an excellent example of a flexibility program.

When a muscle is passively stretched, initial lengthening occurs in the neuromuscular component, and tension in the muscle rises sharply. After a point, mechanical disruption of the cross-bridges of actin and myosin occurs as the filaments slide apart, and abrupt lengthening of the sarcomeres occurs (called *sarcomere give*). Various applications of muscle energy methods support this process. When the stretch force is released, the individual sarcomeres return to their resting length instead of to the shortened position. The tendency of muscle to return to its resting length after short-term stretch is called *elasticity*.

Stretching specifically targets connective tissue structures. The increase in pliability and length of connective tissue is called *plasticity*.

To get the most from stretching, a customized routine to fit the needs of the individual is most effective. For example, in one routine, you stretch until you feel a slight pull without pain. As the stretch is held, the muscle will relax. As less tension is felt, increase the stretch again until the same slight pull is felt. This position should be held until no further increase is felt. If range of motion is not gained using this technique, consider holding the stretch longer (up to 60 seconds).

Bouncing while stretching, or ballistic stretching, can do more damage than no stretching at all. With each bounce, muscle fibers fire and shorten the muscle—the opposite of what the activity is trying to accomplish. Bouncing actually reduces flexibility. A static stretch—holding the muscle still for 10 to 20 seconds—is much better. The muscle responds by lengthening slowly. Each stretch should be gradual and gentle.

Stretching is enhanced by incorporating various muscle energy methods and increasing the tolerance of the muscle to stretching.

Studies indicate that continuous stretching without rest may be better than cyclic stretching (applying a stretch, relaxing, and reapplying the stretch); however, some research shows no difference. Massage is effective in normalizing muscle tone and motion. It is also effective in assisting the athlete to achieve and maintain flexibility.

In addition to improving range of motion, stretching is extremely relaxing, and most athletes use stretching exercises to maintain a balance in body mechanics. One of the biggest benefits of stretching may be something that research cannot quantify: it just feels good. Whether the massage therapist stretches the client, or the trainer or the physical therapist does, the focus of stretching depends on the individual's athletic activities to lengthen shortened tissues. Massage is an excellent way to support flexibility programs, especially if the methods used address both the elasticity and the plasticity of the soft tissue.

See Chapter 12 for implementing a stretching sequence into the massage treatment plan.

SPORT-SPECIFIC TRAINING

Objective

14. Explain the transition from fitness training to sport-specific training.

Training for a particular sport or event is dependent on the **specificity principle**, that is, the individual improves in the exercise task used for training and may not improve in other tasks. For example, swimming may enhance one's performance in swimming events but may not improve one's performance in treadmill running. The athlete should train as if competing in the targeted sport. It is probably detrimental to performance for sprinters and interior linemen to train by running distance miles and lifting light weights for 50 repetitions. Conversely, endurance athletes such as marathon runners need to train for sustained activity. Therapeutic massage should address the appropriate recovery period required for each sport.

It is important to consider the body parts of the athlete that are most prone to injury in a particular sport. These body parts need to be strengthened, not only to improve the performance of muscles used in the sport, but also to minimize the risk of injury to these muscles and joints. This is sometimes called *prehabilitation training* and is supported by application of appropriate sports massage to prevent injury. The large muscle groups of the back, abdomen, shoulders, and hips, commonly called the *core,* should be included as part of strength-training sessions.

Mature and more experienced athletes can tolerate more intensive conditioning programs. Programs for young and/or inexperienced athletes need to be carefully designed and implemented.

Factors considered in sport-specific programs include the following:

- Strength and endurance required for the particular sport
- Movements required to perform the activity
- The athlete's strength-to-body weight ratio
- Positional/sport needs
- Training history

- Body composition
- Aerobic and anaerobic fitness
- Injury-prone or previously injured sites that require special attention

SUMMARY

This chapter presents information about physical fitness and conditioning programs. Therapeutic exercise provides benefit. The exercise program needs to be individually designed for each client. Depending on the client's physical condition, variables that are considered for each fitness program include intensity, duration, frequency, and type of activity. These variables target both anaerobic and aerobic energy systems.

The three main parts of a therapeutic exercise program are warm-up, aerobic activity, and cool-down. Strength training, especially core strength training, is important. Flexibility rounds out the fitness program. Massage support is appropriate during all aspects of a fitness program.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1 List the elements that would be found in an exercise program for each of the following people:

A A 19-year-old male in a weight-management program
B A 28-year-old female training for a marathon
C A 49-year-old female wishing to improve fitness and management of age-related changes
D A 71-year-old male for cardiovascular fitness
E Yourself

2 Describe massage support for each of the exercise programs listed in question 1.

CHAPTER

6 Sport-Specific Movement

OBJECTIVES

After completing this chapter, the student will be able to do the following:

1. Identify elements that influence performance skill.
2. Explain why massage application is movement-generated rather than sport-generated.
3. Describe the importance of coordinated movement strategies.
4. Compare and contrast acceleration and deceleration.
5. Describe the movement strategies of:

catching	rotating
cutting	running
hitting	swinging
jumping	throwing
kicking	turning/pivoting
pivoting	walking

KEY TERMS

Acceleration	Hitting	Rotation
Catching	Jumping	Running
Cutting	Kicking	Swinging
Deceleration	Movement Strategies	Throwing
Functional Movement Development	Pivoting	Turning
Gait Cycle	Primary Movements	Walking
	Reaction Time	

OUTLINE

Each sports activity consists of a combination of functional movement strategies based on fundamental movement skills. Because therapeutic massage is targeted to support effective functional movement, in general it is more important for the massage therapist to understand the movements required to accomplish a task, as opposed to the movements required for proficiency in a specific sport. Assessment can then be focused on the combination of movements that constitutes a sport-specific or activity-specific pattern. It is the role of the performance coach to develop sport-specific skills in the athlete or performer and of the physical therapist or similar professional to target skill achievement in those in rehabilitation. It is the responsibility of the massage therapist to identify the demands of the client's activities and the sequence of movements required for performance, and then to apply appropriate massage treatment both to support performance and to correct dysfunction.

Mobility and stability must coexist to create efficient movement in the human body. If a movement problem exists because of reduced mobility (soft tissue shortening or joint stiffness) or reduced ability (poor strength, coordination, control, or deconditioning), then the movement pattern is altered to compensate.

Mobility and stability are the functional building blocks of strength, endurance, speed, power, and agility. When these building blocks are not in place, the athlete compensates, developing bad biomechanical habits that allow him or her to continue to perform a skill but in a nonoptimal way. Compensations increase the chances of poor performance and of injury.

Physical performance is about **functional movement development**, which is not the same as fitness or muscular strength development. It involves integration of all aspects of training, working together without conscious effort. In the field of education, this unconscious effort is referred to as *automaticity*. Automaticity is an important factor in the performance of athletes; for the brain and muscles to habitually perform a movement, the brain and muscles must be consistently trained in the ways in which they will be used in a specific sport or activity.

Sport skills are learned. Talent is a combination of physical ability, perception, and dedication to repetitive training. People can be born with a tendency toward a particular set of skill development. A genetic predisposition to muscle mass, muscle fiber type, neuromuscular sensitivity, height, cognitive processing, and so forth may be present. Genetic predisposition can be enhanced or deterred by lifestyle (diet, substance use, activity), environment (air quality, sanitation, water quality, training facility, economic opportunity, social support), and motivation (drive, determination, and training commitment).

BASIC FUNDAMENTAL MOVEMENT SKILLS AND FUNCTIONAL MOVEMENT STRATEGIES

Objective

1. Identify elements that influence performance skill.
2. Explain why massage application is movement-generated rather than sport-generated.
3. Describe the importance of coordinated movement strategies.

Fundamental movement skills include basic movements such as throwing, kicking, running, jumping, and catching. Functional **movement strategies** or sport-specific skills consist of these movement skills applied to a sport activity such as throwing a baseball, kicking a soccer ball, running a marathon, jumping to make a basket in basketball, catching a football for a touchdown, or spinning in figure skating.

Fundamental movement stills are divided into three categories:

- Locomotor/Moving: involves the body moving in any way. Skills in this category include walking, running, cutting, pivoting, jumping, sliding, and skipping.
- Non-locomotor/Stability Skills: involve maintaining static balance in one place or dynamic balance while in motion. Skills in this category include bending, stretching, twisting, turning, lifting, landing after jump, standing on one foot, and controlled falling.
- Manipulative Skills: involve handling and controlling objects with the hand, the foot, or an implement such as a bat or a racquet. Skills in this category include throwing, catching, batting, and kicking.

Certain combinations of basic functional movements equal sport-specific skills. These basic movements include walking/running, jumping, kicking, and throwing. These can be further categorized as rotation, swinging, catching, hitting, cutting, pivoting, and turning. Each of these basic movements is even more fundamentally a combination of **primary movements** of flexion, extension, medial and lateral rotation, abduction, adduction, pronation, supination, dorsiflexion, and plantar flexion (Box 6-1).

Therapeutic massage targets the physical capacity to execute these movements. Because this is the case, it is not necessary for a massage therapist to be an expert in a particular sport. Instead, it is necessary to break down a sport activity into fundamental movement skills. Once the movement skills are identified, the muscles, joints, and other structures involved can be assessed and addressed. These combined movements begin in the core and progress through the limbs to the distal joints. These patterns are called *movement strategies*.

Factors important for optimal movement include the following: stable head position with eyes oriented to the horizon, body oriented to a vertical upright position with center of gravity over a base of support, core stability, limb position, velocity, and coordination. These factors are monitored by reflex patterns in the eye, ear, head, neck, vestibular network, and foot-ankle complex.

The speed of **reaction time** determines the speed of movement. Visual stimuli trigger the oculomotor response, which translates to visual and auditory strategies for movement. These reflex responses decrease with fatigue, pain, illness, injury, stress, and age. The skilled athlete is able to scan the environment by looking and listening and responds with appropriate movement faster than nonathletes, indicating both genetic tendency and learned ability to support performance.

The body can move in many different ways. Some are efficient and some are not. Sometimes what feels natural is incorrect and what feels extremely awkward is correct. Bad performance habits increase potential for injury.

Often fatigue, weakness, and tightness will challenge or affect postural and core stability. Optimal functional movement is impossible with faulty posture and an unstable core. Muscles do not get short or weak for just any reason. If muscles are short, it is because the individual has used them in a shortened range, and the activities performed do not lengthen them; for example, an athlete who habitually fails to fully extend the forearm at the elbow after the contraction/flexion phase of a biceps curl. Over time, the athlete adapts and uses movement patterns that rely on short muscles. Because these patterns are habitual, if a muscle is stretched one day, it will likely return to the resting length that it is most familiar with (the short position) and that is used most often. Weak muscles, particularly muscles that are used infrequently or

BOX 6-1 Examples of Primary Movements Combined to Be Function Movements

CATCH
1. Beginning position with elbows flexed and hands in front of body.
2. Hands move forward extending elbows to meet the ball.
3. Hands and fingers positioned correctly to catch the ball.
4. Catch and control the ball with hands only.
5. Elbows flex to absorb the force of the ball.

HIT
1. Passive extension of the elbow.
2. Arm abduction along with outward rotation of the arm.
3. Scapular adduction and upward rotation of the glenoid cavity.
4. Rotation of the thoracic spine.
5. Elbow extension with hyperextension of the back.
6. Adduction of the arm, inward rotation of the shoulder, and hyperextension of the elbow.
7. Trunk flexion with hip flexion.

KICK
1. Flex hip and knee to step forward with nonkicking foot placed near the ball.
2. Flex knee of kicking leg during the backswing for the kick.
3. Hip extension and knee flexion of at least 90 degrees during preliminary kicking movement.
4. Contact the ball with the top of the foot.
5. Forward and horizontal flexion to create sideward swing of arm opposite kicking leg.
6. Kicking leg follows through with hip flexion and knee extension toward the target after ball contact.

VERTICAL JUMP
1. Crouch with hips and knees flexed and arms behind body from hyperextension of the shoulders.
2. Forceful upward thrust of arms (flexion) as legs straighten (knee and hip extension) to take off.
3. Contact ground with front part of feet (plantar flexion) and flexed knees to absorb the force of landing.

CUT/PIVOT
1. Change direction by pushing off outside foot (closed chain abduction and adduction).
2. Body lowered (hip/ knee/ankle flexion) during change of direction.
3. Change of direction occurs in one step.
4. Movement repeated from right to left, left to right, incorporating hip rotation.

that may at one time have been injured, respond similarly. After injury, movement patterns are altered to avoid using the injured area. By the time healing occurs, a habitual movement pattern has developed that is familiar and difficult to change.

Injury can be reduced with proper conditioning and training programs that address stability first, then mobility, agility, and finally, sport-specific skill.

ACCELERATION AND DECELERATION

4. Compare and contrast acceleration and deceleration.

Movement strategies involve starting and going faster–**acceleration**, and going slower and stopping–**deceleration**. Acceleration is created by concentric muscle function and deceleration by eccentric muscle function. The potential for post-exercise soreness, disrupted muscle firing activation sequences, and an altered length-tension relationship is greater with deceleration produced with eccentric movement.

The forces required for stopping can be extremely high, given how deceleration is quicker than acceleration in most instances. Therefore, more injury can occur during the deceleration rather than the acceleration phase of a movement.

Deceleration places much greater stress on the joints and muscles than when they are accelerated. When an athlete tries to change direction without properly decelerating, the joints and muscles are off-balance, which slows down the athlete and increases the potential for injury. Deceleration training ultimately will reduce the risk of injury from deceleration-type movements such as landing, stopping, or changing direction.

Quickness is often thought of as the ability to start a movement in a short amount of time. Actually, true quickness involves the ability to stop a movement in a short amount of time. Quickness improves as deceleration develops because when an athlete is able to stop more efficiently and with better control, there is more time to set up and accelerate in a new direction.

Quickness on the field or court also looks like above-average acceleration, but most of the time, acceleration is not the issue. Deceleration is the key because it sets up the rest of the movement.

GAIT CYCLE (WALKING AND RUNNING)

Objectives

5. Describe the movement strategies of walking and running.

Aspects that influence gait include the number of steps per minute, called the *step rate*, and the time it takes to complete the full **gait cycle**, called the *stride time* (Figures 6-1 and 6-2). Walking speed is increased by increasing step rate or stride length (Figure 6-3).

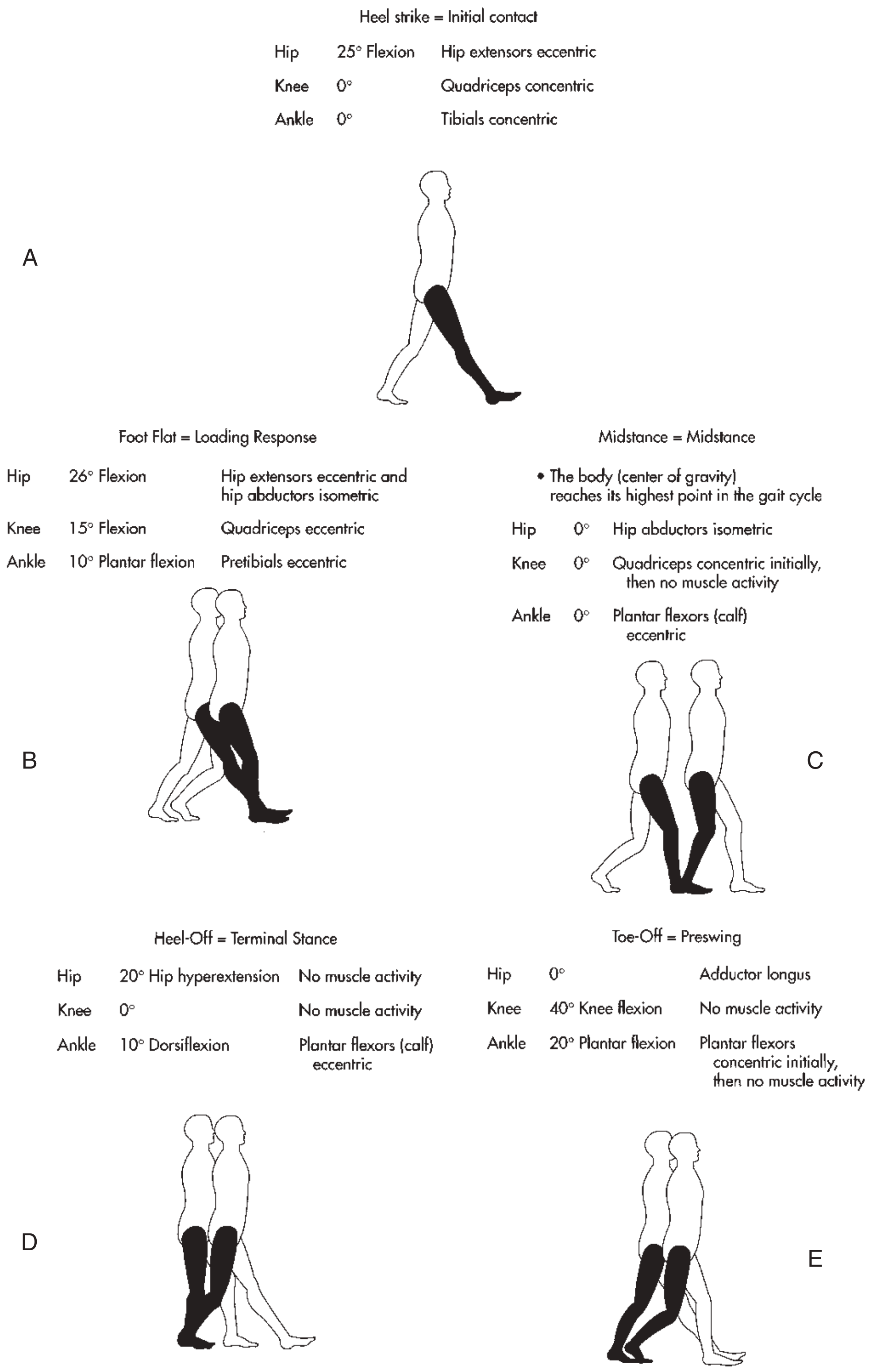


FIGURE 6-1 **A** to **E,** Components of the stance phase. (Modified from Fritz S: *Mosby's essential sciences for therapeutic massage,* ed 3, St Louis, 2013, Mosby.)

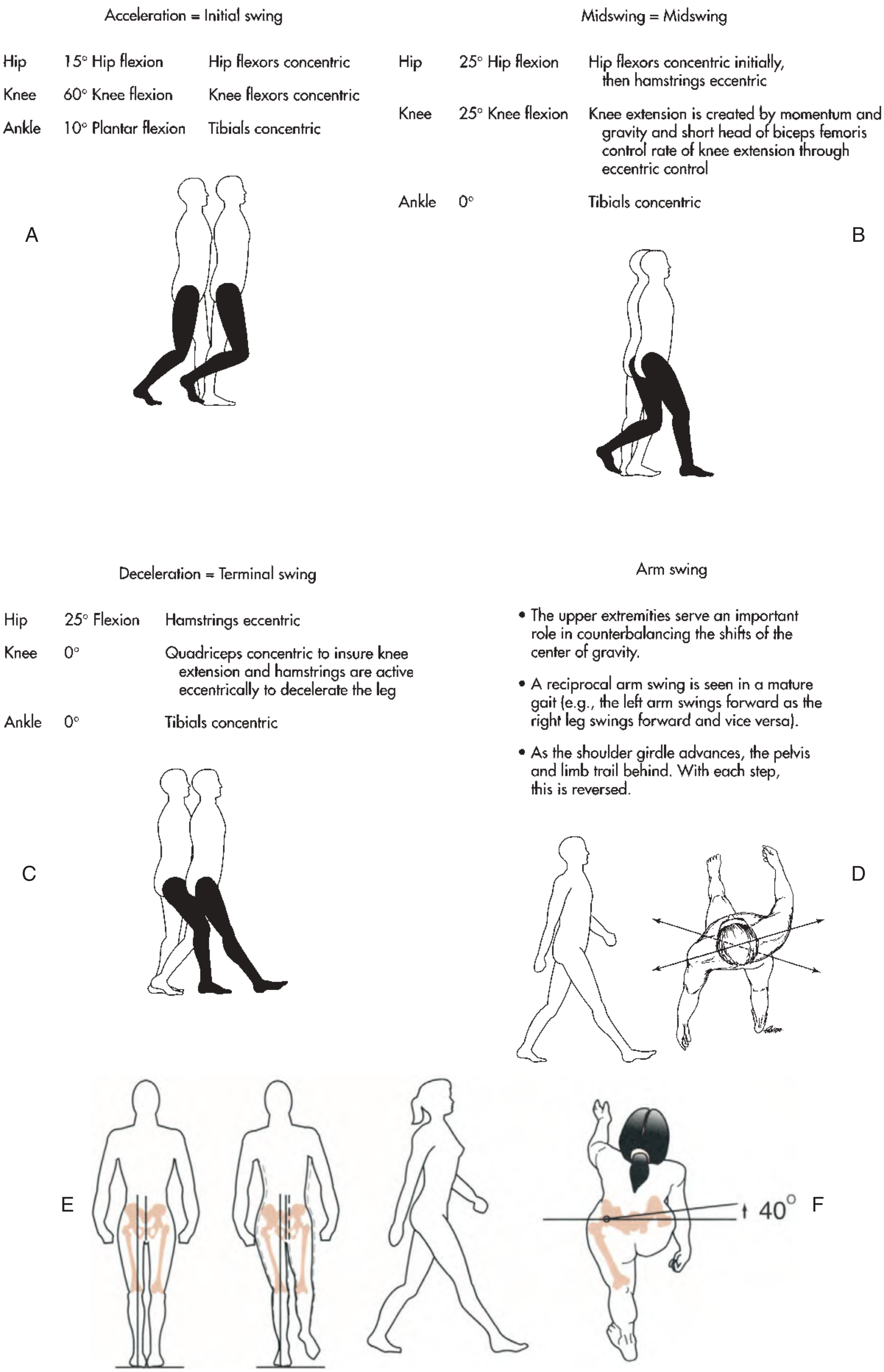


FIGURE 6-2 **A** to **F,** Components of the swing phase. (Modified from Fritz S: *Mosby's essential sciences for therapeutic massage,* ed 3, St Louis, 2013, Mosby.)

FIGURE 6-3 Example of the gait cycle.

FIGURE 6-4 Example of rotation and swinging.

As gait speed increases, the time of double limb support decreases. During running, periods of double limb support disappear and are replaced by periods of both feet being off the ground.

Usually the transition from **walking** to **running** occurs when speed is greater than 4 miles per hour. During running, the arms do more than counterbalance rotation as during walking. Shoulder/arm movement becomes part of the propulsion process as well.

The arms automatically counterbalance the legs. The swing of one arm creates a counterrotation between hip and shoulders that complements the work of the core stabilizers. Swinging the arms faster and farther produces greater stability throughout the core; this typically results in greater mobility of the hips, which improves stride, cadence, symmetry, and rhythm.

ROTATION, THROWING, AND SWINGING

Objectives

5. Describe the movement strategies of rotating, throwing, and swinging.

Hitting a ball and swinging a racquet or club are examples of swinging movements that involve rotation (Figure 6-4). **Rotation** and **swinging** movements occur in many sports, including those that require throwing, such as baseball and tennis.

Throwing, striking, and swinging in most cases are the result of two types of force: linear and rotational. The athlete shifts weight away from and then toward the target with the lower body. A coiling spiral movement is followed by an uncoiling movement that starts at the hips and then moves to the shoulders and arms. The weight shift is the source of power. The goal is not to generate rotational power but rather to transform linear or weight-shifting power into rotational power, in baseball, for instance, when an outfielder strides forward linearly with one leg before throwing with a rotational movement with the opposite arm. In batting, body weight is shifted from the back leg to the front leg to transform forward linear power into rotational force through hip and spinal rotation.

Simple rotation and swinging involve both arms working together; **throwing** and striking focus all energy into the movement of one arm. Weight shifting, balance, and coordination are all important in what appears to be a simple upper body movement. To propel the arm for throwing, striking, and swinging, an athlete needs to have coordinated action of the lower body and trunk. It is more common to have a dynamic lower body by taking a step in a throw or a strike than by remaining still. Weight shift from one foot to the other provides the linear component of power, which is transformed into rotational power if no step is involved, as in golf. Processing of visual and auditory stimuli leads to accuracy during throwing.

Another important element to consider in rotation or swinging is symmetry. Whether movements of the sport are asymmetric (one-sided) (golfers, baseball players, and rowers use swing or rotation of the body in one direction of movement) or symmetric (two-sided) (lacrosse, tennis, racquetball players, and kayakers use swing in rotation from both sides of the body), it is important to maintain symmetry while supporting dominant performance–based movement.

CATCHING AND HITTING

Objectives

5. Describe the movement strategies of catching and hitting.

FIGURE 6-5 Example of catching and hitting.

FIGURE 6-6 Example of kicking.

Catching and **hitting** require visual and auditory tracking of a moving object and precise movement for contact with the object (Figure 6-5). Catching and hitting are typically the end result of rotational and swing movement strategies. It is the added component of visual and auditory tracking of the object that provides accuracy to actually hit or catch the ball or other object as it comes toward the individual. Catching a ball requires several skills to work together. First is eye-to-hand coordination. The second is arm motor skills. The third, if the player has to run to the ball, is using the brain to estimate where the ball will land and how to move the legs to get there.

If the sport requires grab and then push or pull movements, the athlete needs grip, torso, core, and arm strength.

JUMPING AND KICKING

Objectives

5. Describe the movement strategies of jumping and kicking.

When propelling the leg through the air in a kick or the body through the air with a jump, unrestricted and free movement is necessary (Figure 6-6). Mobility, stability, and power create balance in performance. If strength and power are not balanced by flexibility, power will be wasted on overcoming tightness.

Jumping consists of taking off and landing. Jumping does not usually require equal effort by both legs, with both legs performing the same movement. A vertical leap, such as that used for assessment, is an example of a perfect double leg jumping situation; however, this movement rarely occurs in sports.

In **kicking**, all movements rely on stability, strength, balance, and coordination while standing on one leg to provide a foundation of power. Most jumping movements require the movement to occur predominantly off one leg. During kicking movements, one leg usually remains on the ground to generate power for the kick.

Jumping is an effort of both legs moving in different directions. The propulsion leg, typically the last one to leave the ground, generates the push in a jump. A skilled jumper creates pull with the other leg by accelerating one leg up when flexing the hip and knee. The weight and momentum of this leg pull the body up as the strength and power of the other leg push the body up. Both legs work together in opposite directions.

An athlete may prefer to jump off one leg and kick with the other, or a particular sport may dictate the movement, as in the specialty position of kicking in football. An athlete such as a martial artist, soccer player, or dancer may need to be able to perform a wide array of kicks. Even if the athlete never plans to kick with the nondominant leg, it is important to have balance between left and right sides.

The length-tension relationship and muscle firing activator sequence and gait patterns become critical during performance of jumping or kicking; this is an area that the massage therapist can directly influence.

Every kicker has a favorite style. Performance demand will create some asymmetry of function, but this should not compromise general function. Hip range of motion should be similar on the left and on the right. Abilities to stand, balance, and demonstrate control on one leg should be similar as well.

CUTTING AND TURNING/PIVOTING

Objectives

5. Describe the movement strategies of cutting and turning/pivoting.

Athletes need to be able stop quickly and then turn and go in a very short amount of time. Changing direction–**cutting** and **turning** and **pivoting**–requires the ability to lower the center of gravity, decelerate, and accelerate in a controlled function (Figure 6-7).

A low center of gravity is safe and productive in situations in which control is not possible. However, control is needed even in situations in which a low center of gravity cannot be achieved. The athlete needs to be able to lunge and squat to lower the center of gravity. The illusion of quickness is a demonstration of both of these factors. When one athlete is able to break away from another, this is often done with a cutting or turning movement. This movement is the result of deceleration with direction change, followed by acceleration. It is important for athletes to train for deceleration using eccentric muscle functions, for instance, the tibialis anterior to slow a runner quickly after a burst of acceleration.

FIGURE 6-7 Example of cutting, turning, and pivoting.

EXAMPLES OF SPORTS AND THE SPECIFIC SPORT MOVEMENTS

Swimming: swim stroke, spinal/pelvic rotation
Baseball: swing bat, catch, ability to accelerate/decelerate quickly
Basketball: shoot ball, running, ability to accelerate/decelerate quickly
Running: gait, pelvic stability
Football: cutting, jumping, throwing, catching, ability to accelerate/decelerate quickly
Golf: swing club, spinal/pelvic rotation
Soccer: kicking, ability to accelerate/decelerate quickly

SUMMARY

This chapter explains the concepts that must be understood to separate sport-specific movements into fundamental movement strategies. With this knowledge, all movement and sport activities can be understood. Assessment and treatment plans are based on movement efficiency or inefficiency. By comparing optimal movement processes with those the client displays during assessment, areas best addressed by massage are identified.

It is unrealistic to expect any text to thoroughly cover specifics of each and every sport or fitness and rehabilitation movement. However, massage practitioners work with a variety of clients, participating in many different recreational, professional, and fitness areas, as well as in activities of daily living, all of which are movement-dependent. Strategies described in this chapter represent the ABCs of movement; with an understanding of these movement patterns, massage can be outcome-targeted and therefore sport-specific or activity-specific.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1 Explain the following statement, and then justify why you agree or disagree with it: A star is born.

2 How would a massage therapist be able to understand sport performance for an individual sport if he or she were not specifically skilled in that sport?

3 Provide an example of the following movement strategies used in activities of daily living.

Examples: Walking—going from one room to another; running—chasing a small child; hitting—knocking down cob webs; and throwing—heaving trash into the trash can

a. Catching
b. Swinging
c. Kicking
d. Jumping
e. Turning
f. Cutting

4 Explain the importance of starting and stopping as an aspect of sport performance.

5 Provide an example of an exercise or sport that involves each of the following movement strategies:

Examples: Walking—cardiovascular rehabilitation program; running—marathon racing

a. Hitting
b. Throwing
c. Catching
d. Swinging
e. Kicking
f. Jumping
g. Turning
h. Cutting
i. Pivoting

6 Pick an exercise activity or sport and identify the movement strategies involved.

Example: Basketball—running, throwing, catching, jumping, turning, cutting, pivoting.

7 For each of the following movement strategies, list the target areas for massage. (*Hint:* Do the movement, and focus on which body area receives the greatest amount of deceleration activity.)

Examples: Walking—calves; running—hips; hitting—shoulders and low back

a. Throwing
b. Catching
c. Swinging
d. Kicking
e. Jumping
f. Turning
g. Cutting
h. Pivoting

CHAPTER 7

Nutritional Support and Banned Substances

OUTLINE

General Dietary Recommendations
Antiinflammatory Diet
Sport Performance–Related Diet
Weight Control
Nutritional Supplements
- *Antioxidants*
- *Supplements Often Used by Athletes*

Banned Substances, Including Drugs
- *Anabolic Steroids*
- *Beta-2 Agonists*
- *Stimulants*
- *Narcotics*
- *Diuretics*
- *Hormones, Mimetics, and Analogues*
- *Substances Banned by Other Agencies*
- *Identification of Banned Substance Users*

Eating Disorders
Summary

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1. Explain general dieting recommendations.
2. Describe an antiinflammatory diet.
3. Describe the sport performance–related diet.
4. Explain why fluid intake is important.
5. List the components necessary for weight management.
6. Describe nutritional supplements.
7. List the risks and benefits for athletes of using nutritional supplements.
8. List banned substances.
9. Explain the relationship between eating disorders and exercise or sport performance.
10. Define the three major eating disorders of athletes.
11. List the symptoms of eating disorders.
12. Report life-threatening substance abuse behavior and eating disorders to the appropriate professional.

KEY TERMS

Alcohol
Anabolic Steroids
Anorexia Athletica
Anorexia Nervosa
Banned Drug
Banned Substances
Beta-2 Agonists
Beta Blockers
Bulimia Nervosa
Caffeine
Cannabinoids
Creatine
Disordered Eating
Diuretics
Eating Disorders
Ephedrine
Fluid Intake
Glucocorticosteroids
Glucosamine
Healthy Diet
Hormones
International Olympic Committee
Local Anesthetics
Narcotics
Nutritional Antioxidants
Nutritional Supplements
Protein
Ribose
Sport Performance–Related Diet
Stimulants
United States Anti-Doping Agency
Weight Control

The massage therapist needs to understand the nutritional needs of the athletic client. Nutrients and/or the use of nutritional supplements and banned substances can influence massage outcomes and present contraindications. Proper nutrition is necessary for recovery, healing, and performance. Appropriate use of various nutritional supplements can support, but not replace, a nutritious diet (Figure 7-1).

Unfortunately, much dietary advice in the sport and fitness world is exaggerated or inaccurate, and can be downright harmful. Certain substances are illegal, and their use can jeopardize an athlete's career.

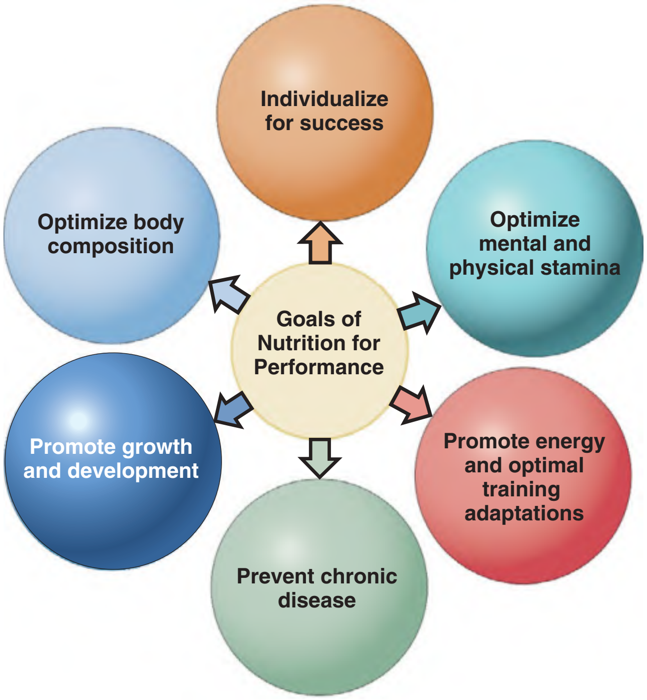


FIGURE 7-1 Goals of nutrition for performance. (*Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

Nutrition is not an exact science. The massage therapist is not usually a nutritional expert. Therefore, it is important for the athlete to consult a reputable person, such as a registered dietitian, preferably one who specializes in sports and cardiovascular nutrition. For a reliable reference, contact the American Dietetic Association, which lists more than 3000 specialized dietitians across the country.

GENERAL DIETARY RECOMMENDATIONS

Objective

1. Explain general dieting recommendations.

A **healthy diet** consists of appropriate portions of healthy fats such as olive, grapeseed, and flaxseed oils and healthy carbohydrates (whole-grain foods) such as whole wheat bread, oatmeal, and brown rice. Vegetables and fruits should be eaten in abundance. A balanced diet includes moderate amounts of healthy sources of **protein** such as nuts, legumes, fish, poultry, lean meat, eggs, and dairy products.

A healthy diet minimizes the consumption of fatty red meat, refined grains including white bread, white rice and pasta made with white flour, and sugar. It eliminates food containing *trans* fats, including many fast foods and prepared foods. A high-quality multiple vitamin that breaks down quickly in the digestive system is suggested for most people.

Fruits and vegetables reduce the risk of cardiovascular disease. Folic acid and potassium appear to contribute to this effect, which has been confirmed in several epidemiologic studies. Inadequate consumption of folic acid is responsible for higher risks of serious birth defects, and low intake of lutein, a pigment in leafy green vegetables, is associated with increased risk for cataracts and degeneration of the retina. Fruits and vegetables are also primary sources of many vitamins needed for good health.

High consumption of red meat has been associated with increased risk of coronary heart disease (most likely because of the high saturated fat content of red meat) and of type 2 diabetes and colon cancer. It may aggravate the inflammatory response and may increase pain sensitivity. The elevated risk of colon cancer may be related in part to the carcinogens produced during cooking and to the chemicals found in processed meats such as salami and bologna.

Poultry and fish, in contrast, contain less saturated fat and more unsaturated fat than red meat does. Fish is a rich source of the essential omega-3 fatty acids as well. Eggs do not appear to have adverse effects on heart disease risk, probably because the effects of a slightly higher cholesterol level are counterbalanced by nutritional benefits. This is especially true of eggs from chickens fed special vegetarian diets to increase nutritional value. Many people avoid nuts because of their high fat content, but the fat in nuts, including peanuts, is mainly unsaturated, and walnuts in particular are a good source of omega-3 fatty acids. Also, people who eat nuts are actually less likely to be obese. Nuts are more satisfying to the appetite, and eating them seems to have the effect of significantly reducing the intake of other foods.

People need to eat clean and fresh food as much as possible. Organic foods and free-range/hormone-free meat, poultry, and fish are becoming easier to obtain. Even though the cost is higher, the value is usually worth the investment.

ANTIINFLAMMATORY DIET

Objective

2. Describe an antiinflammatory diet.

An important aspect of caring for the athlete and for those in various rehabilitation programs is management of inflammation. Therefore, eating a diet targeted to reducing inflammation is prudent. An antiinflammatory diet follows the recommendations given in this section. In addition, foods especially high in antioxidants are valuable.

A typical antiinflammatory diet is high in vegetables, fruits, and legumes and low in refined carbohydrates (including sugar) and undesirable fats, such as saturated fats; most important, it includes the elimination of *trans* fats.

Antiinflammatory foods include most colorful fruits and vegetables, oily fish (which contain higher levels of omega-3 fatty acids), extra-virgin olive oil, nuts, seeds, and select herbs and spices, such as cinnamon, ginger, rosemary, and turmeric. Pineapple is high in an antiinflammatory enzyme called *bromelain*.

SPORT PERFORMANCE–RELATED DIET

Objectives

3. Describe the sport performance–related diet.
4. Explain why fluid intake is important.

Various opinions exist about the components of a diet needed to support athletic performance and recovery. The quantity of carbohydrates included in a **sport performance–related diet** is one area of discussion. In one research study, volunteers were placed on a normal diet composed of 50% carbohydrates, 34% fats, and 16% proteins. The maximum amount of time their muscles could work continuously was 114 minutes. On a noncarbohydrate diet composed of 46% fats and 54% proteins, the maximum was 57 minutes. However, on a high-carbohydrate diet of 82% carbohydrates and 18% proteins, the maximum was 167 minutes, nearly three times as long as for the noncarbohydrate diet.

Endurance athletes know that a high-carbohydrate diet helps performance by storing more fuel (glycogen) in the muscle, but a high-carbohydrate diet seems to be relevant to all sports. People in stop-and-start sports, such as tennis, after consecutive days of hard training deplete their muscle glycogen stores. After each day's workout, a diet that contains sufficient carbohydrates is necessary to replace the glycogen used during activity.

A diet high in complex carbohydrates, moderate in proteins, and adequate in good fats can help keep the energy level up during a weight loss program. Complex carbohydrates also have a fair amount of fiber, so the calories are more filling and fewer calories are consumed. Many foods high in carbohydrates have small amounts of protein and large numbers of vitamins and minerals. Sources of complex carbohydrates include whole-grain breads, cereals, and grains; legumes such as beans, peas, and lentils; fruits; and vegetables.

Children need a relatively high level of protein in their diet because they are still growing, whereas adults need only enough protein to maintain tissue repair. Although protein cannot be metabolized for energy, it contains amino acids, the building blocks for body tissue. During exercise, a breakdown of body tissue occurs, especially during contact sports such as football, but this also occurs during general exercise such as jogging. Continued use of muscle fibers breaks them down, and the body needs protein to repair them.

Eating foods high in fats and proteins slows down the stomach-emptying process. Therefore, it makes sense to eliminate high-fat, high-protein foods from pre-event meals. Instead, an athlete may benefit from eating high–complex carbohydrate, low-fat foods, such as whole-grain breads and pasta, at least 2 hours before a workout or competition so that the stomach empties before exercising. The athlete should allow 3 to 4½ hours between eating and an upcoming competition because competition anticipation slows down digestion, and an upset stomach may occur.

If a person has not eaten for 6 to 8 hours, his or her blood sugar level will be low. Symptoms of low blood sugar include dizziness, inability to think clearly, shakiness or weakness, and difficulty concentrating. Eating carbohydrates can restore and maintain blood sugar levels during exercise and can prevent hunger and exhaustion after a workout. All people should avoid eating foods with high sugar content such as candy because they cause a sharp increase in blood sugar levels. The body responds to this increase by releasing insulin, which burns up blood sugar reserves and depletes overall energy, rather than providing an extra boost.

High-potassium foods such as leafy dark green vegetables, citrus fruits, bananas, and melons are good for athletes because they are great sources of carbohydrates and proteins, contain no fat, and provide lots of vitamins and minerals.

Fluid intake is important because people can suffer heat problems from inadequate fluid replacement. Heat exhaustion or heatstroke can be life-threatening for both professional and amateur athletes. To prevent dehydration, 16 ounces of water should be consumed 15 minutes before a workout. Replenish fluids with water, electrolyte drinks, and diluted 50/50 fruit juices after exercise, and eat salty and high-potassium foods such as pickles. Thirst is not a good guide for fluid replacement.

During the 2 hours before exercise, it is best to drink only plain, noncarbonated water. The bubbles in carbonated water make a person feel full, so plain water is better. During warm-up, cold water is always appropriate. Cold water empties from the stomach faster than warm water. If an athlete has stomach cramps, this is probably the result of taking too much water at once. If an athlete experiences muscle cramps, an electrolyte sport drink diluted (50/50) with warm water may help.

The athlete should drink 4 to 8 ounces of water every 15 minutes during demanding performance, especially if he or she is sweating.

After a workout, cold water or a watered-down electrolyte drink is advisable. Within 2 hours after exercise, and preferably within 15 minutes, a high-carbohydrate snack is appropriate. Ingesting carbohydrates within that time frame seems to accelerate the replacement of muscle glycogen reserves.

Because high-carbohydrate drinks slow fluid replacement, it is best to get some fluid replacement under way first. A good rule of thumb is to take:

1. Water.
2. An electrolyte replacement drink.
3. A high-carbohydrate sport drink within 2 hours, and as close to 15 minutes as possible, after exercise.

Limit caffeinated drinks such as coffee, cola, and iced tea. Although caffeine produces a feeling of increased energy, too much caffeine is a diuretic, and fluids are lost because of excessive urination. The same goes for alcohol. Athletes should limit intake of caffeine or alcohol to 2 or fewer drinks daily because both promote water loss.

WEIGHT CONTROL

Objective

5. List the components necessary for weight management.

Weight control includes weight gain, weight loss, and weight maintenance. Body weight and body composition should be evaluated as part of a weight control program. With a diet or exercise program, the scale is not what determines the progress made. Muscle weighs more than fat, and as muscle mass is increased with exercise, body weight may increase, even though total body fat is decreasing.

An athlete's weight may stay the same during off-season training, but during training, 10 pounds of muscle may be added and 10 pounds of fat may be lost. The athlete will not see a change on the scale but will see a dramatic change in body composition.

The gold standard for determining body fat is hydrostatic weighing. This is a rather complicated procedure that involves full-body immersion in water. A simple yet reliable method is to have a trained professional measure skin thickness in several areas of the body using calipers. This provides a reading of body fat percentage within a narrow range under controlled conditions.

Many people who exercise are overweight but not overfat. Being overweight alone is not a health risk, but being overfat is. A "thin" person may have lower than normal weight for his or her age and sex owing to one or more of the following factors: shorter height (shorter bones), a smaller frame (smaller, lighter bones), less muscle, and less body fat. A "heavy" person's weight could be the result of one or more of these same factors if he or she is heavier than normal. Once the current body weight versus body fat is calculated, an ideal body weight goal can be established.

The more muscle and less fat, the faster and quicker the athlete. A higher tolerance for exercising in the heat should also apply. The heart and muscles will not have to work as hard and a thin individual will be less prone to injury because he or she carries less dead weight on the lower back, hip, knee, and ankle joints.

Athletes who are trying to lower body fat levels must maintain a certain level for general health. The essential body fat level for men is at least 3%, with 5% body fat being optimal because of possible hydration problems. For women, the optimal body fat level is between 15% and 20% for athletes and about 15% for elite athletes. Some women athletes, particularly runners and gymnasts, try to get their body fat levels as low as a man's. This can be dangerous. A woman needs a higher level of body fat to maintain normal menstrual function and reproductive capabilities. The standard weight status categories associated with body mass index (BMI) ranges for adults are shown in Table 7-1.

Optimal body fat levels differ depending on the activity and the goal (fitness or performance). Activities that require more speed and quickness and less body contact require lower levels of body fat. In some sports, athletes need body fat for protection. For example, hockey and football players need body fat to be protected from the pounding they take during contact. Football receivers and defensive backs do not need a lot of excess body fat because it will slow them down, but defensive linemen need the extra bulk provided by more body fat.

If a person is 20% over the ideal body weight, doctors would consider him or her obese. Obesity can lead to heart disease, high cholesterol levels, diabetes, and cancer of the breast, prostate, and colon. Overweight and obesity have become an epidemic in the general population. Weight control in this population can be accomplished by exercising daily and avoiding an excessive total intake of calories. Cardiovascular rehabilitation management in persons with diabetes or arthritis/arthrosis and in those with many other health concerns also involves weight loss.

Because exercise is a required component of a weight management program, sport and fitness massage becomes an important component as well. The massage therapist can support the weight loss program by supporting the necessary exercise program and providing pleasure sensations to replace those provided by food.

There is no magic formula for weight loss. The best way to lose body fat is to decrease intake of food and increase aerobic exercise. This dynamic duo is not only the best program for training, performance, and weight control, but for overall fitness as well.

TABLE 7-1 Body Mass Index (BMI) Ranges for Adults

BMI	Weight Status
Below 18.5	Underweight
18.5 to 24.9	Normal
25.0 to 29.9	Overweight
30.0 and above	Obese

From Centers for Disease Control and Prevention. http://www.cdc.gov/healthyweight/assessing/bmi/adultbmi/index.html

NUTRITIONAL SUPPLEMENTS

Objective

6. Describe nutritional supplements.

A nutritional, or dietary, supplement, by definition, is a substance added to the diet to make up for a nutritional deficiency. It is not intended as a substitute for eating well. **Nutritional supplements** include the following:

- Vitamins
- Amino acids
- Minerals
- Herbs
- Other botanicals

Anything classified as a dietary supplement is not required to meet Food and Drug Administration (FDA) or other standards. No regulations guarantee the safety or purity of something sold as a supplement. With so much contradictory information regarding health and performance benefits of the many supplements available, it is difficult to make an informed decision about what actually works and what could be harmful. Products that have a USP (United States Pharmacopeia) stamp on the label and that are eligible for the Consumer Lab seal of approval are the most reliable.

Because supplements are substances added to the diet to make up for a nutritional deficiency, an athlete would be wise to have a nutritional specialist evaluate his or her diet before developing a supplement program. Ideally, everything an athlete requires for energy and high performance can be obtained through a well-balanced diet, a high-quality multivitamin and mineral supplement, additional antioxidants, and glucosamine.

ANTIOXIDANTS

It is now clear that **nutritional antioxidants** work as a team to protect cells from free radical–mediated damage. It is possible that supplementation with nutritional antioxidants provides protection for the heart (cardioprotection). Cardiovascular disease is a major cause of death throughout the world. Therefore, finding ways to reduce the risk of developing cardiovascular disease and to protect the heart in the event of a heart attack is important. Regular exercise and dietary intake of adequate nutritional antioxidants are two lifestyle factors within our control that have been shown to provide cardioprotection.

Numerous antioxidants have been studied, and three naturally occurring antioxidants have been linked individually or in combination to protection against cardiac injury. These same antioxidants function as antiinflammatory agents:

- **Vitamin E:** Vitamin E is the most widely distributed antioxidant found in nature. Vitamin E, a generic term, refers to eight different structural variants of tocopherols or tocotrienols. These are lipid-soluble antioxidants that protect against free radical–mediated damage to cell membranes.
- **Vitamin C:** Vitamin C is another naturally occurring antioxidant. It is water-soluble and has a twofold role as an antioxidant: it recycles vitamin E, and it directly scavenges free radicals.
- **Alpha Lipoic Acid:** Alpha lipoic acid is a naturally occurring, water-soluble antioxidant that can recycle vitamin C. It is also capable of directly scavenging radicals within the cell.

Given that some antioxidants can be toxic when consumed in very large doses, the decision to use dietary antioxidant supplements should be approached with caution and made only on the advice of a well-trained nutritionist. See Table 7-2 for dietary sources of antioxidant vitamins.

TABLE 7-2 Dietary Sources of Antioxidant Vitamins

Antioxidant Vitamin	Dietary Sources
Vitamin E	Plant oils (e.g., corn, soybean), grains, nuts, asparagus, eggs
Vitamin C	Citrus fruits, tomatoes, potatoes, green vegetables
Carotenoids (provitamin A)	Carrots, broccoli, spinach, sweet potatoes, peaches

A general rule is that most vitamin and mineral dietary requirements are best met by eating foods containing them rather than by ingesting a supplement, and this rule should be followed for antioxidants as well. A prudent dietary goal is to obtain most antioxidant vitamins (e.g., vitamins A, E, and C) and minerals (e.g., zinc, copper, magnesium, selenium) through a varied diet. Eating a diet rich in fruits and vegetables is a sound approach toward obtaining the maximum health benefits from antioxidants.

SUPPLEMENTS OFTEN USED BY ATHLETES

Objective

7. List the risks and benefits for athletes of using nutritional supplements.

Athletes may believe that certain supplements can enhance sport performance. This may or may not be based on scientific evidence. Athletes may also take excessive amounts of a supplement believing that more will produce better results. This is not the case. In addition, some supplements may have a variety of adverse effects. It is important for the massage therapist to be aware of what the athlete is using and the potential benefits and adverse effects.

Creatine

To meet the demands of high-intensity exercise, such as sprinting or power sports, muscles generate energy from chemical reactions involving adenosine triphosphate (ATP), phosphocreatine (PCr), adenosine diphosphate (ADP), and creatine. Stored PCr can fuel the first 4 to 5 seconds of a high-intensity effort, but after that, another source of energy is needed. **Creatine** supplements seem to work by increasing the storage of PCr, thus making more ATP available to fuel the working muscles and enable them to work harder before becoming fatigued.

Creatine has been used by athletes for over 10 years, yet very little research has investigated its safety or long-term effects. Increasingly, research is looking at possible benefits of this supplement. What little research there is suggests that creatine works to build muscle in those who, through illness or disease, have compromised muscle mass and strength. Athletes with high creatine stores do not appear to benefit from supplementation, whereas individuals with the lowest levels, such as vegetarians, have the most pronounced results following supplementation. Creatine might enable a healthy athlete to maintain a higher training load.

Claims for creatine:

- Improves high-power performance of short duration
- Increases muscle mass
- Delays fatigue
- Increases creatine and creatine phosphate levels in muscles

Valid research indicates that creatine can improve high-power performance during a series of repetitive high-power output exercise sessions. It may augment gains in muscle hypertrophy during resistance training, especially in those with compromised skeletal muscle mass due to injury or disease. It does not increase endurance or anabolic effect.

Cautions for creatine use include these:

- Causes muscle cramping, strains, and pulls
- Causes renal stress/damage
- Increases risk of heat illness (athletes should increase fluid intake when taking creatine)

Caffeine

Caffeine has been used by endurance athletes for years as a way to stay alert and improve endurance. It is one of the best-researched nutritional supplements, and overwhelming scientific evidence suggests that, in moderation, it has no adverse health effects. Caffeine use is fairly common among athletes at all levels of competition. However, keep in mind that caffeine is on the **International Olympic Committee** (IOC) banned substance list.

Claims for caffeine:

- Improves athletic performance
- Increases energy
- Delays fatigue
- Improves fat burning
- Spares muscle glycogen
- Promotes body fat loss

Valid research indicates that caffeine can act as a central nervous system (CNS) stimulant, raise epinephrine levels, increase alertness, and delay fatigue, and it may slightly spare muscle glycogen. It does not promote body fat loss.

Cautions for caffeine use include the following:

- Causes side effects such as nausea, muscle tremor, palpitations, and headache, including withdrawal headache
- Potentiates ephedrine side effects (should not be taken together)
- Acts as a diuretic, so adequate fluid intake is crucial

Protein

High-protein/low-carbohydrate diets are popular, promising quick and easy weight loss. Power athletes have argued for years that high-protein diets lead to increased muscle mass and strength gains. Research on both athletes and sedentary individuals has failed to support these claims.

Claims for high-protein diet:

- Protein supports muscle growth.
- Protein increases muscle strength and mass.
- Weight training drastically increases protein requirements.
- Protein improves recovery.

Valid research indicates that protein intake greater than 2 g/kg of body weight per day does nothing to increase muscle growth and does not enhance recovery.

Cautions for high-protein diet are these:

- Increases risk of certain cancers
- Increases calcium excretion and increases risk of osteoporosis
- Leads to reduced intake of vitamins, minerals, fiber, and phytochemicals

Glucosamine

In the laboratory, **glucosamine** stimulates cartilage cells to synthesize glycosaminoglycans and proteoglycans. In animal models, oral glucosamine sulfate has a beneficial effect on inflammation. Used as a supplement, glucosamine appears safe; however, more long-term research is needed to determine its effectiveness.

Claims for glucosamine:

- Protects cartilage from damage during weight-bearing exercise
- Slows cartilage breakdown
- Stimulates growth of cartilage
- Reverses clinical course of arthritis

Valid research indicates that glucosamine does play a role in maintenance and repair of cartilage, and it stimulates cartilage cells to synthesize cartilage building blocks. It also may have an antiinflammatory action by interfering with cartilage breakdown.

Glucosamine is most effective for early arthritis when cartilage is still present; it is less effective for severe arthritis. Supplements appear to be safe. Glucosamine is recommended if physical activity stresses the joints.

Cautions for glucosamine are minimal if dosage recommendations are followed.

Ribose

Ribose has many important roles in physiology. For example, ribose is a necessary substrate for synthesis of nucleotides, and it is one of the building blocks that form DNA and RNA molecules.

A great deal of research must be done before any claims of athletic performance benefits can be made for ribose.

Claims for ribose:

- Increases synthesis and re-formation of ATP
- Improves high-power performance
- Improves recovery and muscle growth
- Increases cardiac muscle tolerance to ischemia

Valid research indicates that ribose does improve the heart's tolerance to ischemia, but no research published in peer-reviewed journals shows benefits for athletic performance. The only research that supports ribose supplementation shows benefit in patients with heart conditions who lack the ability to synthesize ribose.

Ephedrine

Ephedrine, now banned by most sport organizations, is a drug derived from the plant *Ephedra equisetina*. It has been used for hundreds of years as a CNS stimulant and decongestant. A synthetic form of the drug, pseudoephedrine, is a common ingredient in over-the-counter and prescription cold and allergy products. Structurally similar to amphetamines, it increases blood pressure and heart rate. Mechanisms behind the effect of ephedrine on weight loss appear to be those of increasing energy expenditure through increased lipolysis; increasing basal metabolic rate through thyroxine; and decreasing food intake by suppressing appetite.

Ma huang is an herbal form of ephedrine called *ephedra* that is contained in many herbal products available in health food stores (often along with chromium). Ma huang has been blamed for the death of several high school students who used it as a stimulant or aphrodisiac; these deaths presumably resulted from CNS dysregulation or cardiac arrhythmia. Sports-related deaths associated with ephedra use have been reported.

Claims for ephedrine:

- Increases body fat loss
- Improves athletic performance
- Improves concentration

Valid research indicates that ephedrine has no effect on strength, endurance, reaction time, anaerobic capacity, or recovery time after prolonged exercise.

Caffeine increases the effect of ephedrine, and the combination can be dangerous.

Cautions for ephedrine are extensive. It is strongly suggested that it not be used. Ephedrine is banned by the National Collegiate Athletic Association (NCAA) and the IOC. The FDA has documented 40 deaths and more than 800 side effects linked to ephedrine use.

Side effects vary and do not correlate with the amount consumed. They include the following:

- Irregular heart rate
- Elevated blood pressure
- Dizziness
- Headache
- Heart attack
- Stroke
- Seizure
- Psychosis
- Death

BANNED SUBSTANCES, INCLUDING DRUGS

Objective

8. List banned substances.

Athletes become vulnerable to using banned substances when they reach a plateau at some point in their training and the substances help them move beyond it. Some athletes may become curious and take banned substances just to see what will happen, or they may give in to peer pressure to try them. The psychological effects of some banned substances, such as greater aggression and feelings of invincibility and euphoria, may be pleasurable enough that an athlete does not want to stop taking a banned drug. Athletes know that banned drugs enhance performance, and that some of their competitors and fellow athletes take them.

The massage therapist may recognize the signs of banned substance use. Knowing what to do with this knowledge can be a very difficult ethical dilemma. Massage therapists must not recommend or provide to athletes supplements or other substances.

The terms **banned drug** and **banned substance** refer to compounds that are prohibited for use during athletic training and competition. The body naturally produces some of these compounds, such as testosterone and growth hormone, in small amounts. Other compounds, including some anabolic steroids, are created only in the laboratory.

To make things more complicated, different sport organizations ban different substances–if they ban anything at all. Athletes who compete in Olympic sports must avoid taking compounds listed on the IOC list of banned substances. If they test positive for any such drugs, they may not compete for a short time (e.g., a few months) or for as long as the rest of their lives.

Major League Baseball has banned performance-enhancing drugs such as androstenedione and steroids. The IOC, the National Football League (NFL), the National Basketball Association (NBA), and the NCAA all prohibit the use of androstenedione. NFL, NBA, and IOC prohibit steroids and test for them.

Even if a substance is not classified as a drug, it can be banned. Some substances that are banned by the IOC are sold in the United States as nutritional supplements rather than as drugs. They can be bought at some health food stores and pharmacies. This category includes dehydroepiandrosterone (DHEA), androstenedione, and creatine.

Various vitamins and herbal mixtures sold through catalogs and advertised in muscle magazines purportedly improve strength. Absolutely no evidence suggests that any of them work. An illegal drug called *gamma hydroxybutyrate* is being sold in body-building and athletic clubs and in some health food stores. The FDA has issued a public health warning stating that this potent drug has serious side effects, including coma, seizures, and severe breathing problems.

The IOC also bans certain practices that achieve the same results as banned drugs. Blood doping is one such practice. This involves removing and storing a small quantity of blood, and then administering it immediately before a competition. The additional red blood cells increase the amount of oxygen that the blood carries to the muscles, thereby increasing the amount of work the athlete can do before performance starts to wane.

The list of substances banned by the International Olympic Committee is the most comprehensive used by any agency governing sports. The types of drugs and substances included have many common medical uses, so it is important for athletes to check the list before entering a sanctioned competition.

ANABOLIC STEROIDS

Anabolic steroids are probably the best known of substances banned by the IOC. Anabolic steroids have several medical uses. They improve the symptoms of arthritis, and they may help people infected with the human immunodeficiency virus (HIV) gain and maintain muscle mass and reduce the wasting that occurs with acquired immunodeficiency syndrome (AIDS).

This group of drugs includes synthetic derivatives of testosterone, a male sex hormone. Men who are testosterone-deficient owing to endocrine disease may take steroids to supply the missing testosterone. Some of the most common steroids include dehydrochlormethyl testosterone (Turnibol), metandienone (Dianabol), methyltestosterone (Android), nandrolone phenpropionate (Durabolin), oxandrolone (Oxandrin), oxymetholone (Anadrol), and stanozolol (Winstrol).

Some athletes take anabolic steroids to increase their muscle mass and strength. These drugs may help athletes recover from a hard workout more quickly by reducing the amount of muscle damage that occurs during the session. Some like the aggressive feelings that they have when the drugs are taken over several weeks or months. Athletes usually take anabolic steroids at doses that are much higher than those prescribed for AIDS wasting or testosterone replacement therapy. Effects of taking steroids at very high doses have not been well studied.

Steroid use has potentially life-threatening side effects. Men may develop prominent breasts and shrunken testicles. Women may develop a deeper voice and enlargement of the clitoris. Severe acne, liver abnormalities and tumors, increased low-density lipoprotein (LDL) and lower high-density lipoprotein (HDL) cholesterol levels, psychiatric disorders, and dependence may occur in both sexes. If an injected form is used, the risk of infection or disease that is transmitted in blood, including HIV and hepatitis, is increased. Use of steroids by adolescents can halt their normal pattern of growth and development and can put them at risk for future health problems.

Steroid users may develop a severe form of acne over the upper torso and become prematurely bald. They are more susceptible to bone and tendon injury because these support structures are not strong enough to anchor overdeveloped muscles.

A relatively new group of steroid users are female body builders. More muscular female body builders tend to win more competitions. Women can strengthen their upper bodies with weight training, but the only way to bulk up these muscles is by taking male **hormones**.

Female body builders not only suffer the same side effects as men, they also lose breast tissue, develop deeper voices, undergo changes in the structure of their reproductive organs, and grow increased facial and body hair. None of these changes is reversible. Women on steroids also stop menstruating, which is reversible when the steroids are discontinued.

BETA-2 AGONISTS

Drugs in another class, the **beta-2 agonists**, also are considered anabolic agents. This group includes drugs such as salmeterol (Serevent) and metaproterenol (Alupent). Beta-2 agonists may be prescribed for athletes if they have asthma and can administer them with an inhaler.

STIMULANTS

Stimulants may reduce fatigue, suppress appetite, and increase alertness and aggressiveness. They stimulate the CNS, increasing heart rate, blood pressure, body temperature, and metabolism.

The most common stimulants include caffeine and amphetamines such as Dexedrine and Benzedrine. Cold remedies often contain the stimulants ephedrine, pseudoephedrine hydrochloride (Sudafed), and phenylpropanolamine (Acutrim). Illegal drugs such as cocaine and methamphetamine also belong to this group.

Although stimulants can boost physical performance and promote aggressiveness on the field, they have side effects that can impair athletic performance. Athletes may become psychologically addicted or may develop tolerance and need greater amounts to achieve the desired effects. Nervousness and irritability make it hard to concentrate. Insomnia prevents an athlete from getting needed rest. Heart palpitations, weight loss, hypertension, hallucinations, convulsions, brain hemorrhage, heart attack, and other circulatory problems may result.

NARCOTICS

Narcotics are synthetic compounds and drugs derived from the poppy, such as morphine, codeine, and heroin. In conventional medicine, narcotics are used to ease pain, and injured athletes may use them for that purpose. Narcotics act as a sedative and decrease bowel activity. Some people experience elation or euphoria when taking narcotics. Adverse effects include nausea and vomiting, mental clouding, dizziness, delirium, constipation, respiratory depression, muscle rigidity, and low blood pressure. Dependence and addiction are common among those who abuse narcotics.

DIURETICS

Diuretics change the body's natural balance of fluids and salts (electrolytes) and can lead to dehydration. This loss of water may allow an athlete to compete in a lighter weight class, which many athletes prefer. Diuretics also help athletes pass banned substance drug testing by diluting their urine.

Diuretics are commonly used to treat high blood pressure and conditions that cause fluid retention (edema), such as congestive heart failure. When taken in small amounts, they have relatively few side effects, although electrolyte disturbances can occur.

When taken at the higher doses preferred by some athletes, however, adverse effects may be significant. Using diuretics to achieve weight loss may cause muscle cramps, exhaustion, decreased ability to regulate body temperature, potassium deficiency, and heart arrhythmias.

Some of the most common diuretics are acetazolamide (Diamox, Storzolamide), benzthiazide (Marazide, Aquastat), spironolactone (Aldactone), dichlorfenamide (Daranide), chlorothiazide (Diuril), and furosemide (Lasix, Fumide).

HORMONES, MIMETICS, AND ANALOGUES

This class of drugs includes several hormones naturally produced by the body that can enhance performance. The IOC banned substance list includes the following:

- *Human chorionic gonadotropin (HCG):* hormone of early pregnancy that stimulates secretion of testosterone by the fetus (prohibited only in men)
- *Luteinizing hormone (LH):* hormone that stimulates the secretion of sex hormones by the ovaries and testes (prohibited only in men)
- *Adrenocorticotropic hormone (ACTH):* hormone that stimulates secretion of other hormones by the adrenal cortex
- *Tetracosactide (corticotropin):* hormone that stimulates growth of the adrenal cortex or secretion of its hormones
- *Human growth hormone (HGH):* hormone that indirectly stimulates the transport of amino acids (protein) into cells, thereby increasing body size
- *Insulin-like growth factor (IGF)-1:* peptide that mimics many of the functions of insulin in tissues, such as stimulation of amino acid uptake, and of all substances associated with it
- *Erythropoietin (EPO):* hormone that stimulates the formation of red blood cells
- *Insulin:* hormone that stimulates absorption of sugars, fats, and proteins into cells (permitted in athletes with documented type 1 diabetes–formerly called juvenile or insulin-dependent diabetes)

Many sports authorities believe that HGH and EPO are the most commonly abused compounds in this category.

SUBSTANCES BANNED BY OTHER AGENCIES

The IOC permits individual sport-governing agencies to ban some classes of drugs. These classes include alcohol, cannabinoids, local anesthetics, glucocorticosteroids, and beta blockers.

ALCOHOL

Alcohol may impair judgment and cause loss of coordination.

Cannabinoids

Cannabinoids, the active compounds in plants such as marijuana, may decrease awareness of the athlete's surroundings, impair judgment, and reduce reaction time.

Local Anesthetics

Regular use of **local anesthetics** is prohibited because they may mask the pain of injury and permit an athlete to injure himself or herself more seriously or to put others at risk. They may be used when medically necessary, as when treating an injury.

Glucocorticosteroids

Systemic use of **glucocorticosteroids** is prohibited because they alter metabolism, circulation, muscle tone, arterial blood pressure, and other body functions. They may be used when medically necessary, as after an injury.

Beta Blockers

Beta blockers slow the heart rate and are used to treat high blood pressure and some heart disease. In sports that require precision rather than speed, strength, or endurance, a lower heart rate can be an advantage. Shooters, biathletes, and modern pentathletes may take these drugs so that they can shoot between heartbeats to improve accuracy. Beta blockers also help steady the hands of shooters and archers. Some of the more commonly banned beta blockers include acebutolol (Sectral), atenolol (Tenormin), metoprolol tartrate (Lopressor), and propranolol (Inderal).

IDENTIFICATION OF BANNED SUBSTANCE USERS

Determining which athletes use banned substances is not easy. No accurate tests are available for some banned drugs, such as human growth hormone. Many athletes have learned how to avoid testing positive for drugs.

The United States Anti-Doping Agency (USADA) is responsible for coordinating drug testing of U.S. athletes. A urine test for EPO and a test for HGH are in development. Because of the serious consequences of using banned substances, **the massage therapist must never recommend the use of any such product**.

EATING DISORDERS

Objectives

9. Explain the relationship between eating disorders and exercise or sport performance.
10. Define the three major eating disorders of athletes.
11. List the symptoms of eating disorders.
12. Report life-threatening substance abuse behavior and eating disorders to the appropriate professional.

Eating disorders have been associated with athletic participation in various sports. Prolonged nutrient inadequacies and impaired psychological functioning associated with eating disorders can affect physical performance and, if uncorrected, can be life-threatening. Massage therapists should be aware of the signs and symptoms that accompany disordered eating patterns and should know how to respond when they suspect that they are dealing with an eating-disordered athlete.

Eating disorders manifest as refusal to maintain a minimum healthy body weight (i.e., 85% of expected body weight), dramatic weight loss, fear of gaining weight even when underweight, abnormal preoccupation with food, abnormal food consumption patterns, and binge eating associated with loss of control and feelings of guilt.

Eating disorders common in the athlete are anorexia athletica, anorexia nervosa, and bulimia nervosa.

Anorexia athletica has been proposed as a classification for athletes who show significant symptoms of eating disorders but who do not meet the diagnostic criteria for anorexia nervosa or bulimia nervosa.

Anorexia nervosa is characterized by refusal to maintain weight at or above a minimum normal level for height and age; an intense fear of gaining weight or becoming fat; a disturbance in the way in which one's body weight, size, or shape is perceived by the individual; and, in females, absence of at least three menstrual cycles when otherwise expected to occur.

Bulimia nervosa is characterized by recurrent episodes of binge eating, a feeling of lack of control over eating behavior, regularly engaging in self-induced vomiting, strict fasting, use of laxatives, excessive vigorous exercise, and a minimum average of two binge eating episodes per week for at least 3 months.

The spectrum of abnormal eating patterns ranges from mild to severe. Nonclinically defined disorders, such as the relentless effort to eliminate all fat from the diet, are unnecessary and unhealthful practices that can certainly have a negative impact on physical performance, among other things. **Disordered eating** is differentiated from an "eating disorder" by the degree and frequency of the aberrant eating behaviors, for example, excluding whole food groups, such as fats or carbohydrates, versus restricting eating to limited times of the day.

Few controlled studies have examined the prevalence of eating disorders among athletes. However, several small studies suggest that the prevalence of "disordered eating" among female athletes may be as high as 62% in sports such as gymnastics, and as high as 31% among men who participate in sports requiring a specified weight to compete, such as wrestling and rowing. It is important to emphasize that athletes in all sports can develop disordered eating behaviors, but sports associated with higher rates of disordered eating problems can be classified into three distinct groups: "appearance sports" such as gymnastics, body building, figure skating, and ballet; sports in which low body weight is considered advantageous, such as distance running and horse racing; and "weight category" sports such as wrestling and boxing.

Studies have provided numbers suggesting a higher incidence of eating disorders among athletes in sports and performers in whom the strength/weight ratio is a premium and body fat is expected to be low (gymnastics, ballet, long-distance running).

Females tend to have a smaller percentage of lean body mass than males and therefore have a reduced calorie need. To be thinner, females generally have to eat considerably less than males. In female athletes, this reduced food intake may not be sufficient to satisfy hunger and, when combined with the desire to lose weight, may result in disordered eating patterns. Many published reports on the female triad—eating disorders, amenorrhea, and osteoporosis—provide a hint of the health-related consequences of inadequate consumption of food.

Muscle power and endurance will be affected, and the athlete with a disordered eating pattern is likely to become ill more frequently. Severe and prolonged disordered eating can negatively affect every organ system in the body.

Endocrine abnormalities are common among persons with anorexia nervosa, and more subtle endocrine abnormalities have been described in those with bulimia nervosa. Furthermore, eating disorders can lead to gastrointestinal complications such as esophagitis, esophageal tears, and pancreatitis.

Fluid and electrolyte disturbances can increase the risks of cardiac arrhythmias, renal damage, impaired temperature regulation, and loss of endurance and coordination.

Swelling of the parotid glands as a result of frequent stimulation of the salivary glands caused by repeated vomiting can produce a "chipmunk-like" appearance in individuals with bulimia. Although this condition is painless and has no significant medical consequence, it does distort facial features. This may have no direct effect on athletic performance, but it is disfiguring and it can be emotionally upsetting to the individual who is searching for the unrealistic "ideal body."

The massage professional will often identify eating problems before anyone else does. Concerns should be expressed to the coach or athletic trainer if necessary. Eating disorders lead to life-threatening conditions that should not be overlooked. Dieting, weight loss, and pre-event diet rituals do not mean that an athlete has an eating disorder. However, if any of the following signs or behaviors are recognized, they should not be ignored:

- Repeated comments about being or feeling fat
- Weight loss below ideal competitive weight that continues during the off-season
- Secretive eating or disappearing immediately after meals
- Excessive exercise that is not part of the team training regimen
- Weakness, headaches, and dizziness with no apparent medical cause

In anorectics, the most obvious physical symptom is an emaciated appearance. The anorectic's shoulder blades, backbone, and hip bones protrude, and muscle groups are clearly visible. However, keep in mind that the athlete with anorexia may not be as thin or light as the nonathletic anorectic because physical training generally increases muscle mass to a certain extent. Anorectics may also suffer from cold intolerance, may dress in layers or baggy clothes, and may have persistent rashes, thin hair and nails, and gum disease.

It is important for the massage therapist to remain supportive of an individual who is suspected of suffering from an eating disorder, but the behavior should not be condoned. Be aware of mood swings, and do not attempt to challenge the athlete about the logic or significance of the abnormal behavior. Eating disorders are often rooted in psychological disturbances, cultural myths, and body image distortion. They are serious conditions that require referral for professional intervention.

During treatment for an eating disorder, the athlete should have access to a physician, a mental health worker, and a nutrition therapist (generally a registered dietitian), all of whom have been trained to work with eating-disordered patients.

SUMMARY

The massage therapist can support recommended dietary plans but should never recommend or provide supplements to clients. The massage therapist may be the first to notice dietary problems, eating disorders, or the use of banned substances. These behaviors have serious consequences and can be life-threatening. They require referral and reporting to the supervising medical professional. Because this population is vulnerable to various internal and external pressures, the massage therapist should remain vigilant for the development of potentially destructive behavior.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1. Analyze your own diet in relationship to general dietary recommendations.
2. Design breakfast, lunch, dinner, and two snacks based on an antiinflammatory diet.
3. List the differences between the general dietary recommendations and the sport performance diet.
4. Develop a recommended fluid intake protocol.
5. How would an athlete alter diet to gain or lose 10 pounds?
6. List supplements commonly used by athletes.
7. List claims of supplements that are invalid.
8. What are commonly banned substances, and what organizations regulate the use of these substances? Develop a reporting plan for banned substance use.
9. What factors would be considered to determine the difference between the structured behavior normal for an athlete and abnormal behavior indicating potential eating disorders?
10. What is the difference between disordered eating and an eating disorder?
11. Develop a reporting plan for suspected eating disorders.

CHAPTER

8 Influences of the Mind and Body

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1. Define sport psychology.
2. Identify qualified sport psychologists.
3. Explain how massage supports the sport psychologist.
4. List ways in which massage supports the zone experiences—mental toughness, ideal performance state, and peak performance.
5. Explain the importance of sport psychology during injury rehabilitation.
6. Identify the signs of mental and emotional strain requiring referral to the medical team or sport psychologist.
7. List the five stages of response to injury.
8. Define stress and explain stress coping strategies.
9. List factors that interfere with restorative sleep.
10. List behaviors that support restorative sleep.

KEY TERMS

Acute Stress
Chronic Stress
Coping Skills
Ideal Performance State
Insomnia
Mental Toughness
Peak Performance
Restorative Sleep
Secondary Gain
Sport Psychologist
The Zone

OUTLINE

Sport psychology is the study of psychological and mental factors that influence, and are influenced by, participation and performance in sport, exercise, and physical activity, and application of knowledge gained through this study to everyday settings.

Sport psychology professionals are interested in how participation in sport, exercise, and physical activity may enhance personal development and well-being throughout the life span.

Sport psychology involves several different components: mental training, performance enhancement, social interactions, learning, motivation, leadership, anxiety and stress management, cognitive rehearsal techniques (including hypnosis), intentional control training, injury treatment, cognitive intervention strategies, aggression management, and cohesion/congruency.

Sport psychology professionals may be trained primarily in the sport sciences, with additional training in counseling or clinical psychology, or they may be trained primarily in psychology, with supplemental training in the sport sciences.

The activities of a particular sport psychology professional will vary based on the practitioner's specific interests and training. Some may primarily conduct research and educate others about sport psychology. These individuals teach at colleges and universities and, in some cases, also work with athletes, coaches, or athletic administrators. They provide education and develop and implement programs designed to maximize the overall well-being of sport, exercise, and physical activity participants.

Other professionals may focus primarily on applying sport psychology knowledge. These individuals are more interested in enhancement of sport, exercise, and physical activity performance or enjoyment. They may consult with a broader range of clients and may serve in an educational or counseling role.

Only those individuals with specialized training and, with certain limited exceptions, only those with appropriate certification and/or licensure may call themselves **sport psychologists**. A sport psychologist should be a member of a professional organization such as the Association for the Advancement of Applied Sport Psychology (AAASP) and/or the American Psychological Association (APA). A growing number of sport psychology professionals are certified by the AAASP. These professionals–who earn the designation Certified Consultant, AAASP (or CC, AAASP)–have met a minimum standard of education and training in the sport sciences and in psychology. They have also undergone an extensive review process. The AAASP certification process encourages sport psychology professionals who complete it to maintain high standards of professional conduct.

Some sport psychology professionals may be listed on the U.S. Olympic Committee (USOC) Sport Psychology Registry, meaning that they are approved to work with Olympic athletes and national teams. To be on the Registry, a professional must be a CC, AAASP and a member of the APA.

WHY SPORT PSYCHOLOGY?

Objectives

1. Define sport psychology.
2. Identify qualified sport psychologists.
3. Explain how massage supports the sport psychologist.

During the past two decades, sport psychology has received significant and increasing attention from athletes, coaches, parents, and the media. A growing number of elite, amateur, and professional athletes acknowledge working with sport psychology professionals.

Exercise specialists, athletic trainers, youth sport directors, corporations, and psychologists are using knowledge and techniques developed by sport psychology professionals to assist with improving exercise compliance, conducting rehabilitation programs, educating coaches, building self-esteem, teaching group dynamics, and increasing performance effectiveness.

Almost all sports are based on competition. Striving to reach peak performance is appropriate until athletes push themselves beyond their capacity. Exercise is very helpful in alleviating stress, releasing tensions, and producing a relaxing kind of fatigue. However, some people go far beyond this normal response and become overly dependent on daily exercise.

One of the by-products of exercise is the production of naturally occurring brain chemicals that influence mood. Endorphins are morphine-like substances that produce a sense of well-being and relaxation and are responsible for the “runner’s high.” Some people become addicted to daily exercise through production of these chemicals. If they don’t exercise, they become depressed and irritable, and they may actually have withdrawal symptoms. If they become injured, they will make life miserable for everyone around them until they can get back to exercising daily. Many athletes refuse to take time off because of their drive to keep pushing themselves. It can be difficult to get the message across that an injury, like a hamstring pull, may take 3 or more months to heal. This mental outlook often interferes with even the best treatment because the athlete will try to play before he or she is ready.

Muscles may be held in sustained tension owing to overuse, poor posture, and/or psychological or emotional stress. States of anxiety and anger, for example, can create sustained muscular hypertonicity. Emotional stress, such as depression, can also cause decreased muscular tone and loss of sensory motor communication (Figure 8-1).

Appropriate massage can support the work of the sport psychologist by calming anxiety, reducing increased motor tone of muscles, and, to a lesser extent, addressing mild depression. Massage affects the same mood-altering neurochemicals as exercise.

FIGURE 8-1 Sport performance is a roller coaster of physical and emotional ups and downs. (From Cuppett M, Walsh K: *General medical conditions in the athlete,* St Louis, 2012, Mosby.)

WHAT IS THE ZONE?

Objective

4. List ways in which massage supports the zone experiences—mental toughness, **ideal performance state**, and peak performance.

Studies of athletes, artists, and others have shown that being "in **the zone**" generally means being in a state in which mind and body are working in harmony. When in the zone, an individual is calm yet energized, challenged yet confident, focused yet instinctive. Different parts of the brain are working together smoothly to automate the movement or skill. This is comparable with the massage practitioner's being "centered."

Training the mind is an important step toward getting in the zone. Aspects of mental training for some sports and positions include increasing concentration and focus, controlling emotions, feeling relaxed but energized, being calm and positive, and aiming to feel challenged and confident. A person who is in the zone is free of worries and is confident and relaxed, so that the best performance occurs automatically.

Getting in the zone combines physical and mental training. When the body is conditioned, skills are well practiced, or habituated, and mental conditioning is congruent; a zone experience is then possible.

The implications for massage supporting "zone" functions are vast. Physical sensations of relaxation can help relieve anxiety and tension and improve concentration and focus. Various progressive relaxation methods that involve contracting and releasing the tension in large muscles are used. Massage can induce deep relaxation and support zone functions.

Guided imagery can help reduce anxiety and increase concentration and confidence, and can serve as mental practice or rehearsal. Imagery techniques work well in conjunction with relaxation techniques such as massage because relaxation can help the client better imagine performing the skill required. During massage or other induced relaxation states, the athlete can mentally picture himself or herself performing a specific sport or activity. He or she can visualize being dressed, getting ready to perform, hearing the sounds and smells—feeling the muscles and emotions and envisioning doing the activity, practicing skills, running the race—whatever it might be.

Negative thoughts can get in the way of concentration and confidence. The massage therapist must not be negative during the massage and must support positive and productive thought processes.

Although training the mind and body can lead to more skillful and enjoyable play, it is important to understand that the athlete might not get in the zone all the time. The zone experience does not happen nearly as often as people like to think it does. Do not overfocus on the zone experience during the massage.

Several names may be used for states of being similar to the zone. Each is slightly different, but the basic concepts are the same.

Mental toughness is the ability to perform near the athlete's best no matter what the competitive circumstance—to maintain calmness of thought, thinking positively, being realistic, and remaining focused.

Ideal performance state is the level of physical and mental excitement that is ideal for performing at the top. Key elements include being confident, relaxed yet energized, positive, challenged, focused, and automatic.

Peak performance describes one's very best performance, although a person need not necessarily be in the zone while achieving it. Key elements include being focused, relaxed, confident, and energized.

INJURY AND SPORT PSYCHOLOGY

Objectives

5. Explain the importance of sport psychology during injury rehabilitation.
6. Identify the signs of mental and emotional strain requiring referral to the medical team or sport psychologist.

Whether the athlete is a competitive or a recreational exerciser, recovering from an injury can present a challenge. How the athlete understands and responds to pain and limitation is a very individual experience based on many factors. However, certain responses and psychological skills can help most people take an active role in their own recovery.

People often initially feel overwhelmed by an injury. The ability to cope will greatly improve if the athlete works closely with the doctor and other health care providers to develop a clear plan for recovery.

Successful rehabilitation begins with becoming informed about the injury. It's important to know the extent of the injury and anticipated recovery time, and to understand the rehabilitation plan required to recover safely and effectively.

It is important that the injured person considers himself or herself as an active participant in rehabilitation planning and treatment. An individual may not understand the scientific aspects of recovery, but he or she is the expert on his or her own experience—a reality that may help or hinder rehabilitation.

How the athlete responds to the injury is also very important. Although certain sports or activities present greater risk for injury than others, an injury usually is not expected or planned for. Athletes are rarely prepared for the emotional response to an injury.

Injuries have very different meaning for different people. For some, an injury might be life-threatening or career-ending. For others, an injury might take them away from a team or social structure that gives them a sense of identity and community. An injury can also interfere with a job or responsibilities at home. It's important, therefore, that the athlete acquire the **coping skills** required to help him or her through the loss—with professional help if necessary.

Athletes should try to maintain a sense of identity and importance through activities that help them feel good. They should express their needs and concerns to the health care team. It is helpful to identify any negative mental responses to injury, then to reframe them to promote a positive approach to healing: be aware of the current level of function and of what function is lost, and then move beyond those limitations to envision the future level of function.

The athlete needs to ask for and receive help and to be surrounded by emotionally and physically supportive people. Interaction with those who hinder the healing process should be eliminated or minimized.

Athletes in today's society have many problems to deal with, including multiple personal and professional demands, increased stress, and injury. Some athletes know how to successfully deal with injury, and others have a hard time coping with it. The athlete may need professional help to get through the injury healing process, and the massage therapist needs to be supportive.

Injury can negatively impact the mind, emotions, and body. Rehabilitation is often a time of emotional distress.

Injury rehabilitation affects a person in many ways, including the following:

- Change in status relative to peers
- Having to deal with pain
- The need for discipline and compliance with rehabilitation programs
- Decreased independence and control
- Resultant worries about finances
- Changes in self-esteem or self-image

Signs that an athlete is having some problems include these:

- Depression
- Feeling of being helpless
- Mood swings
- Dwelling on minor complaints
- Denial

When these issues are recognized by the massage therapist, a referral is necessary. Avoid the tendency to try to fix them. Ultimately, therapeutic massage is secondary to, although supportive of, the medical team, including the sport psychologist. Respect for professional boundaries and honoring scope of practice are essential. However, because of the time that massage therapists spend with athletes and the compassionate quality of the professional interaction, we may be the first to notice difficulties. Athletes may share information with massage professionals that was not provided to others working with them.

As massage professionals interested in the sports massage career specialty, we want to understand and help an athlete through an injury. We need to understand the demands placed on the whole person while addressing the injury.

Sport psychology interventions can minimize negative experiences and maximize recovery from injury. Mental training enhances performance in rehabilitation and sport, improving the ability to return to play. Outcome of an injury, degree of pain, and expected performance are important factors in determining how fast rehabilitation should occur.

When coaches or trainers adopt an attitude that injured athletes are worthless, they create an environment in which athletes will continue to participate while hiding their injury, increasing the likelihood of further injury. Similarly, coaches who emphasize a strong will to compete and win, no matter what the athlete's physical status, promote the idea of sacrificing one's body for the team, which can cause players to take unhealthy risks and become injured.

All athletes should understand that the nature of participation in sports dictates that at some time, pain and injury are very likely to occur. However, instead of stressing the inherent risks associated with sport, the focus should be on doing those things that can minimize the chances of injury, such as making certain that the athlete is fit, is practicing safe sport techniques, and is learning to recognize when his or her body is saying that something is wrong. If athletes are confident that they have done as much as they can to reduce the likelihood of injury, perhaps their risk of injury will indeed be minimized. Teaching athletes how to distinguish between the "normal" pain and discomfort associated with training and "injury" pain is of vital importance. Athletes who do not learn to make this distinction often become seriously injured because they do not recognize the onset of minor injuries and do not modify their training regimens accordingly.

The individual's current medical status must also be addressed. Conditions such as diabetes, asthma, and high blood pressure, as well as orthopedic concerns, must be factored into the exercise prescription for rehabilitation or fitness-based programs for performance.

Learning stress management skills is important for athletes–both for enhancing performance and for reducing injury risk. Psychological stress has been shown to predict increases in injury. Stress is thought to increase the risk of injury because of the unwanted disruption in concentration or attention and the increased muscle tension associated with heightened stress. Athletes especially prone to injury seem to be those who experience considerable life stress. They have little social support from others, possess few psychological coping skills, and are apprehensive, detached, and overly sensitive.

Sport massage therapists should learn to treat the whole athlete, not just the injury. They must communicate effectively and factually without instilling fear or unrealistic expectations and with concern for the athlete's feelings.

No one can work closely with human beings without becoming involved with their emotions and, at times, their personal problems. The sport massage therapist is placed in numerous daily situations in which close interpersonal relationships are important. Understanding an athlete's fears, frustrations, and daily crises is essential, along with knowing when to refer individuals with emotional problems to the proper professionals. Injury prevention includes dealing with both psychological and physiologic attributes of the athlete. The athlete who competes while angry, frustrated, or discouraged, or while suffering from some other emotional disturbance, is more prone to injury than one who is better adjusted emotionally. Because of the emotional intensity surrounding competing athletes, the massage therapist working with this population needs to attend to his or her own mental health.

IN MY EXPERIENCE

I remember working with a rookie football player who was extremely homesick. He came from a large family and was the "baby." It was unclear if he really wanted to play football at a professional level. The transition from the college game to the demands of "going to work" seemed to overwhelm him.

He had a turf toe injury that just would not heal to his satisfaction. The pain and functional limitations exceeded the typical time usually indicated for being excused from practice. The coach became impatient with him, and the athletic trainer was unable to provide further treatment.

I was working with the young man for the turf toe injury and for general massage. He became attached to me and began saying things like, "You remind me of my mom." Eventually, I talked with the trainer about this, who then talked with the coach.

Intervention was provided. Voluntarily, the young man's mom began to schedule more frequent visits, and the situation improved. He did play professional football and was moderately successful, lasting for about 5 years in the league. When the constant moving around and separation from his family became too difficult, he left the league. He is currently teaching and coaching football at a high school near his family and is married and has a family of his own.

MASSAGE APPLICATION

Objective

7. List the five stages of response to injury.

Generally speaking, injured athletes can experience feelings of vulnerability, isolation, and low self-worth. Denial of the reality of the injury also comes into play. All of these feelings can adversely affect the athlete and his rehabilitation. The injured athlete may experience a number of personal reactions besides a sense of loss. These may include physical, emotional, and social reactions. A fairly predictable response to injury often occurs in five sequential stages: (1) denial, (2) anger, (3) grief, (4) depression, and (5) reintegration. Athletes who fail to move through these five stages may suffer adverse psychological effects related to the injury. Such adverse effects are more likely to occur if the injury is season-ending or career-ending.

Some degree of psychological distress and discomfort accompanies most major athletic injuries. However, more serious problems of poor psychological adjustment to injury are often preceded by the following warning signs:

- Feelings of anger and confusion
- An obsession with the question of returning to play
- Denial of the injury
- Exaggerated bragging about accomplishments
- Guilt about letting one's team down
- Withdrawal from significant others
- Rapid mood swings
- Pessimistic attitude about the prognosis for recovery

When these warning signs are detected, the athlete should be referred to a sport psychologist or another mental health professional.

Certain factors are commonly seen among athletes going through adjustment to injury and rehabilitation. Severity of injury usually determines length of rehabilitation. Regardless of length of rehabilitation, the injured athlete has to deal with three reactive phases of the injury and rehabilitation process:

- Reaction to injury
- Reaction to rehabilitation
- Reaction to return to competition or career termination

Other factors that influence reactions to injury and rehabilitation include the athlete's coping skills, past history of injury, social support, and personality traits. All athletes do not necessarily have all of these reactions, nor do all reactions fall into the suggested sequence.

Athletes who deal with their feelings and focus on the future rather than the past have a tendency to advance through rehabilitation at an accelerated rate. Those who have a high degree of hardiness, a well-developed self-concept, and good coping strategies and mental skills are more likely to recover rapidly and fully from injury than athletes who lack these qualities.

Athletes who lack motivation and are depressed or in denial have difficulty with the rehabilitation process.

After injury, particularly one that requires long-term rehabilitation, the athlete may have problems adjusting socially and may feel alienated from the rest of the team. The athlete may believe that there has been little support from coaches and teammates. The athletic trainer is responsible for rehabilitation and becomes the primary source of social support. The massage therapist can play an important part in this support process only if the professionals work together. Conflict among professionals can adversely affect this process.

One of the outcomes of an injury may be **secondary gain**. This can be a beneficial "time-out" (time to rest and refocus) with a decrease in pressures and expectations. Secondary gain can both support and interfere with the healing process.

Psychological strategies and communicative skills used by the sport psychologist help the athlete move successfully through the rehabilitation process. Care needs to be taken to maintain appropriate boundaries during this vulnerable time for the athlete.

The following strategies are used by the massage therapist to support the medical staff:

Coping skills: The massage professional has a limited role in this area. Teaching self-help is appropriate as long as it does not conflict with other treatment being provided.

Education about the injury: When sharing information, make sure that it is correct and does not conflict with information provided by other professionals.

Coping with nonparticipant status and other changes: These changes include separation from family, friends, and teammates. The massage therapist is supportive but defers to the medical and coaching staff.

Managing emotional reactions to injury and regaining sense of control: The massage therapist can target the massage to address the physical effects of emotional turmoil and refers to the sport psychologist for additional mental support.

Pain management: The massage therapist can play an active role in helping the athlete to cope with pain related to injury, surgery, and rehabilitation after returning to play.

During injury rehabilitation, management of the emotional demands of treatment and rehabilitation consists of the following:

- Adhering to physical therapy
- Maintaining motivation for rehabilitation
- Tolerating pain
- Goal setting and achievement
- Consultation with medical and rehabilitation staff as needed
- Coping with chronic pain
- Coping with issues associated with returning to sport activity such as fear of reinjury, intrusive or disruptive thinking regarding the injury, and loss of confidence

The massage therapist plays an important supportive role during this phase of rehabilitation and reinforces awareness of physical healing to support rehabilitation.

IN MY EXPERIENCE

Many of the athletic clients I have worked with over the years have experienced serious injury requiring a long and complex rehabilitation period. I have had to learn to have a "thick skin" and not be reactionary to some of the behaviors displayed by clients. They do sometimes get grumpy, sullen, irritable, and difficult. It is important to remember that it is the client's issue and "not about me." One player's wife said to me, "How can you stand him?!" My response, "He pays me."

It wasn't until I experienced my own health crisis (cardiac bypass surgery in 2006) that I experienced the following:

- Coping skills
- Education about the injury
- Coping with nonparticipant status and other changes
- Managing emotional reactions to injury and regaining sense of control
- Pain management

Even though I understood the whole recovery process and had worked with many going through it, I had never personally experienced the process myself. It was frightening and overwhelming. I remember those feelings now when I work with those going through the upheaval of a health crisis. I am more kind and gentle.

STRESS

Objective

8. Define stress and explain stress coping strategies.

Stress is often associated with situations or events that are difficult to handle. How a person views things also affects the level of stress. Unrealistic or high expectations increase the stress response.

Stress may be linked to external factors, such as

- Community
- Unpredictable events
- Environment
- Work
- Family

Stress can also come from internal factors, such as

- Irresponsible behavior
- Poor health habits
- Negative attitudes and feelings
- Unrealistic expectations

It is one thing to be aware of stress in daily life, but it is another to know how to change it. Stress is not just in the mind. It is a physical response to an undesirable situation, and it has the potential to control one's life. Stress has many sources. Mild stress can result from being caught in a traffic jam, standing in line at a store, or getting a parking ticket. Stress also can be severe and cause major health problems. Divorce, family problems, and the death of a loved one can be devastating.

Stress can be short-term (acute) or long-term (chronic). **Acute stress** is a reaction to an immediate or perceived threat. Everyday life sometimes poses situations that are not short-lived, such as relationship problems, loneliness, and financial or health worries. The pressures may seem unrelenting and can cause **chronic stress**.

When a person's coping behavior is ineffective, a physical stress response occurs to meet the energy demands of the situation. First, the stress hormone adrenaline is released. Then, the heart beats faster, breathing quickens, and blood pressure rises. The liver increases its output of blood sugar, and blood flow is diverted to the brain and large muscles. The massage therapist should recognize signs and symptoms of nonproductive sympathetic dominance.

After the threat or anger passes, the body relaxes again. One may be able to handle an occasional stressful event, but when it happens repeatedly, such as with chronic stress, the effects multiply and are compounded over time.

For example, a football player endures week after week of hits in a season, or a source of pain, and may reach a point of not being able to handle it anymore.

It is evident that there is too much stress for a person to cope with when the following telltale signs appear:

- Irritability
- Sleep problems (sleeps all the time or can't sleep at all)
- Lack of joy
- Loss of appetite or can't stop eating
- Trouble with relationships (e.g., no longer gets along with friends and family members)
- Illness, infertility, or fatigue

Signs of chronic stress, which can damage overall health, include the following:

- Uneasiness and vigilance
- Anxiety and panic attacks
- Sadness or a heightened sense of energy
- Depression or melancholia
- Loss of appetite
- Anorexia or overeating
- Alertness
- Irritability
- Suppression of the immune system
- Lowered resistance to infection
- Increased metabolism
- Diabetes or hypertension
- Infertility
- Fatigue
- Absence of menstruation (amenorrhea), loss of sex drive or performance ability

COPING WITH STRESS

The following measures can help in coping with stress.

Sleep well. Sleep is very important and can provide the athlete with the energy needed to face each day. Going to sleep and awakening at a consistent time may help the person sleep more soundly. Restorative sleep should be a major goal of massage.

Eat a balanced diet that includes a variety of foods and provides the right mix of nutrients to keep the body systems working well. When healthy, the athlete will be better able to control stress and pain.

Change the pace of your daily routine.

Be positive. It helps to spend time with people who have a positive outlook and a sense of humor. Laughter actually helps ease pain because it releases the chemicals in the brain that give a sense of well-being.

Relaxation methods trigger the body's relaxation response. The relaxation response is a group of physiologic changes that cause decreased activity of the sympathetic nervous system and support parasympathetic function. Relaxation methods are helpful in reducing the physical sensations of the stress response and help to manage stress by

- Reducing anxiety and conserving energy
- Increasing self-control when dealing with stress
- Enhancing recognition of the difference between tense muscles and relaxed ones
- Helping to keep the individual alert, energetic, and productive

Massage is a major relaxation modality. It supports physical relaxation techniques such as deep breathing, progressive muscle relaxation, word repetition, and guided imagery.

Progressive Muscle Relaxation

This technique involves relaxing a series of muscles, one at a time. First, raise the tension level in a group of muscles, such as those in a leg or an arm, by tightening the muscles and then relaxing them. Concentrate on letting the tension go out of each muscle. Then, move on to the next muscle group. Do not tense muscles near pain sites. Massage supports the practice of progressive muscle relaxation.

Word Repetition

Choose a word or phrase that is a cue for relaxing, and then repeat it. While repeating the word or phrase, breathe deeply and slowly, and think of something that gives pleasant sensations of warmth and heaviness.

Guided Imagery

Also known as visualization, this technique involves lying quietly and picturing yourself in a pleasant and peaceful setting. Try to experience the setting with all of the senses, as if you are actually there. For instance, imagine lying on the beach. Picture the beautiful blue sky, smell the salt water, hear the waves, and feel the warm breeze on your skin. The messages your brain receives as you experience these sensations help you to relax (Box 8-1).

BOX 8-1 Lifestyle Adjustments to Stress

- Simplify life.
- View negative situations as positive and a chance to improve life.
- Use humor to reduce or relieve tension.
- Exercise.
- Get more sleep.
- Eat a good breakfast and lunch.
- Reduce or eliminate caffeine consumption. Caffeine is a stimulant.
- Get a regular massage.
- Don't take work problems home or home problems to work.
- Call a friend and strengthen or establish a support network.
- Hug your family and friends.
- Do volunteer work or start a hobby.
- Pray or meditate.
- Practice relaxation techniques, such as deep breathing and self-hypnosis.
- Take a vacation.

RESTORATIVE SLEEP

Objectives

9. List factors that interfere with restorative sleep.
10. List behaviors that support restorative sleep.

Restorative sleep is extremely important for anyone who is an athlete or in rehabilitation. Almost everyone has occasional sleepless nights, perhaps owing to stress, heartburn, or drinking too much caffeine or alcohol. How much sleep is enough varies for different individuals. Although 7½ hours of sleep is about average, some people feel fine on only 5 or 6 hours of sleep, and others need 9 or 10 hours a night.

Lack of restorative sleep can affect energy levels, and restorative sleep helps bolster the immune system, fighting off viruses and bacteria.

Insomnia is the most common of all sleep disorders. Insomnia includes difficulty going to sleep, staying asleep, or going back to sleep when awakened early. It may be temporary or chronic. About one out of three people have insomnia at some point in their lives. Simple changes in one's daily routine, lifestyle, and habits may result in better sleep (Box 8-2).

Insomnia becomes more prevalent with age. As a person gets older, the following changes often occur that may affect sleep.

Between the ages of 50 and 70, more time is spent in stages 1 and 2 of non–rapid eye movement (NREM) sleep and less time in stages 3 and 4. Stage 1 is *transitional sleep,* stage 2 is *light sleep,* and stages 3 and 4 are *deep (delta) sleep*—the most restful kind. Because one is sleeping lighter in stages 1 and 2, one is more likely to wake up. With age, the internal clock often speeds up, and a person may get tired earlier in the evening and consequently wake up earlier in the morning.

A change in daily activity can disrupt sleep patterns regardless of whether the client is less or more physically or socially active. Consistent activity as part of daily activities helps promote a good night's sleep. The retired client may have more free time and because of that may drink more caffeine or alcohol or take a daily nap. These things can interfere with sleep at night.

A change in health can affect sleep patterns. Chronic pain associated with conditions such as arthritis and back problems, as well as depression, anxiety, and stress, can interfere with sleep. Older men often develop noncancerous enlargement of the prostate gland (benign prostatic hyperplasia), which can cause the need to urinate frequently, interrupting sleep. In women, hot flashes and urinary urgency that accompany menopause can be equally disruptive. Other sleep-related disorders, such as sleep apnea and restless legs syndrome, become more common with age. Sleep apnea causes one to stop breathing periodically throughout the night and awaken. Restless legs syndrome causes an unpleasant sensation in the legs and an uncontrollable desire to move them, which may awaken one or prevent one from falling asleep. Nutritional

BOX 8-2 Common Causes of Insomnia

Stress: Realistic and unrealistic concerns about work, school, health, or family keep the mind too active and unable to relax for sleep. The busy brain and excessive boredom can create stress and interfere with sleep.

Anxiety: Everyday anxieties as well as severe anxiety disorders may keep the mind too alert to fall asleep at the beginning or in the middle of the night.

Depression: People either sleep too much or have trouble sleeping if depressed. This may be due to chemical imbalances in the brain, or it may occur because worries that accompany depression may keep people from relaxing enough to fall asleep when needed.

Stimulants: Prescription drugs, including some antidepressants, high blood pressure, and steroid medications, can interfere with sleep. Many over-the-counter medications, including some brands of aspirin, decongestants, and weight loss products, contain caffeine and other stimulants. Antihistamines initially may make one groggy, and they can worsen urinary problems, making it necessary to get up more frequently during the night.

Changes in the environment or work schedule: Travel or working a late or early shift can disrupt the body's circadian rhythms, making it difficult to get to sleep. Circadian rhythms act as internal clocks, guiding the wake-sleep cycle, body metabolism, and body temperature.

Long-term use of sleep medications: Doctors generally recommend using sleeping pills only for up to 4 weeks until the person notices benefits from self-help measures. If someone needs sleep medications longer, they should be used no more than 2 to 4 times a week, so that they don't become habit-forming. Sleeping pills often become less effective over time.

Medical conditions that cause pain. These include arthritis, fibromyalgia, and neuropathies that result in nerve pain. Many people with fibromyalgia experience higher-frequency brain waves than normally expected when they sleep. These higher-frequency brain waves may interfere with the restfulness of sleep.

Behavioral insomnia: This may occur when people worry excessively about not being able to sleep and try too hard to fall asleep. Most people with this condition sleep better when they're away from their usual sleep environment, or when they don't try to sleep, such as when they're watching TV.

Eating too much too late in the evening: Having a light snack before bedtime is OK, but eating too much may cause the person to feel physically uncomfortable when lying down, making it difficult to get to sleep. Many people also experience heartburn, or reflux, which is a back flow of food from the stomach to the esophagus after eating. This uncomfortable feeling may keep a person awake.

depletions may be the reason for restless legs syndrome; therefore, nutritional supplements may help. A nutritionist or a physician can help by making recommendations.

The following strategies promote restorative sleep:

Stick to a schedule. Keep bedtime and wake time routines on as constant a schedule as possible.

Limit time in bed. Too much time in bed can promote shallow, unrestful sleep. Try to get up at the same time each morning, regardless of when you go to bed.

Avoid "trying" to sleep. The harder a person tries, the more awake the person becomes. Reading or listening to music until drowsy helps one to fall asleep naturally.

Avoid or limit caffeine, alcohol, and nicotine. Caffeine and nicotine can keep a person from falling asleep. Alcohol can cause unrestful sleep and frequent awakenings.

Reset the body's clock. If falling asleep too early, use light to push back the internal clock. In the evenings, if it is still light, go outside in the sun or sit near a bright light.

Check medications. If medications are taken regularly, check with the doctor to see if the medications may be contributing to sleep disturbances. Also check the labels of over-the-counter products to see if they contain caffeine or other stimulants such as pseudoephedrine.

Don't put up with pain. Make sure that any pain reliever being taken is effective enough to control pain while sleeping.

Find ways to relax. A warm bath or a light snack before bedtime may help prepare for sleep. Massage also may help promote relaxation.

Limit naps. Naps can make it harder to fall asleep at night.

Minimize sleep interruptions. Close the bedroom door or create a subtle background noise, such as running a fan, to help drown out other noises. Sleep in a different room if the bed partner snores.

Adjust bedroom temperatures. The room should be comfortably cool.

Limit nighttime use of the bathroom by drinking less toward evening.

The training and competing athlete needs an appropriate amount of restorative sleep. This is typically 8 to 9 hours at night and a 1-hour nap. Playing schedules and travel to different time zones disrupt an athlete's sleep patterns. Sleeping in a different bed when traveling can be a problem.

IN MY EXPERIENCE

Most of the clients I work with fall asleep during the massage. Athletes are usually physically fatigued, as well as often emotionally fatigued, so it is not surprising that just the act of lying down is enough for them to drift off. What does surprise me is that the qualities of the massage application I am usually using are not necessarily what you would consider "relaxation massage." These clients commonly have acute injuries coupled with chronic patterns of compensation. They sleep through joint movement assessment (passive of course), being moved into a variety of positions, a variety of connective tissue methods, addressing of trigger points, and so forth. Because much of the massage application is an assessment process during which I need feedback from the client, I have learned to get much of the "talk"-based assessment completed at the beginning of the massage. I have also learned to rely on my palpation skills to gather the information I need to choose what methods I will use to make the massage as valuable as possible. The sleeping client is a challenge, but sometimes it is as important to support sleep during the massage and to use massage to support restorative sleep in general.

SUMMARY

This chapter briefly describes the mental and emotional world of the athlete. The role of the sport psychologist is becoming increasingly important. More people are seeking professional assistance with coping and performance, especially in managing stress. Stress is both mental and physical. It is in this area that massage is most beneficial.

The massage therapist must not take on the role of psychologist. Instead, the massage professional provides a skilled and compassionate touch, a nonjudgmental and no-advice-giving presence, and a supportive and quiet experience.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1 How does sport psychology influence physical performance?
2 If a client was asking questions about mental performance to support physical performance, how would you refer him or her to a qualified sport psychologist?
3 Based on physiologic outcomes, what methods of relaxation and meditation would create similar effects as massage?
4 A client indicates that she feels “in the zone” after massage. She also expresses concern that during skating she has a hard time finding “the zone.” How might the massage therapist help her understand the zone experience?
5 A client has experienced a serious knee injury requiring surgical repair and a long, involved rehabilitation program. How and when would you approach a referral to a sport physiologist?
6 Write a case study (fictional or real) about the circumstances that would indicate that a client needs a referral to help with mental and emotional coping.

Example: A 29-year-old golfer has played in eight tournaments and he hasn’t made the cut (got into the final money-making rounds). He is not sleeping and has been experiencing headaches and an “upset stomach.”

7 Provide an example of a behavior that might be displayed for each of the five stages of response to injury.

Example: Denial—Client continues to run daily even though his repeatedly sprained ankle is painful and he is limping

8 Using the case study you wrote about in Question 6 and the approach used by sport psychologists, identify at least three methods that would be appropriate for helping this client.

Examples: visualization, hypnosis, progressive relaxation

9 A client indicates during the massage that even though he is sleeping 7 hours at night and taking a short nap in the afternoon, he is still tired. What questions would you ask the client to obtain more specific information?

Example: Are you having trouble falling asleep or staying asleep?

10 Develop a self-help handout to give clients to support restorative sleep.
11 Again, using the case study from Question 6, develop a massage treatment plan that would complement the treatment of a sport psychologist.

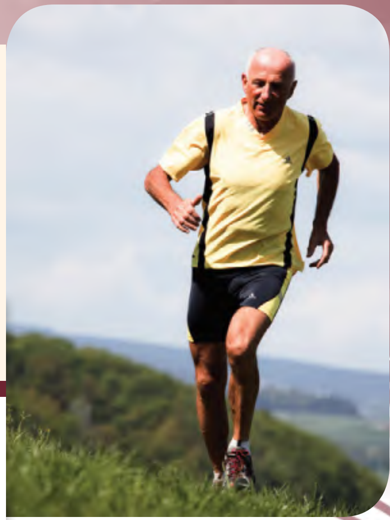
Example: parasympathetic dominance, deep pressure, nonspecific massage with attention to breathing function

UNIT TWO

Sports Massage: Theory and Application

CHAPTER

9 Indications and Cautions



OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1. List the general indications for massage.
2. Describe illness and injury and how they predispose a client to contraindication or caution for massage application.
3. Evaluate various medications for indications/cautions for massage.
4. Identify and avoid endangerment sites.

KEY TERMS

Acute Inflammation
Anxiety and Depressive Disorders
Athlete's Foot
Boils
Deep Vein Thrombosis
Diabetes
Endangerment Sites
Folliculitis
General Contraindications/Cautions
Hemophilia
Herpes Simplex Virus
Inflammation
Lymphangitis
Melanoma
Myositis Ossificans
Nerve Compression
Nerve Entrapment
Pain and Fatigue Syndromes
Pain Threshold
Pain Tolerance
Post-traumatic Stress Disorder
Regional Contraindications
Ringworm
Somatic Pain
Therapeutic Inflammation
Tumors
Varicose Veins
Visceral Pain

OUTLINE

Massage can be very beneficial for athletes and those involved in physical performance activity such as dance, if the professional performing the massage understands the multidimensional aspects of the client's experience. If not, massage can impair optimal function of the performance. Because of the intense physical activity involved in sports, an athlete may be prone to injury. The massage therapist often works with clients from many different sport or fitness activities. Physical rehabilitation programs are also varied. The author of this text owns just about every sport for dummies and idiot's guide to various sport performance books. I often use these types of books to help me understand various sport activities and to determine indications and benefits of massage. Unit I discusses the basic movement functions an athlete uses to accomplish a sport-specific task. Massage is beneficial, is used to allow the body to complete these movements, and can manage compensation patterns that result from repetitive movement.

Because therapeutic massage has widespread effects on the physiologic functions of the body, it is the massage professional's responsibility, when applying massage techniques, to have knowledge of pathology, contraindications, and endangerment sites. It is difficult to obtain a consensus on such information, however, because not all sources agree.

INDICATIONS FOR MASSAGE

Objective

1. List the general indications for massage.

Normal physiologic mechanisms inhibit the tendency to function at the body's anatomic and physiologic limits. We usually do not run as fast as we can, work as long as we can, or exert all of our energy to complete a task. Instead the body signals fatigue, pain, or strain before the anatomic or physiologic limits are reached, and we back off. This very important protective mechanism allows us to live within a healthy range of energy expenditure while maintaining functioning energy reserves in case of emergency or extraordinary demand. This is not necessarily the case for athletes, who often strive to exceed normal physical and mental functioning.

Dysfunction occurs when energy reserves run low because restorative mechanisms are not able to function effectively, or when the body begins to limit function in an attempt to maintain higher energy reserves.

If a person plays tennis and overstretches the shoulder reaching for the serve, the body senses danger of harm to the joint. Neurologic sensors may reset muscle patterns, limiting range of motion slightly to prevent this from happening again. Physiologically, protective space has been created even though range of motion has been sacrificed. If this continues, eventually the limited range of motion interferes with the ability to play tennis. Dysfunction occurs. If perpetuated and compensated for over time, pathology usually develops. The person could end up with a frozen shoulder or tendonitis.

Massage intervention just after the first event, coupled with a more conservative playing style or improved playing form, might reverse the process, and dysfunction would not develop. Intervention applied at the point at which range-of-motion limits are first observed would likely still be effective in reversing the dysfunctional process. Interventions introduced after pathology has begun are more complex, sometimes aggressive, and occasionally too late to support repair and restoration of function. Also, it may take longer before benefits are noticed.

Massage can support the restorative process to help athletes maintain peak performance for extended periods. The benefits of massage are most effectively focused on assisting people to stay within the healthy range of physical functioning and supporting those who wish to achieve fitness.

Illness occurs when a body process breaks down. A person whose immune system did not effectively fight off a cold virus becomes ill with a cold. A person with diabetes is ill. Chronic fatigue syndrome, ulcers, cancer, and multiple sclerosis are all examples of illness.

Injury occurs when tissue is damaged. Cuts, bruises, burns, contusions, fractured bones, sprains, and strains are examples of injuries.

Illness tends to indicate general cautions and contraindications, whereas injury more often indicates regional cautions and contraindications.

Therapeutic massage is indicated for both illness and injury. Massage techniques for illness involve very general application of massage to support the body's healing responses (e.g., stress management, pain control, restorative sleep). This approach to massage, sometimes called *general constitutional application,* is more reflexive in nature and is used to reduce the stress load so that the body can heal. (See Unit Three for specific massage interventions for illness and sport injury.)

Massage for injury incorporates aspects of general constitutional massage because healing is necessary for tissue repair. The more mechanical application of lymphatic drainage is used to control edema. Gliding methods are used to approximate (bring close together) the ends of some types of injured tissue, as in minor muscle tears and sprains. Hyperstimulation analgesia and counterirritation reduce acute pain. Methods to increase circulation to the area support tissue formation. Connective tissue applications are used to manage scar tissue formation. Inflammation is a factor in both illness and injury because healing in both cases involves appropriate activation of the inflammatory response system.

Healing an injury is taxing on the body and strains the restorative mechanism. If an injured person is not in a state of health to begin with, it is common for the stress of the injury to compromise the immune system, and the person then becomes susceptible to illness.

Because many diseases and injuries have similar symptoms, it is difficult to determine the specific underlying causes of pathology. The massage professional must refer clients to qualified, licensed health care providers for a specific diagnosis.

In general, massage is indicated for

- Relaxation and pleasure
- Anxiety reduction
- Mild depression management
- Effective digestion and elimination
- Efficient circulation of body fluids
- Enhanced growth, development, and regeneration of injured tissue
- Enhanced immune function
- Exercise recovery and performance
- Inflammation management
- Mood management
- Nerve impingement syndrome
- Pain management
- Soft tissue dysfunction

The following areas of effect are especially beneficial for the population targeted in this textbook.

INFLAMMATION

Therapeutic massage seems to be beneficial in cases of prolonged inflammation. Possible theories regarding this include the following:

1. Stimulation from massage activates release of the body's own antiinflammatory agents.
2. Certain types of massage promote the inflammatory process (**therapeutic inflammation**) to a small degree, triggering the body to complete the process.
3. Massage may facilitate dilution and removal of the irritant by increasing lymphatic flow.

The processes of **inflammation** trigger tissue repair. Tissue repair is the replacement of dead cells with living cells. In the type of tissue repair called *regeneration,* the new cells are similar to those they replace. In another type of tissue repair called *replacement,* the new cells are formed from connective tissue and are different from those they replace, resulting in a scar. Often fibrous connective tissue replaces damaged tissue. Most tissue repairs are a combination of regeneration and replacement. A goal of the healing process is to promote regeneration and keep replacement to a minimum. Massage has been shown to slow the formation of scar tissue and to keep scar tissue pliable when it does form (Table 9-1).

Because the inflammatory response is part of the healing process, the deliberate creation of inflammation theoretically can generate or "jump start" healing mechanisms. Certain methods of massage are used to create a controlled, localized area of therapeutic inflammation. Deep frictioning techniques and connective tissue stretching methods are the most common approaches. The evidence is suspect, and currently research does not support the method, but historically friction has been clinically effective if used with caution.

Benefit derived from the use of therapeutic inflammation depends on the body's ability to generate healing processes. If healing mechanisms are suppressed, methods that create therapeutic inflammation should not be used. For example, therapeutic inflammation is not used in situations in which sleep disturbance, compromised immune function, a high stress load, or systemic or localized inflammation is already present. This method is also contraindicated if any condition that consists of impaired repair and restorative functions is present, unless application is carefully supervised as part of a total treatment program. Training and competing athletes may not have enough adaptive capacity to resolve inflammation, so caution is advised when considering using methods to create inflammation.

Client use of antiinflammatory medications is another factor that must be considered. If a person is taking such medication–steroidal or nonsteroidal–the effectiveness of therapeutic inflammation is negated or reduced, and restoration mechanisms are inhibited. When these medications are used, any methods that create inflammation are to be avoided (Table 9-2).

PAIN

The massage professional especially needs to understand the mechanisms of pain. Pain receptors are found in almost every tissue of the body and may respond to any type of stimulus. When stimuli for other sensations, such as touch, pressure, heat, and cold, reach a certain intensity, they stimulate the sensation of pain as well. Injured tissue may release prostaglandins, making peripheral nociceptors more sensitive to the normal pain response (hyperalgesia). Aspirin and other nonsteroidal antiinflammatory drugs (NSAIDs) inhibit the action of prostaglandins and reduce pain.

Excessive stimulation of a sensory organ causes pain. Additional stimuli for pain receptors include excessive distention or dilation of a structure (typically fluid pressure), prolonged muscular contractions, muscle spasms, inadequate blood flow to tissues, and the presence of certain chemical substances. Because of their sensitivity to all stimuli, pain receptors perform a protective function by identifying changes that may endanger the body.

The point at which a stimulus is perceived as painful is called the **pain threshold**. This varies somewhat from individual to individual. One factor affecting the pain threshold is *perceptual dominance,* in which the pain felt in one area of the body diminishes or obliterates the pain felt in another area. Not until the most severe pain is diminished does the person perceive or acknowledge the other pain. This mechanism is often activated with massage application that produces a "good hurt" and creates hyperstimulation analgesia and counterirritation.

Pain tolerance refers to the duration or intensity of pain that a person endures before acknowledging the pain and seeking relief. Unlike the pain threshold, pain tolerance is likely to vary from one individual to another. A person's tolerance to pain is influenced by a variety of factors, including personality type, psychological state at the onset of pain, previous experiences, sociocultural background, and the meaning of the pain for that person (e.g., the ways in which it affects the person's lifestyle). Factors that decrease pain tolerance include repeated exposure to pain, fatigue, sleep deprivation, and stress. Warmth, cold, distraction, alcohol consumption, hypnosis, and strong religious beliefs or faith all act to increase pain tolerance.

The origins of pain can be divided into two types: somatic and visceral. **Somatic pain** arises from stimulation of receptors in the skin (superficial somatic pain) or from stimulation of receptors in skeletal muscles, joints, tendons, and fascia (deep somatic pain). **Visceral pain** results from stimulation of receptors in the viscera (internal organs).

Pain is usually classified as acute, chronic, intractable, phantom, or referred.

Evaluation and Management of Pain

Because pain is a primary indicator in many disease processes, the massage practitioner must have a basic

TABLE 9-1 Stages of Tissue Healing and Massage Interventions

	Stage 1 (Acute): Inflammatory Reaction	Stage 2 (Subacute): Repair and Healing	Stage 3 (Chronic): Maturation and Remodeling
Characteristics	Vascular changes Inflammatory exudate Clot formation Phagocytosis, neutralization of irritants Early fibroblastic activity	Growth of capillary beds into area Collagen formation Granulation tissue Fragile, easily injured tissue	Maturation and remodeling of scar Contracture of scar tissue Alignment of collagen along lines of stress forces (tensegrity)
Clinical signs	Inflammation Pain before tissue resistance	Decreased inflammation Pain during tissue resistance	Absence of inflammation Pain after tissue resistance
Massage intervention	(3 to 7 days after injury) Main goal: Protection Control and support effects of inflammation PRICE treatment (protection, rest, ice, compression, and elevation) Promote healing and prevent compensation patterns Passive movement midrange General massage and lymphatic drainage with caution Support for rest with full-body massage	(14 to 21 days after injury) Main goal: Controlled motion Promote development of mobile scar Cautious and controlled soft tissue mobilization of scar tissue along fiber direction toward injury Active and passive, open and closed-chain range of motion (midrange) Support for healing with full-body massage	(3 to 12 months after injury) Main goal: Return to function Increase strength and alignment of scar tissue Cross-fiber friction of scar tissue coupled with directional stroking along lines of tension away from injury Progressive stretching and active and resisted range of motion (full range) Support for rehabilitation activities with full-body massage

MASSAGE APPROACH DURING HEALING

Acute Phase
- Manage pain.
- Support sleep.

Subacute Phase (Early)
- Manage pain.
- Support sleep.
- Manage edema.
- Manage compensation patterns.

Subacute Phase (Later)
- Manage pain.
- Support sleep.
- Manage edema.
- Manage compensation patterns.
- Support rehabilitative activity.
- Support mobile scar development.
- Support tissue regeneration process.

Remodeling Phase
- Support rehabilitation activity.
- Encourage appropriate scar tissue development.
- Manage adhesions.
- Restore firing patterns, gait reflexes, and neuromuscular responses.
- Eliminate reversible compensation patterns.
- Manage irreversible compensation patterns.
- Restore tissue pliability.

evaluation protocol for pain to refer his or her clients to the appropriate health care provider. The following guidelines for evaluating pain will help in this process.

Pain has many characteristics. Location, for example, can be divided into four categories:
1. Localized pain is pain confined to the site of origin.
2. Projected pain is typically a result of proximal nerve compression. This pain is perceived in the tissue supplied by the nerve.
3. Radiating pain is diffuse pain, which is not well localized, around the site of origin.
4. Referred pain is felt in an area distant from the site of the painful stimulus.

Pain can be divided into five types:
1. **Pricking or bright pain:** This type of pain is experienced when the skin is cut or jabbed with a sharp object. It is short-lived but intense and is easily localized.
2. **Burning pain:** This type is slower to develop, lasts longer, and is less accurately localized. It is experienced when the skin is burned or inflammation is present. It often stimulates cardiac and respiratory activity.

TABLE 9-2 Disorders Related to Chronic Inflammation*

Disorder	Mechanism
Allergy	Mediators induce autoimmune reactions.
Alzheimer's disease	Chronic inflammation destroys brain cells.
Anemia	Mediators attack erythropoietin production.
Aortic valve stenosis	Chronic inflammation damages heart valves.
Arthritis	Inflammatory mediators destroy joint cartilage and synovial fluid.
Asthma	Mediators close the airways.
Cancer	Chronic inflammation causes most cancers.
Congestive heart failure	Chronic inflammation causes heart muscle wasting.
Fibromyalgia	Mediators are elevated in fibromyalgia patients.
Fibrosis	Mediators attack traumatized tissue.
Heart attack	Chronic inflammation contributes to coronary atherosclerosis.
Kidney failure	Mediators restrict circulation and damage nephrons.
Lupus	Mediators induce an autoimmune attack.
Pancreatitis	Mediators induce pancreatic cell injury.
Psoriasis	Mediators induce dermatitis.
Stroke	Chronic inflammation promotes thromboembolic events.
Surgical complications	Mediators prevent healing.

*Seemingly unrelated disorders often have a common link—inflammation. This is a partial list of common medical problems associated with chronic inflammation.
From Fritz S: *Mosby's fundamentals of therapeutic massage*, ed 3, St Louis, 2004, Mosby.

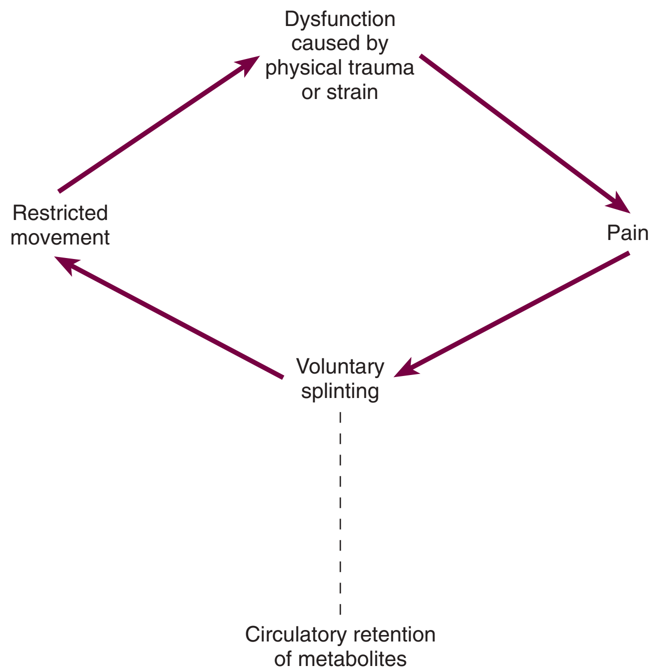


FIGURE 9-1 Pain-spasm-pain cycle. (From Fritz S: *Mosby's fundamentals of therapeutic massage*, ed 5, St Louis, 2013, Mosby.)

3. **Aching pain:** Aching pain occurs when the visceral organs are stimulated. It is constant, is not well localized, and is often referred to areas of the body far from which the damage is occurring. This type of pain is important because it may be a sign of a life-threatening disorder of a vital organ.
4. **Deep pain:** The main difference between superficial and deep sensibility is the different nature of the pain evoked by noxious stimuli. Unlike superficial pain, deep pain is poorly localized, nauseating, and frequently associated with sweating and changes in blood pressure. Deep pain can be elicited experimentally in the periosteum and ligaments by injecting them with hypertonic saline. Pain produced in this fashion initiates reflex contraction of nearby skeletal muscles. This reflex contraction is similar to the muscle spasm associated with injuries to bones, tendons, and joints. The steadily contracting muscles become ischemic, and ischemia stimulates pain receptors in the muscles. The resultant pain, in turn, initiates more spasms, creating a vicious cycle called the *pain-spasm-pain cycle* (Figure 9-1).
5. **Muscle pain:** If a muscle contracts rhythmically in the presence of an adequate blood supply, pain does not usually result. However, if the blood supply to a muscle is occluded (closed off), contraction soon causes pain. Pain persists after the contraction until blood flow is reestablished. If a muscle with a normal blood supply is made to contract continuously without periods of relaxation, it begins to ache because the maintained contraction compresses the blood vessels supplying the muscle.

Nonverbal behaviors such as facial grimacing, flinching, tearing, abnormal gait or posture, muscle tension, and guarding of the body are common indicators of pain. Verbal and emotional signals indicating pain may include crying, moaning, groaning, irritability, sadness, and changes in voice tone.

Pain scales, such as a 1 to 10 scale, or a mild, moderate, and severe scale, are helpful for measuring pain perception. Only the client can determine the degree of severity. Pain is rarely the same at all times. It is felt (perceived) differently over time and differs with various precipitating and aggravating factors. Pain can range from excruciating to mild and may be difficult for the client to verbalize.

Many ways may be used to alleviate pain. The massage professional, as part of a health care team, can contribute valuable manual therapy in various pain conditions using direct tissue manipulation and reflex stimulation of the nervous system and the circulation. As a therapeutic intervention, massage may help reduce the need for pain medication, thus reducing the side effects of medication.

All medications, including over-the-counter products available without a prescription, have side effects. Obviously, with clients in extreme pain, massage therapy must be monitored by a physician or other appropriate health care professional. Most people experience pain in less severe forms occasionally throughout life. Massage may provide temporary symptomatic relief of moderate pain brought on by daily stress, replacing over-the-counter pain medications or reducing their use.

Acute pain and chronic pain are managed somewhat differently; therefore, it is important to make the distinction between the two. Intervention for acute pain is less invasive and focuses on supporting a current healing process. Chronic pain is managed with symptom relief or through a more aggressive rehabilitation approach that incorporates a therapeutic change process.

IMPINGEMENT SYNDROMES

The two types of nerve impingement syndromes are compression and entrapment. **Nerve compression** is pressure on a nerve by a bony structure; **nerve entrapment** is pressure on a nerve from soft tissue. Massage is beneficial for entrapment and can manage some symptoms of nerve compression, even though the direct causal factor is not addressed.

Cervical Plexus

If the cervical plexus is being impinged, the person experiences headaches, neck pain, and breathing difficulties. The muscles most responsible for pressure on the cervical plexus are the suboccipital and sternocleidomastoid muscles. Shortened connective tissues at the cranial base will also press on these nerves.

The cervical plexus is formed by the ventral rami of the upper four cervical nerves. The phrenic nerve is part of this plexus. It innervates the diaphragm, and any disruption to this nerve affects breathing. Many cutaneous (skin) branches of the cervical plexus transmit sensory impulses from the skin of the neck, ear, and shoulder. Motor branches innervate muscles of the anterior neck.

Brachial Plexus

The brachial plexus, situated partly in the neck and partly in the axilla, provides virtually all the nerves that innervate the upper limbs. Any imbalance that causes pressure on this complex of nerves results in pain in the shoulder, chest, arm, wrist, and hand.

The muscles most often responsible for impingement of the brachial plexus are the scalenes, pectoralis minor, and subclavius. Muscles of the arm occasionally impinge branches of the brachial plexus. Brachial plexus nerve impingement is responsible for thoracic outlet symptoms, which often are misdiagnosed as carpal tunnel syndrome. Whiplash injury involves the brachial plexus.

Lumbar Plexus

Lumbar plexus nerve impingement may give rise to low back discomfort with a belt distribution of pain, as well as pain in the lower abdomen, genitals, thigh, and medial lower leg. The main muscles that impinge on the lumbar plexus are the quadratus lumborum and the psoas. Shortening of the lumbar dorsal fascia exaggerates a lordosis and causes vertebral impingement of the lumbar plexus.

Sacral Plexus

The sacral plexus has approximately a dozen named branches. Almost half of these serve the buttocks and lower limbs; the others innervate pelvic structures. The main branch is the sciatic nerve. Impingement of this nerve by the piriformis muscle gives rise to sciatica.

Ligaments that stabilize the sacroiliac joint can affect the sacral plexus. Pressure on the sacral plexus can cause gluteal pain, leg pain, genital pain, and foot pain.

Massage methods can soften and stretch connective tissues that may impinge nerves, as well as normalize muscle tension patterns, restoring a more normal resting length to shortened muscles, thereby reducing pressure on nerves.

PSYCHOLOGICAL DYSFUNCTIONS

Science has validated the body/mind link in terms of health and disease. Many risk factors for the development of physical (body) pathology are mentally (mind) influenced, such as stress level and lifestyle choices. The same is true for mental health and pathology. The physical state of an individual has a strong influence on mental functioning. Usually when people feel well physically, they also feel well mentally; the reverse, too, is often the case–feeling bad mentally results in physical dysfunctions. Neurochemicals such as serotonin and dopamine exert strong influence on a person's mental state.

The major mental health dysfunctions affecting Western society are post-traumatic stress disorder and other stress-related illnesses, as well as pain and fatigue syndromes coupled with anxiety and depression. If a person is involved in athletic competition or a rehabilitation program, it is safe to assume that there has been strain on the mind/body connection.

Trauma is defined as follows:

- Physical injury caused by violent or disruptive action or by a toxic substance
- Psychic injury resulting from a severe emotional shock–short-term or long-term

Post-traumatic stress disorder, as defined by the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV),* includes flashback memory experiences, state-dependent memory, somatization, anxiety, irritability, sleep disturbance, concentration difficulties, times of melancholy or depression, grief, fear, worry, anger, and avoidance behavior. Post-traumatic stress disorder can have long-term effects and often occurs after athletic injury.

Pain and fatigue syndromes are defined as multicausal, often chronic nonproductive patterns that interfere with well-being, activities of daily living, and productivity. Current conditions in this category include fibromyalgia, chronic fatigue syndrome, Epstein-Barr viral infection, sympathetic reflex dystrophy, headache, arthritis, chronic cancer pain, neuropathy, low back syndrome, idiopathic pain, somatization disorder, and intractable pain syndrome. Acute pain can be a factor, as can acute "episodes" of chronic conditions.

Anxiety and depressive disorders are common. Anxiety is an uneasy feeling that is usually connected with increased sympathetic arousal responses. Depression is characterized by decreased vital functional activity and mood disturbances of exaggerated emptiness, hopelessness, and melancholy, or unbridled periods of high energy with no purpose or outcome.

It is common to see **anxiety and depressive disorders** in conjunction with pain and fatigue syndromes. Panic behavior, phobias, and a sense of impending doom, along with feelings of being overwhelmed and hopelessness, are common with these disorders. Mood swings, breathing pattern disorder, sleep disturbance, concentration difficulties, memory disturbances, outbursts of anger, fatigue, and changes in habits of daily living, appetite, and activity levels are symptoms of these disorders.

Stress-Related Illness

Stress-related illness is defined as an increased stress load or a reduced ability to adapt that depletes the reserve capacity of individuals, increasing their vulnerability to health problems. Stress-related illness can encompass the previously mentioned conditions as the primary cause of dysfunction or as the result of the stress of the dysfunction. Excessive stress sometimes manifests as cardiovascular problems, including hypertension; digestive difficulties, including heartburn, ulcer, and bowel syndromes; respiratory illness and susceptibility to bacterial and viral infection; endocrine dysfunction, particularly adrenal and thyroid dysfunction and delayed or reduced cellular repair; sleep disorders; and breathing pattern disorder, just to mention a few conditions. Clients, especially those with injury, should be carefully monitored for signs of psychological dysfunction (see Chapter 8).

Indications for Massage

Massage intervention has a strong physiologic effect through the comfort of compassionate touch, as well as a physical influence on mental state through its effect on the autonomic nervous system (ANS) and on neurochemicals.

Those experiencing mental health problems, therefore, may derive benefits from massage. Management of pain is an important factor in the athletic community and for those in rehabilitation programs. Because therapeutic massage often can offer symptomatic relief from chronic pain, the helplessness that accompanies these difficulties may dissipate as the person realizes that management methods exist. Soothing of ANS hyperactivity or hypoactivity provides a sense of inner balance. Normalization of the breathing mechanism allows the client to breathe without restriction and can reduce the tendency toward breathing pattern disorder, which feeds anxiety and panic.

Therapeutic massage can provide intervention on a physical level to restore more normal function to the body, which supports appropriate interventions by qualified mental health professionals. Certainly strong and appropriate indications exist for the use of massage therapy in the restoration of mental health, but caution is indicated in terms of establishment of dual roles and boundary difficulties. It is very important in these situations to work in conjunction with mental health providers such as sport psychologists.

IN MY EXPERIENCE

I worked over the years with many athletes who had the cluster effect of pain and anxiety coupled with depression and fatigue. I remember one player especially, who was playing extremely well but with a team that was struggling. As a result, all of his accomplishments were ignored. He became discouraged but continued to perform well. Over time, he developed intestinal irritation and headaches. The next year, he transferred to a different school, whose team performed well. The player's symptoms disappeared, he thrived, and he currently plays in a professional league. Massage for this young man was a method of symptom relief when the situation was unable to be changed.

SLEEP SUPPORT

Sleep interruption has many causes, including pain that repeatedly wakes the person, external random noise (such as traffic noise), tending to infants and children, varied work schedules, a restless or snoring bed partner, sinus or other respiratory difficulties such as coughing, and urinary frequency. The list is endless. Regardless of the perpetuating factors, sleep is compromised and the stage of deep sleep is seldom achieved.

Sleep patterns may also be disrupted because of insomnia, snoring, sleep apnea, hormone fluctuations, high cortisol (stress hormone) levels, medications, and stimulants such as caffeine. Stimulant use, especially caffeine, is common in the sports world. Again, quality sleep is sacrificed. Travel across time zones also interferes with sleep.

Light/dark cycles regulate sleep patterns. For effective sleep, we need adequate exposure to daylight, which stimulates serotonin. We also need adequate exposure to darkness. With the advent of artificial lighting, we spend less and less time in the dark, and this disturbs sleep patterns. Absence of light supports release of melatonin, a pineal gland hormone that is involved in the sleep pattern.

During sleep, the body renews, repairs, and generally restores itself. Growth hormone is an important factor in this process, with more than half of its daily secretions taking place during sleep. If the deeper stages of sleep are not sustained, the body's restorative mechanisms are compromised. Sleep disturbances are a major factor in many chronic pain and fatigue syndromes, diminished athletic performance, injury predisposition, and delayed recovery. Massage is very effective in supporting restorative sleep.

CAUTIONS FOR MASSAGE

Objective

2. Describe illness and injury and how they predispose a client to contraindication or caution for massage application.

Terminology is confusing in attempts to describe when massage may be harmful. A contraindication is any condition that renders a particular line of treatment improper or undesirable, or any symptom or circumstance that indicates the inappropriateness of a form of treatment that is otherwise advisable. This concept can be further divided into the concepts of absolute and relative contraindications. Another description uses general and local contraindications. *Caution* is becoming the more used term. Caution is defined as careful forethought to avoid danger or harm.

Regardless of the language, massage application should do no harm, and the massage therapist needs clinical reasoning skills to assess and adapt massage so that benefit is achieved without harm. A method that is used to indicate the degree of caution involves red flag situations and yellow flag situations. When contraindications/cautions exist and massage is indicated, adjustment of application may be required to apply methods safely. Massage applications should be monitored by a health care professional such as a physician, nurse, physical therapist, athletic trainer, or other qualified personnel when the condition is serious or the ability to perform is critical. In professional team sports, an athletic training department is usually in charge of maintaining health and injury rehabilitation of athletes. Recommendations by personnel of this department are valuable when appropriate massage application is determined. It is most difficult when this type of support is not available, as occurs with amateur team sports or when working with individual athletes such as golfers.

A general recommendation when working with all athletes is to be cautious and to not take risks. The closer to competition, the more important this is.

Conditions that may present contraindications requiring avoidance (red flag, absolute) and cautions resulting in alteration in application (yellow flag, relative) include the following:

- Acute injury
- Systemic infection and acute inflammation
- Contagious conditions
- Loss of sensation
- Loss of voluntary movement
- Acute or severe cardiac, liver, and kidney diseases
- Use of sensation-altering substances–both prescribed, such as pain medication, and recreational, such as alcohol
- Medication that thins blood–both over-the-counter, such as aspirin, and prescribed, such as Coumadin (warfarin)

Contraindications are unique to each client and to each region of the body. The ability to reason clinically is essential for making appropriate decisions about the advisability of, modifications to, or avoidance of massage interventions. It is important to understand when to refer a client for diagnosis and when to obtain assistance in modifying the approach to the massage session so that it will best serve the client. A medical professional must always be consulted if any doubt exists concerning the advisability of therapy. *When in doubt, refer!*

Contraindications and cautions can be separated into regional and general types. **Regional contraindications** are those that relate to a specific area of the body. For our purposes, a regional (or local) contraindication means that massage may be provided but not to the problematic area. However, the client should be referred to a physician, who can make a diagnosis and rule out underlying conditions.

General contraindications/cautions are those that require a physician's evaluation to rule out serious underlying conditions before any massage is applied. If the physician recommends massage, he or she will need to help the massage therapist develop a comprehensive treatment plan with appropriate cautions.

As discussed, massage usually is indicated for musculoskeletal discomfort, circulation enhancement, relaxation, stress reduction, and pain control, as well as in situations in which analgesics, antiinflammatory drugs, muscle relaxants, and blood pressure, antianxiety, and antidepressant medications may be prescribed. Therapeutic massage, appropriately provided, can support the use of these medications and management of some side effects; in mild cases, it may be able to replace them.

The general effects of stress and pain reduction and increased circulation, as well as the physical comfort derived from therapeutic massage, complement most other medical and mental health treatment modalities. However, when other therapies, including medication, are being used, the physician must be able to evaluate accurately the effectiveness of each treatment the client is receiving. If the physician, physical therapist, or athletic trainer is unaware that the client is receiving massage, the effects of other therapies may be misinterpreted.

Clients with any vague or unexplainable symptoms of fatigue, muscle weakness, or general aches and pains should be immediately referred to a physician. Many disease processes share these symptoms. This recommendation may seem overly cautious, but in the early stages of some very serious illnesses, the symptoms are not well defined. If the physician is able to detect a disease process early in its development, a more successful outcome often results. A specific diagnosis is essential for effective treatment. Massage should be avoided in all infectious diseases suggested by fever, nausea, and lethargy until a diagnosis has been made and recommendations from a physician can be followed.

Specific conditions that present contraindications and cautions for athletic and rehabilitation populations are discussed here.

ACUTE LOCAL SOFT TISSUE INFLAMMATION

Acute inflammation can occur in any of the soft tissues, including skin (wounds and blisters), muscles, tendons, ligaments, bursae, synovial capsule, intervertebral discs, and periosteum. Common causal factors are overuse and injury.

Common symptoms of acute inflammation include pain and dysfunction in the affected area, heat and redness, and swelling local to the injury. Frequently, a history of recent trauma is described.

Superficial signs and symptoms are usually easy to identify, but less so with inflammation of the deep tissues, when symptoms may be not visible but only palpable. On palpation, areas of acute inflammation deep in the tissues are harder and denser than surrounding tissue. Focused pressure may cause sharp pain. These symptoms may indicate an acute problem that requires caution in massage application, with a focus on lymphatic drain.

To test for acute inflammation, apply enough pressure to the area to cause mild discomfort. Maintain this fixed pressure for up to 10 seconds. If discomfort increases, this suggests that the tissues are in an acute state; if it decreases, it is safe to apply massage.

BONE AND JOINT INJURIES

These conditions usually are not seen initially by a massage therapist, but if they are, the histories, as well as the symptoms, normally make them obvious. If a fall or impact is involved, a fracture should always be ruled out. (*Note:* With fractures or dislocations of the wrist, fingers, ankles, or toes, symptoms may be less obvious.) Fractures tend to be characterized by pain and tenderness around the injury site with any movement or weight bearing. Stress fractures are very difficult to diagnose. Be especially concerned if the pain persists and is coupled with swelling and bruising in the injured area.

Massage in the acute stage of these conditions is obviously contraindicated because it would cause further damage.

DIABETES

Diabetes can affect the peripheral circulation, especially in the feet, causing the tissues to become brittle and fragile. Diabetes can also affect the nerves and can reduce a person's sensitivity to pressure. Deep massage techniques can damage brittle tissues, and with an impaired pain response, which is common in diabetes, feedback mechanisms may be ineffective.

The stimulating effect of massage on the circulation sometimes seems to be similar to the effect of exercise on circulation affecting the blood sugar level of a diabetic patient. Clients should be made aware of this possibility, so their medication and/or diet can be altered accordingly. Although caution is required, if massage is applied correctly, clients with diabetes can receive much benefit.

FUNGAL INFECTIONS

Ringworm and **athlete's foot,** the most common fungal infections, can affect warm, moist areas, such as between the toes, in the armpits, or under the breast. The affected area may appear red, with white flaky skin. Although massage does not worsen the problem, it can cause irritation, which may be transmitted to the therapist's hands. For these reasons, treatment of the area should be avoided.

BACTERIAL INFECTIONS

Boils are superficial abscesses that appear as localized swellings on the skin, which eventually rupture and discharge pus. **Folliculitis** is a condition in which the hair follicles become inflamed; it appears as a rash of very small blisters. Massage can break the blisters, leaving the skin open to further infection. These areas are regional contraindications.

Lymphangitis

Bacteria can invade the lymphatic system through open wounds, resulting in inflammation of lymphatic vessels, or **lymphangitis**. The local area around the wound, which may itself be very minor, will appear red and swollen. A dark line sometimes can be seen running up the limb toward the affected lymph nodes, which may also be swollen and tender. Massage may cause the infection to spread. Medical treatment is required.

VIRAL INFECTIONS

Herpes simplex virus (HSV) infection is a communicable disease that presently has no cure. Cold sores are a common symptom of HSV infection and usually appear on the face and on or near mucous membranes in that area. These cold sores will recur from time to time. Before they erupt, the skin usually feels hypersensitive and tingling. HSV infection is a regional contraindication.

Other viral infections, such as warts and verrucae, should also be considered regional contraindications because these infections can be transmitted to other parts of the body and to the massage therapist.

MELANOMA (SKIN CANCER)

Skin melanomas are becoming more common, probably because of overexposure of the skin to the sun.

Melanoma appears first as a change in pigmentation of the skin and looks like a large freckle. An increase in size, a change in shape, or bleeding, itching, or tingling causes increased concern. If prompt medical treatment is given, this is an easily treatable condition, but if left untreated, it can be fatal.

MYOSITIS OSSIFICANS

In **myositis ossificans**, a large hematoma, which can occur with a deep bruise that goes untreated for a long time, ossifies, and forms small pieces of bony deposits within the soft tissues. This is more likely to happen when a fracture has been involved because osteoblasts move into the tissues and can be the catalysts for calcification. Massage to the area could cause a piece of bone to damage surrounding soft tissues.

Although this is a rare condition, it should be considered when clients have had a long recovery from a serious fracture or another major impact trauma. Myositis ossificans is a regional contraindication, so avoid the area.

OPEN WOUNDS

The presence of an open wound is the most obvious contraindication; this should be a matter of common sense. However, after a large wound has healed, residual problems may be associated with scar tissue; treatment may include massage (see Unit Three).

TUMORS

Undiagnosed **tumors** should be referred to a medical practitioner. Massage, particularly friction massage, of a tumor may stimulate its development and facilitate its spread to other areas. If the tumor is diagnosed as benign, the tumor area is regionally contraindicated. If the area is malignant, massage application should follow the physician's recommendation.

BLEEDING DISORDERS

Hemophilia is a hereditary disease that prevents the blood from clotting. Several different types and levels of severity of the disease are known. Males are primarily affected. Many people take medication that thins the blood and predisposes them to bleeding.

Anything that could cause trauma to the tissues, on any level, should be avoided. The client's physician will be able to advise regarding what is safe and possible for massage application.

DEEP VEIN THROMBOSIS

A *thrombus* (blood clot) can form in a vein and can become dislodged, or a fragment (embolus) may break off, during the application of massage. When this occurs in one of the deep veins of the lower limbs, the condition is known as **deep vein thrombosis** (DVT). Because the veins get larger as they travel toward the heart, the clot can pass through the chambers of the heart and into the pulmonary circulation. The vessels become smaller as they divide and enter the lungs, and eventually, the clot may block the vessels, possibly occluding an area of the lung. If the clot is large enough, it may block the circulation to a major part of the lung (pulmonary embolism), which can lead to death within minutes.

Factors that may lead to DVT include long periods of immobility or bed rest, which reduces circulation and can compress the veins; recent major surgery; varicose veins, heart disease, and diabetes; use of contraceptive pills; and impact trauma, which may cause damage inside the vein. Although very rare, DVT can occur in seemingly healthy people as the result of other predisposing factors.

Acute pain and hard swelling may be felt when minimal pressure is applied and may be confused with an acute muscle strain. General swelling and discoloration may be noted in the distal part of the limb as the result of restricted circulation. The client may feel more pain and aching in the area when resting than would be expected if it were a muscle strain. There would be no history to suggest such an injury.

If a DVT is suspected, the client should be referred to a physician or hospital immediately.

VARICOSE VEINS

Varicose veins usually occur at the back of the leg. The valves within the veins, which prevent a back flow in the circulation, break down, and stop functioning.

In minor cases, light superficial stroking over the area should do no harm and may in fact ease pressure on the vein and aid repair. Deep pressure and drag should not be applied because further damage to the walls of the blood vessels can occur. In advanced cases, even superficial stroking should be avoided because of the added risk of DVT.

This contraindication relates only to the actual location of the vein. Tissues adjacent to the area can be massaged. This will improve circulation away from the varicose vein and relieve some of the pressure.

MEDICATIONS

Objective

3. Evaluate various medications for indications/cautions for massage.

The massage professional needs to be aware of any medications the client is taking. Massage therapists should have a current drug reference book so that all medications listed on the client information form can be researched. Internet search programs for researching medications are available as well. Also, the client may be able to provide information about each medication being taken.

In general, a medication is prescribed to do one of the following:

- Stimulate a body process
- Inhibit a body process
- Replace a chemical in the body

Therapeutic massage can also stimulate and inhibit body processes. When medication and massage stimulate the same process, the effects are synergistic and the result can be too much stimulation. If medication and massage inhibit the same process, the result is again synergistic, but this time too much inhibition is present. If medication stimulates an effect and massage inhibits the same effect, massage can be antagonistic to the medication.

Although massage seldom interacts substantially with a medication that replaces a body chemical, it is important to be aware of possible synergistic or inhibitory effects.

Massage often can be used to manage undesirable side effects of medications. In particular, medications that stimulate sympathetic ANS function can cause uncomfortable side effects such as digestive upset, anxiety and restlessness, and sleep disruption. The mild inhibitory effects of massage resulting from stimulation of parasympathetic activity can sometimes provide short-term relief from the undesirable effects of a medication without interfering with its desired action. Caution is required, and close monitoring by the primary care physician is necessary.

The massage professional should be able to assess the effects of medications and should be aware of the ways that massage may influence these effects. Massage practitioners need to be specifically knowledgeable about antiinflammatory drugs, muscle relaxants, anticoagulants (blood thinners), analgesics (pain modulators), and other medications that alter sensation, muscle tone, standard

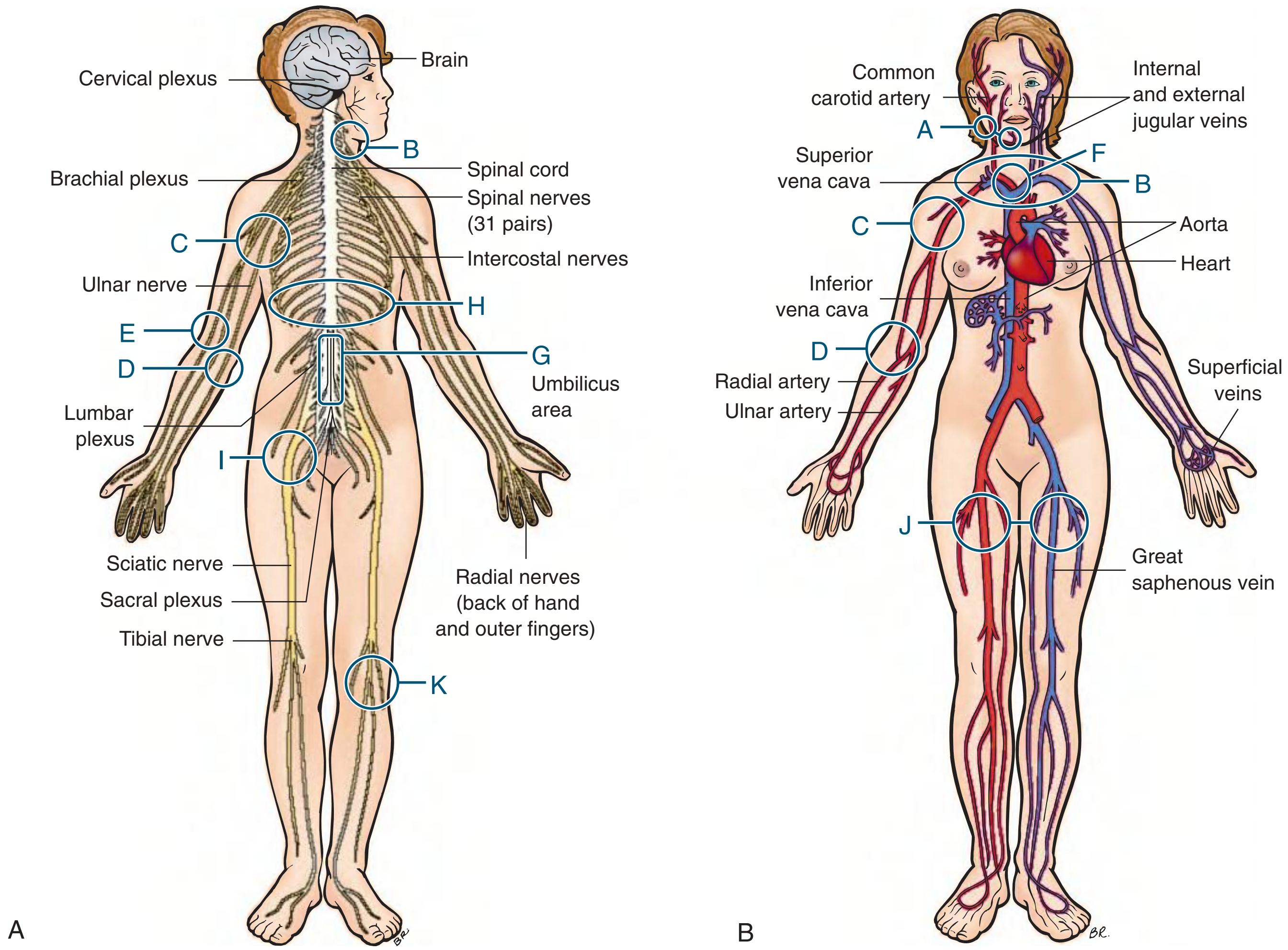


FIGURE 9-2 Endangerment sites of the nervous system **(A)** and the cardiovascular system **(B)**. *A,* Anterior triangle of the neck (carotid artery, jugular vein, and vagus nerve), which is located deep to the sternocleidomastoid. *B,* Posterior triangle of the neck, specifically, the nerves of the brachial plexus, the brachiocephalic artery and vein superior to the clavicle, and the subclavian arteries and vein. *C,* Axillary area—brachial artery, axillary vein and artery, cephalic vein, and nerves of the brachial plexus. *D,* Medial epicondyle of the humerus—the ulnar nerve; also the radial and ulnar arteries. *E,* Lateral epicondyle—the radial nerve. *F,* Area of the sternal notch and anterior throat—nerves and vessels to the thyroid gland and the vagus nerve. *G,* Umbilicus area—to either side; descending aorta and abdominal aorta. *H,* Twelfth rib, dorsal body—location of the kidney. *I,* Sciatic notch—sciatic nerve (the sciatic nerve passes out of the pelvis through the greater sciatic foramen, under cover of the piriformis muscle). *J,* Inguinal triangle located lateral and inferior to the pubis—medial to the sartorius, external iliac artery, femoral artery, great saphenous vein, femoral vein, and femoral nerve. *K,* Popliteal fossa—popliteal artery and vein and tibial nerve. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

reflex reactions, cardiovascular function, kidney and liver function, and personality. They also should be aware of the effects of over-the-counter medications, herbs, and vitamins. If a client is taking medication, it is important to have the client's physician confirm the advisability of therapeutic massage.

Refer to the Evolve website accompanying this book for a list of common medications and possible interactions with massage.

ENDANGERMENT SITES

Objective

4. Identify and avoid endangerment sites.

Endangerment sites are areas in which nerves and blood vessels surface, are close to the skin, and are not well protected by muscle or connective tissue. Consequently, deep, sustained pressure into these areas could damage the vessels and nerves. Areas containing fragile bony projections that could be broken off are also considered endangerment sites. The kidney area is considered an endangerment site because the kidneys are loosely suspended in fat and connective tissue. Heavy pounding is contraindicated in this area.

When the massage therapist is working over an endangerment site, avoidance or light pressure is indicated to prevent damage. The areas shown in Figure 9-2 show commonly considered endangerment sites.

Other endangerment sites include the following:

- Eyes
- Inferior to the ear–fascial nerve, styloid process, external carotid artery
- Posterior cervical area (spinous processes, cervical plexus)
- Lymph nodes
- Medial brachium–between biceps and triceps
- Musculocutaneous, median, and ulnar nerves
- Brachial artery
- Basilic vein
- Cubital (anterior) area of the median nerve, radial and ulnar arteries, and median cubital vein
- Area of application of lateral pressure to the knees

SUMMARY

Massage is a valuable treatment for most conditions, ranging from stress to severe illness and injury. However, it must be applied intelligently, based on the current condition of the client. Competing athletes usually seem to have a bang, bruise, blister, sprain, strain, or wound, and regional avoidance or altered massage application is necessary. Persons in physical rehabilitation are in the program because of some illness or injury, so contraindications and cautions are part of working with this population. It is important to not assume that minor symptoms equate to minor causes. Nothing is lost by being cautious. Just make sure that during referral, the communication approach does not scare the client, and do not overstep the scope of practice by diagnosing.

The statement I often use is, "I need to have these things ruled out by the doctor or trainer so the massage can be given without undue restriction. If I don't know what it is, I have to be extra cautious, so let's just eliminate these possibilities and proceed from there."

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1 List situation(s) in which massage is indicated that you feel you will most often encounter. Refer back to Chapter 9 and describe the physiologic mechanism of benefit for massage application.
2 What cautions are necessary when a client has diabetes?
3 Develop a checklist for screening for contraindications, including cautions related to medication and supplements.
4 Why are endangerment sites considered points for caution during massage?
5 Develop a position statement on the value of massage for performance fitness and rehabilitation based on the indications discussed in this chapter.

CHAPTER

10 Assessment for Sports Massage and Physical Rehabilitation Application

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1. Describe assessment for the sport and fitness population.
2. Apply a clinical reasoning process to treatment plan development.
3. Develop outcome goals that are quantifiable and qualifiable.
4. Adapt charting methods to the athletic population.
5. Complete a comprehensive history.
6. Complete a comprehensive physical assessment.
7. Perform postural assessment.
8. Perform basic orthopedic tests to assess for joint injury.
9. Analyze movement assessment findings.
10. Perform muscle strength assessment.
11. Describe and assess kinetic chain function.
12. Perform gait assessment.
13. Perform palpation assessment.
14. Integrate clinical reasoning into the treatment plan using assessment findings.
15. Relate assessment data to first-degree, second-degree, and third-degree dysfunction, and categorize the adaptation response to stage 1, 2, or 3 pathology.
16. Integrate ongoing assessment data channeled into appropriate massage treatment strategies.

KEY TERMS

Active Movements
Assessment
Charting
Clinical Reasoning
Connective Tissue Changes
End-Feel
First-Degree, Second-Degree, and Third-Degree Distortion in Functioning
Functional Stress
Functional Tension
Gait Assessment
History
Kinetic Chain
Limits to Joint Movement
Microtrauma
Muscle Firing Pattern
Muscle Strength Testing
Outcome Goals
Palpation Assessment
Phasic (Mover) Muscles
Physical Assessment
Postural (Stabilizer) Muscles
Posture
Range of Motion (ROM)

OUTLINE

ASSESSMENT

Objective

1. Describe assessment for the sport and fitness population.

The massage therapist working with athletes, physical rehabilitation, and those involved with fitness has an expanded assessment responsibility. **Assessment** identifies the structures that need to be worked with, creates a clear intention about treatment goals, provides a baseline of objective information to measure the effectiveness of the treatment, and helps identify conditions that are contraindicated. When working with a client who is striving for optimal performance or who has pain, dysfunction, or disability, the massage therapist needs to gather information about both long-term and short-term treatment goals and relevant data about activities and training activity, as well as about pain or decreased function.

Information from the athletic trainer, coaches, or other professionals is important. The massage therapist must understand and apply assessment information provided by the trainer. If at any time you do not understand, ask clarifying questions. Information gathered by the massage therapist should be shared with the athletic trainer or other appropriate member of the sport and/or medical team in a concise and intelligent manner.

A massage treatment plan based on efficient biomechanical movement should focus on reestablishing or supporting effective movement patterns. Biomechanically efficient movement is smooth, bilaterally symmetric, and coordinated, with easy, effortless use of the body. Functional assessment measures the efficiency of coordinated movement. During assessment, noticeable variations need to be considered.

Once the treatment plan has been determined, the massage therapist needs to develop strategies for achieving the goals pertaining to the therapeutic massage. Teamwork is essential, with cooperation and consensus among the various professionals attending to the client. It is important for the massage therapist to maintain an appropriate scope of practice and not infringe on the professional responsibilities and expertise of others.

CLINICAL REASONING PROCESS

Objective

2. Apply a clinical reasoning process to treatment plan development.

As the volume of knowledge pertaining to massage increases, and as soft tissue modalities such as massage are integrated into the areas of sport fitness and physical rehabilitation, it is becoming increasingly important to be able to think or reason through an intervention process and justify its effectiveness. Therapeutic massage practitioners must be able to gather information effectively, analyze that information to make decisions about the type and appropriateness of an intervention, and evaluate and justify the benefits derived from the intervention.

Effective assessment, analysis, and decision making are essential in meeting the needs of each client. Routine or a recipe-type application of therapeutic massage does not work for this population because each person's set of presenting circumstances and outcome goals is different. An experienced sports massage professional possesses effective clinical reasoning skills targeted to this complex population.

Fact gathering is an initial part of the **clinical reasoning** process. Each unique client situation needs to be thoroughly researched. This text provides only a portion of the information needed. Additional research is almost always necessary.

Every massage professional who works with athletes needs to have a medical dictionary and comprehensive texts on athletic training, kinesiology, and pathology, as well as resources on the particular sport and references on medication and nutritional supplements. See the resource list in this text for recommendations. The Internet is also a vast resource.

Each sport has its ideal performance requirement and common injuries; however, a sprain in a football player, a soccer player, or a skate boarder is still a sprain. The sprain should be addressed according to the recommendations in this text. Understanding the demands of the sport is important. However, it is not necessary for the massage professional to be an expert in the sport activity.

The sport activity is the context that the massage outcomes support.

Subjective and objective assessments are also sources of facts and are the major focus of this chapter. Analysis of factual data in the assessment leads to treatment plan development.

OUTCOME GOALS AND CARE OR TREATMENT PLANS

Objective

3. Develop outcome goals that are quantifiable and qualifiable.

Outcome goals need to be *quantified*. This means that they are measured in terms of objective criteria such as time, frequency, 1 to 10 scales, measurable increase or decrease in ability to perform an activity, and/or measurable increase or decrease in sensation, such as relaxation or pain.

Outcome goals also need to be *qualified*. How will we know when the goal is achieved? What will the client be able to do after the goal has been reached that he or she is not able to do now? For example, How fast will the client be able to run? What performance skills will the client be able to perform?

After the analysis of history and assessment data is complete and problems and goals have been identified, a decision needs to be made about the care or treatment plan. Depending on the situation, the massage treatment plan may need to be approved by appropriate supervising personnel.

Short-term goals typically support a session-by-session process and are dependent on the current status of the client. Long-term goals typically support recovery, performance, or rehabilitation. Long-term goals focus on what is being worked toward. Short-term goals focus on what currently is being worked on, as well as incremental steps toward achieving long-term goals. Short-term goals should not be in conflict with long-term goals.

For example, a golfer is involved in a conditioning program in preparation for going on tour. She has been working with the strength and conditioning coach on core strength and cardiovascular fitness. She has also been working with the golf coach on swing mechanics. Long-term goals for this client are to maintain range of motion (ROM) and manage a chronic tendency for low back pain. During this particular session, the client has indicated that she has a headache and delayed-onset muscle soreness. The focus of the current massage must consider both short-term and long-term goals. Short-term goals are to reduce headache pain and fluid retention as part of the existing long-term treatment plan.

How much time is allocated to each set goal depends on the adaptive capacity of the client. For example, massage targeting connective tissue application as part of the long-term goals plan may be reduced or eliminated in the areas where delayed-onset muscle soreness exists. Muscle energy application may require more effort than the client is willing to expend because of the headache.

It is this ever-changing dynamic of past history, current conditions, and future outcomes that makes any sort of massage routine useless. Each and every session is uniquely developed and applied on the basis of multiple factors. Many influencing factors must be considered when one is treating athletes or those in physical rehabilitation of any type. Assessment is the identification of all of these influences. Clinical reasoning is the sorting and developing of an appropriate treatment session.

CHARTING

Objective

4. Adapt charting methods to the athletic population.

As the treatment plan is implemented, it is recorded sequentially, session by session, in some form of **charting** process such as SOAP (*s*ubjective, *o*bjective, *a*ssessment [*a*nalysis], and *p*lan). The plan is reevaluated and adjusted as necessary. This process should have been learned in entry level massage training.

Various charting methods are used in the sport and fitness realm. Regardless of the particular style, the basic SOAP plan is easily modified to other charting styles. *Be very clear with supervisory personnel, usually the trainer, about the type and depth of information included on the client's chart.*

Good record keeping provides the therapist with the information necessary to communicate with health care and other personnel and furnishes accurate details about what treatment goals are specified, the methods of massage used, and the effectiveness of treatment.

ASSESSMENT DETAILS

Objective

5. Complete a comprehensive history.

How extensive the assessment is depends on whether you are working under the direction of a doctor, a trainer, or another health care provider or are working independently. It is the responsibility of the primary care provider to take a thorough history, perform a complete examination, and inform the massage therapist regarding the client's condition and desired outcomes for the massage. If you are working independently, it is your responsibility to perform the appropriate comprehensive assessment, especially to note contraindications and to clarify treatment goals.

This text assumes that the reader already has completed a comprehensive therapeutic massage course of study that included assessment procedures such as history taking, physical assessment, treatment plan development, and charting.[1]

[1]For more in-depth information, see Fritz S: *Mosby's fundamentals of therapeutic massage*, ed 5, St Louis, 2013, Mosby; and Fritz S: *Mosby's essential sciences for therapeutic massage*, ed 4, St Louis, 2013, Mosby.

The following procedures are recommended for targeting this specific population.

HISTORY

The **history** interview provides subjective information pertaining to the client's health history, the reasons for massage, a history of the current condition, a history of past illness and health, and a history of any family illnesses that may be pertinent. It also contains an account of the client's current health practices.

Targeting this information to the athlete or person in physical rehabilitation is the focus of this text. In addition to the general history, anyone who is working with an athlete or a person in physical rehabilitation needs to explore the following for each client:

- Surgery or medical procedures
- Medications and supplements
- Use of hydrotherapy
- Use of electrostimulation
- Therapeutic exercise activities
- Physical therapy intervention
- Nutrition
- Training protocols
- Training types such as strength and conditioning and agility
- Sleep patterns
- Breathing patterns
- Mood
- Cognitive load (how much mental training required)
- Competition schedule
- Practice and training schedules
- Previous massage experience
- Use of alternative therapies (essential oils, magnets)

The client's history may vary depending on whether the problem is the result of sudden trauma or is chronic. The following questions should be addressed if the athlete has an acute injury. Usually it is the doctor or trainer who performs the initial injury assessment:

- Has the client hurt the area before?
- How did the client hurt the area?
- What was heard when the injury occurred—a crack, snap, or pop?
- How bad was the pain and how long did it last?
- Is there any sense of muscle weakness?
- How disabling was the injury?
- Could the client move the area right away?
- Was the client able to bear weight for a period of time?
- Has a similar injury occurred before?
- Was there immediate swelling, or did the swelling occur later (or at all)?
- Where did the swelling occur?

For an athlete with a chronic condition, ask the following:

- What was the nature of the injury (trauma or repetitive use)?
- How much does it hurt?
- Where does it hurt?
- What is the nature of the pain—hot, pokey, sharp?
- Does it hurt to the touch?
- Does it hurt when you move?
- When does the pain occur—when bearing weight or after activity?
- What injuries have occurred in the past?
- What first aid and therapy, if any, were given for these previous injuries?

Additional questions address when the client first noticed this condition to help to identify any previous incident or injury that occurred before the current condition:

- What are the details of onset?
- Did the condition arise suddenly or gradually?
- Was there a specific injury?

Typically, a gradual onset suggests an overuse syndrome, postural stresses, or somatic manifestations of emotional or psychological stresses common in athletes.

- Where is the location of the area? Show me.

Ask the client to point to as well as explain the area of complaint.

- What were the prior treatments—medication, surgery?
- What was the outcome?

It is also important to know whether the client has had massage therapy before, whether it was helpful, and the type of massage application.

- What medications are being taken?

If the client has taken pain medication within 4 hours of assessment and treatment, the medication may be giving the client a false sense of comfort during assessment and during massage. Be aware of antiinflammatories, muscle relaxers, and so forth.

- What diagnostic studies have been performed—radiography, magnetic resonance imaging?
- What were the results?
- What is the nature of the progress?

Is the client getting better, worse, or is the client in need of a referral?

GESTURES

Pay attention to gestures used by the client. The general guidelines for gestures listed here are not written in stone. Professional experience indicates that those listed here are fairly dependable starting points when interpreting an individual's body language.

It is the professional's responsibility to understand what a gesture means for a particular individual.

The following are common gestures:

- A finger pointing to a specific area suggests an acupressure or motor point hyperactivity or a joint problem. What the pointing means depends on the area indicated.
- If the finger is pointed to a specific area and then the hand swipes in a certain direction, it may be a trigger point problem.
- If the area is grabbed, pulled, or held and is moved as if being stretched, this often indicates muscle or fascial shortening.

- If movement is needed to show the area of concern, the area may need muscle lengthening combined with muscle energy work to prepare for the stretch and reset of neuromuscular patterns.
- If the client moves into a position and then acts as if stuck, the area may need connective tissue stretching.
- If the client draws lines on his body, this may indicate nerve entrapment in the fascial planes or grooves.

SYMPTOMS

It is important to determine how often the client notices the dysfunction or disability. Is it once a day, 2 or 3 days a week, once a week, or constant? Grade 1 and 2 sprains and strains to the muscles, tendons, and ligaments usually hurt when they are being used, and are relieved with rest. Constant pain may be associated with severe injury or underlying pathology. A client with constant pain should be referred to a physician.

- What is the frequency of the discomfort?

The more serious the condition, the longer it will last.

- How long is the duration?

Typical words used by the client to describe the symptoms are "stiff," "achy," "tight," "stuck," and "heavy." These words are associated with muscles, tendons, ligaments, and joint capsules and their associated connective tissue and usually describe simple tension or mild overuse of the soft tissue or edema. If an ache is more than mild, is frequent, and lasts a long time, it is more serious and represents inflammation. A referral is required to rule out a more serious condition.

Typically, *tight* means an increase in neuromuscular activity. *Achy* and *fat* often indicate fluid retention or swelling. *Stiff* sensations often indicate a connective tissue pliability issue. *Heavy* sensation of the limbs indicates a firing pattern or gait reflex problem. *Stuck* sensations often mean a joint problem.

Other terms used to describe symptoms include the following:

Sharp, stabbing, tearing describes a more severe injury to the musculoskeletal system or a nerve root condition. This type of sensation is experienced with muscle or ligament tears, especially when the muscle or ligament is being used. The sensation is usually relieved at rest. A nerve root inflammation can elicit a sharp or stabbing pain, independent of movement.

Tingling, numbing, picky describes a nerve compression near the spine or in the extremities, or a circulation impairment.

Throbbing, hot is associated with acute injury inflammation and swelling, such as an abrasion puncture wound or an acute bursitis. Severe throbbing is a contraindication to massage.

Gripping, cramping is typically used to describe a serious condition, often a nerve root injury or a visceral condition. Gripping and cramping pain is a contraindication to massage and requires referral to a doctor.

- What is the nature of the symptoms?

The client can choose from the following descriptors:

- Sore
- Tight
- Stiff
- Weak
- Stuck
- Knot
- Balled up
- Fat, cold
- More pain in the morning or night
- Heavy
- Tired
- Burning
- Cramp
- Poking
- Twisted
- Hurt to touch
- Hurt during movement
- Pinching

Irritation or injury to the soft tissue can refer to the extremities, with diffuse pain and aching. Nerve entrapment and trigger point pain can radiate. Sharp well-localized pain in the extremities felt even at rest typically indicates a nerve root problem and requires a referral.

- Does the symptom radiate?

Ask the client to rate his or her pain on a 0 to 10 scale, with 10 being the worst pain ever experienced (incapacitating pain) and 0 being no pain. Moderate pain (5 to 9) interferes with a person's ability to perform sport-related activities. Mild pain (1 to 4) does not interfere with a person's activities of daily living but may interfere with sport performance.

- How severe are the symptoms?

The most simple strains and sprains of the musculoskeletal system are irritated by too much movement and are relieved by rest. When a condition hurts more with rest, this indicates either inflammation or pathology.

- What activities make the condition worse–moving, sitting, standing, walking, or resting?
- What sport movement is affected–running, jumping, cutting, swinging, acceleration, or deceleration?

As the soft tissue heals, it feels good to move the injured area. Stretching tight muscles, shortened ligaments, and joint capsules feels good, despite some mild discomfort. Acute injuries involving the soft tissue are painful with large movements and are relieved with rest. Muscle guarding makes stretching painful.

- What activities make the condition better–resting, moving, or applying ice or heat?

Pain caused by inflammation and tumors is worse at night. Constant, gripping pain that is worse at night requires immediate referral to a doctor. An area that hurts at night but is relieved with movement usually indicates inflammation. Joint pain and stiffness with fascial shortening are usually worse in the morning.

- When does the pain occur?

Clarifying assessment questions to ask include the following:

- What can you do? Show me.
- What can't you do? Show me.
- What do you want to improve? Show me.
- What does the pain feel like?

The client should demonstrate for the massage therapist. Trust the client's impressions. They usually are right. Then translate what the client is saying into a massage application.

- If you could fix it yourself, what would you do?

The client should draw a picture of his or her condition. When the client draws the picture, give as few directions as possible. Evaluate the drawing for location and intensity of the symptom. Does the client use hard zigzag lines or small or large circles? Then ask the client to explain.

All the history information should be consolidated and considered when treatment plans and session outcomes are documented.

See the Evolve website that accompanies this book for an example of a history taking form.

PHYSICAL ASSESSMENT

Objective

6. Complete a comprehensive physical assessment.
7. Perform postural assessment.

After the history is complete, the **physical assessment** is performed. The objective data are obtained during physical assessment.

Accurate assessment is best achieved using a sequence to ensure that all relevant information has been gathered. A major aspect of a massage session is palpation assessment.

In general, physical assessment includes the following:

- Visual (blisters, bruises, rash) assessment
- Posture
- Palpation
- Stability
- Firing patterns (muscle activation sequence)
- Gait
- Range of motion (ROM)
- Tissue pliability
- Mobility
- Agility
- Stamina
- Strength
- Performance skills

Identify any scars or muscle atrophy. Scars may indicate prior surgery or prior injury and reveal that the area is compromised. Ask the client to describe how he or she received the scar.

An area of atrophy may have been deconditioned owing to lack of use, or this may indicate neurologic involvement. Simple atrophy can be a result of immobilization caused by prior fracture or lack of use due to pain.

PHYSICAL ASSESSMENT OF POSTURE

Note the **posture** of the client in standing and seated positions, as well as the posture or position of the area of complaint. Look for areas of asymmetry. Asymmetry usually results when overly tense muscles or shortened connective tissue pulls the body out of alignment.

Direct trauma pushes joints out of alignment. Weak stabilizing mechanisms, such as overstretched ligaments or inhibited antagonist muscles, contribute to the problem. In these situations, a chiropractor, an osteopath, or another trained medical professional skilled in skeletal manipulation is needed. Often a multidisciplinary approach to client care is necessary.

First, observe the client during general movement as opposed to formal assessment to identify natural function. Then, perform the following structured standing assessment and compare the findings.

Standard Posture Front View

- Head: neutral position neither tilted nor rotated
- Shoulders: level, not elevated or depressed
- Pelvis: level with both anterior superior iliac spines in same transverse plane
- Hip joints: neutral position neither adducted nor abducted nor internally or externally rotated
- Lower extremities: straight
- Feet: parallel

Standard Posture Back View

- Head: neutral position neither tilted nor rotated
- Shoulders: level, not elevated or depressed
- Scapulae: neutral position, medial borders essentially parallel and approximately 3 to 4 inches apart
- Thoracic and lumbar spines: straight
- Pelvis: level with both posterior superior iliac spines in same transverse plane
- Hip joints: neutral position neither adducted nor abducted or rotated (internal or external)
- Lower extremities: straight
- Feet: parallel

Standard Posture Side View

- Head: neutral position, not tilted forward or backward
- Cervical spine: normal curve, slightly convex to anterior
- Scapulae: flat against upper back
- Thoracic spine: normal curve, slightly convex to posterior
- Lumbar spine: normal curve, slightly convex to anterior
- Pelvis: neutral position, anterior superior iliac spine in same vertical plane as symphysis pubis
- Hip joints: neutral position, leg vertical at right angle in sole of foot

Note: An imaginary line should run slightly behind the lateral malleolus, through the middle of the femur, the center of the shoulder, and the middle of the ear.

Chart the findings and relate them to the client's history (Figure 10-1).

For the physical assessment, the main considerations are body balance, efficient function, and basic symmetry (Box 10-1).

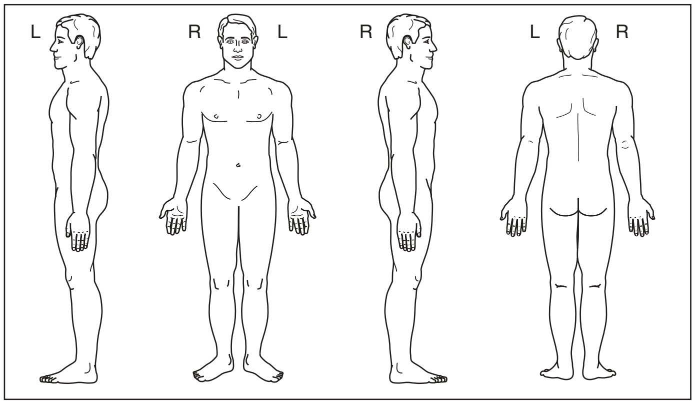
The body is not perfectly symmetric, but the right and left halves of the body should be similar in shape, ROM, and ability to function. The greater the discrepancy in symmetry, the greater is the potential for soft tissue dysfunction.

Three major factors influence posture: *heredity*, *disease*, and *habit*. These factors must be considered when evaluating posture. The easiest influence to adjust is habit. By normalizing the soft tissue and teaching balancing exercises, the massage practitioner can play a beneficial role in helping clients overcome habitual postural distortion.

MASSAGE ASSESSMENT/PHYSICAL PALPATION AND GAIT

PRE
POST

Client Name: ______________________ **Date:** ______________



	OBSERVATION & PALPATION		OBSERVATION & PALPATION		GAIT ASSESSMENT
	ALIGNMENT		**RIBS**		
	Chin in line with nose, sternal notch, navel		Even		**HEAD**
	Other:		Springy		Remains steady/eyes forward
	HEAD		Other:		Other:
	Tilted (L)		**ABDOMEN**		**TRUNK**
	Tilted (R)		Firm and pliable		Remains vertical
	Rotated (L)		Hard areas		Other:
	Rotated (R)		Other:		**SHOULDERS**
	EYES		**WAIST**		Remain level
	Level		Level		Rotate during walking
	Equally set in sockets		Other:		Other:
	Other:		**SPINE CURVES**		**ARMS**
	EARS		Normal		Motion is opposite leg swing
	Level		Other:		Motion is even (L) and (R)
	Other:		**GLUTEAL MUSCLE MASS**		Other:
	SHOULDERS		Even		(L) swings freely
	Level		Other:		(R) swings freely
	(R) high / (L) low		**ILIAC CREST**		Other:
	(L) high / (R) low		Level		**HIPS**
	(L) rounded forward		Other:		Remain level
	(R) rounded forward		**KNEES**		Other:
	Muscle development even		Even/symmetrical		Rotate during walking
	Other:		Other:		Other:

FIGURE 10-1 Physical assessment form. (Feel free to copy this form to use as an assessment tool.) (From Fritz S: *Mosby's fundamentals of therapeutic massage*, ed 5, St Louis, 2013, Mosby.)

	SCAPULAE		PATELLA		LEGS
	Even		(L) ☐ movable ☐ rigid		Swing freely at hip
	Move freely		(R) ☐ movable ☐ rigid		Other:
	Other:		**ANKLES**		**KNEES**
	CLAVICLES		Even		Flex and extend freely through stance and swing phase
	Level		Other:		Other:
	Other:		**FEET**		**FEET**
	ARMS		Mobile		Heel strikes first at start of stance
	Hang evenly (internal) (external)		Other:		Plantar flexed at push-off
	(L) rotated ☐ medial ☐ lateral		**ARCHES**		Foot clears floor during swing phase
	(R) rotated ☐ medial ☐ lateral		Even		Other:
	ELBOWS		Other:		**STEP**
	Even		**TOES**		Length is even
	Other:		Straight		Timing is even
	WRISTS		Other:		Other:
	Even		**SKIN**		**OVERALL**
	Other:		Moves freely and resilient		Rhythmic
	FINGERTIPS		Pulls/restricted		Other:
	Even		Puffy/baggy		
	Other:		Other:		

FIGURE 10-1, cont'd

Effects may arise from occupational habits (e.g., a shoulder rotation from golf) and recreational habits (e.g., a forward-shoulder position in a bike rider), or they may be sleep-related (long-term use of high pillows).

Clothing, sport equipment, shoes, and furniture affect the way a person uses his or her body. Tight clothing or equipment around the neck restricts breathing and contributes to neck and shoulder problems. Restrictive belts or tight pants also limit breathing and affect the neck, shoulders, and midback. Shoes with high heels and those that do not fit the feet comfortably interfere with postural muscles. Shoes with worn soles imprint the old postural pattern, and the client's body assumes the dysfunctional pattern if he or she puts them back on after the massage. If postural changes are to be maintained, it is important to wear shoes that do not have worn soles.

Sleep positions can contribute to a wide range of problems. Furniture that does not support the back or that is too high or too low perpetuates muscular tension. Competing athletes travel and therefore change beds often. The seats in airplanes are seldom comfortable for athletes.

When assessing posture, it is important for the massage therapist to notice the complete postural pattern. Most compensatory patterns occur in response to external forces imposed on the body. However, if the client has had an injury, maintains a certain position for a prolonged period, or overuses a body area, the body may not be able to return to a normal dynamic balance efficiently. The balance of the body against the force of gravity is the fundamental determining factor in a person's posture or upright position. Even subtle shifts in posture demand a whole body compensatory pattern (Figure 10-2).

Cervical, thoracic, lumbar, and sacral curves develop because of the need to maintain an upright position against gravity (Figure 10-3).

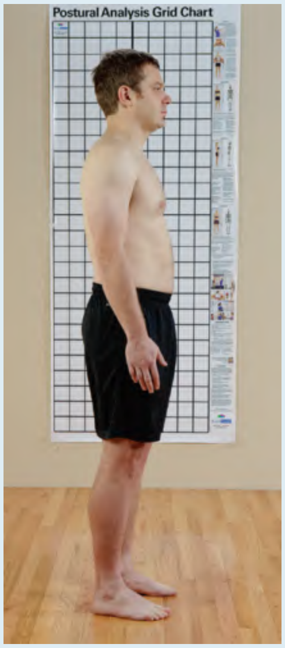
Standing posture requires various segments of the body to cooperate mechanically as a whole. Passive tension of ligaments, fascia, and connective tissue elements of the muscles supports the skeleton. Muscle activity plays a small but important role. Postural muscles maintain small amounts of contraction that stabilize the body upright in gravity by continually repositioning the body's weight over the mechanical balance point.

In relaxed symmetric standing, both the hip and the knee joints assume a position of full extension to provide the most efficient weight-bearing position. The knee joint has an additional stabilizing element in its "screw home" mechanism. The femur rides backward on its medial condyle and rotates medially about its vertical axis to lock the joint for weight bearing. This happens only in the final phase of extension. The hamstrings are the major muscles that resist the force of gravity at the knees.

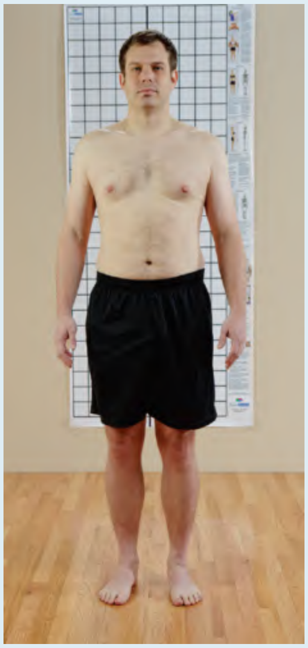
At the ankle joint, bones and ligaments do little to limit motion. Passive tension of the two-joint gastrocnemius muscle (i.e., the muscle crosses two joints) becomes an important factor. This stabilizing force is diminished if high-heeled shoes are worn. For example, rodeo riders wear cowboy boots. The heel of the shoe puts the gastrocnemius on a slack. If these heels are worn constantly, the muscle and the Achilles tendon shorten.

BOX 10-1 Landmarks That Help Identify Lack of Symmetry

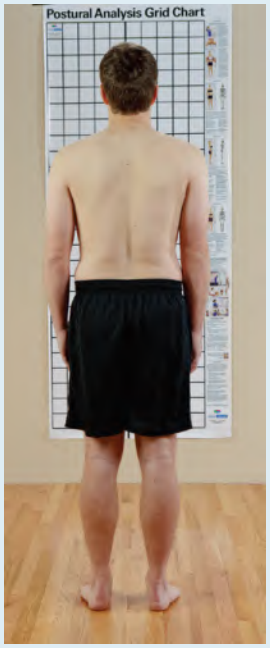
The following landmarks can be used for comparison. Be sure to observe the client from the back, the front, and the left and right sides.



Side view.



Anterior view.



Posterior view.

- The middle of the chin should sit directly under the tip of the nose. Check the chin alignment with the sternal notch. These two landmarks should be a direct line.
- The shoulders and clavicles should be level with each other.
- The shoulders should not roll forward or backward or be rotated with one forward and one backward.
- The arms should hang freely and at the same rotation out of the glenohumeral (shoulder) joint.
- The elbows, wrists, and fingertips should be in the same plane.
- The skin of the thorax (chest and back) should be even and should not look as if it is pulled or is puffy.
- The navel, located on the same line as the nose, chin, and sternal notch, should not look pulled.
- The ribs should be even and springy.
- The abdomen should be firm but relaxed and slightly rounded.
- The curves at the waist should be even on both sides.
- The spine should be in a direct line from the base of the skull and on the same plane as the line connecting the nose and the navel. The curves of the spine should not be exaggerated.
- The scapulae should appear even and should move freely. You should be able to draw an imaginary straight line between the tips of the scapulae.
- The gluteal muscle mass should be even.
- The tops of the iliac crests should be even.
- The greater trochanter, knees, and ankles should be level.
- The circumferences of the thigh and calf should be similar on the left and right sides.
- The legs should rotate out of the acetabulum (hip joint) evenly in a slightly external rotation.
- The knees should be locked in the standing position but should not be hyperextended. The patellae (kneecaps) should be level and pointed slightly laterally.
- A line dropped from the nose should fall through the sternum and the navel and should be spaced evenly in between.

Modified from Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.

Posture is primarily determined by hereditary factors, such as bone structure and muscle type, and even by habitual movement patterns. These can create natural imbalances, but alone they do not normally lead to painful conditions until later in life. They can, however, combine with other stresses such as athletic activity, and together can lead to injury. Little can be done to change these hereditary factors, and regular exercise and soft tissue treatment are often the only ways of avoiding such symptoms.

Upright posture is maintained by a series of muscles running down the body. These muscles need to balance each other, in terms of strength and tension, and together must resist the forces of gravity. Any postural change will

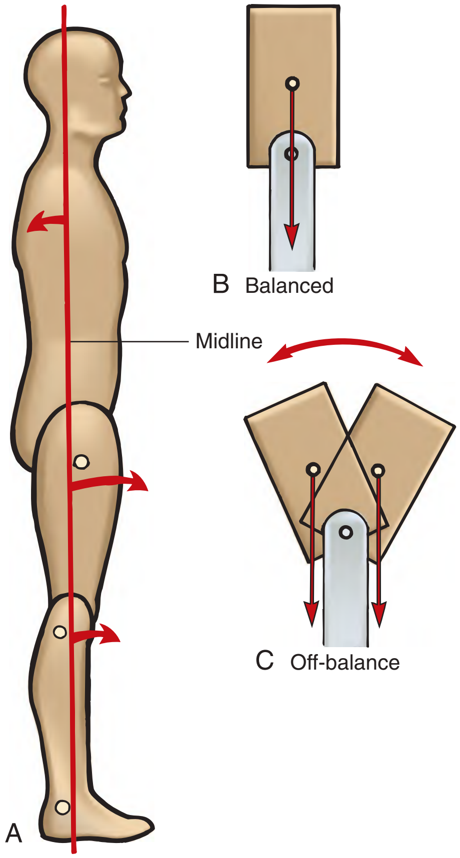


FIGURE 10-2 In normal relaxed standing **(A),** the leg and trunk tend to rotate slightly off the midline of the body but maintain a counterbalance force. Balance is achieved in **B,** but not in **C.** Whenever the trunk moves off this midline balance point, the body must compensate. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 3, St Louis, 2004, Mosby.)

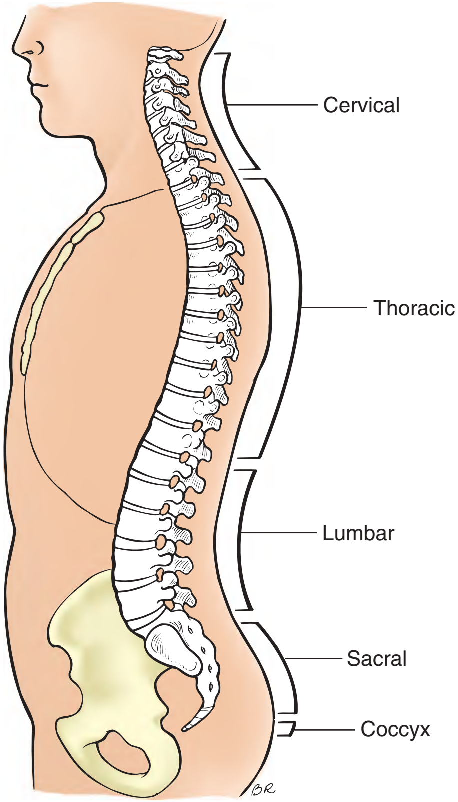


FIGURE 10-3 Normal spinal curves. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

nearly always be in a downward and forward direction because fatigue or injury reduces the ability of postural muscles to combat gravity. This creates increased curvature in particular sections of the spine, which can be seen by the therapist when observing the client's standing posture.

Postural dysfunction occurs in the three planes of movement (sagittal, frontal, and transverse), as well as in supination and pronation (Figures 10-4 and 10-5).

ASSESSMENT OF JOINT AND MUSCLE FUNCTION

The more the fascia muscle tissue structure is researched, the more we understand that the concept of individual muscles is flawed. It is necessary to rethink the functional and structural aspect of contractile tissues—muscle tissue—as a continuum of function within spans of connective tissues such as fasciae, ligaments, and tendons. The idea of individual muscles and specific attachments is ingrained and it will take a long time to shift the paradigm. Throughout this text, the functional unit has been emphasized; however, knowledge of individual muscle names and locations remains valuable and will be used. Although the muscular system looks highly complicated, it is important to realize that the actual mechanics involved in movement are simple. A muscle can do only two things: it can contract and shorten, and it can relax and lengthen. The system is a complex pattern of movement composed of many simple levers and pulleys. Movement is created by muscle shortening, which pulls together bones that are connected at the joint.

Many muscles working in functional units provide the widest variety of movements and the ability to do them with stability, control, and efficiency. For example, the knee is basically a hinge joint capable of moving on only one plane, and so, theoretically, it should need only one pulley (muscle) to flex it and one to extend it. However for extension, there are the four quadriceps muscles, each of which pulls across the joint in a slightly different direction. During flexion, three hamstrings accomplish the same thing. This muscle interaction stabilizes the joint and enables it to adapt to variations in movement and to the random direction of forces from the outside environment. The whole of the muscular system works in unison to enable the body to cope with the stresses caused by gravity when movement takes place. It is important to see movement in terms of patterns of activity (movement strategies) taking place within a system rather than as the action of individual muscles. Almost all movement strategies involve the gait (walking) process.

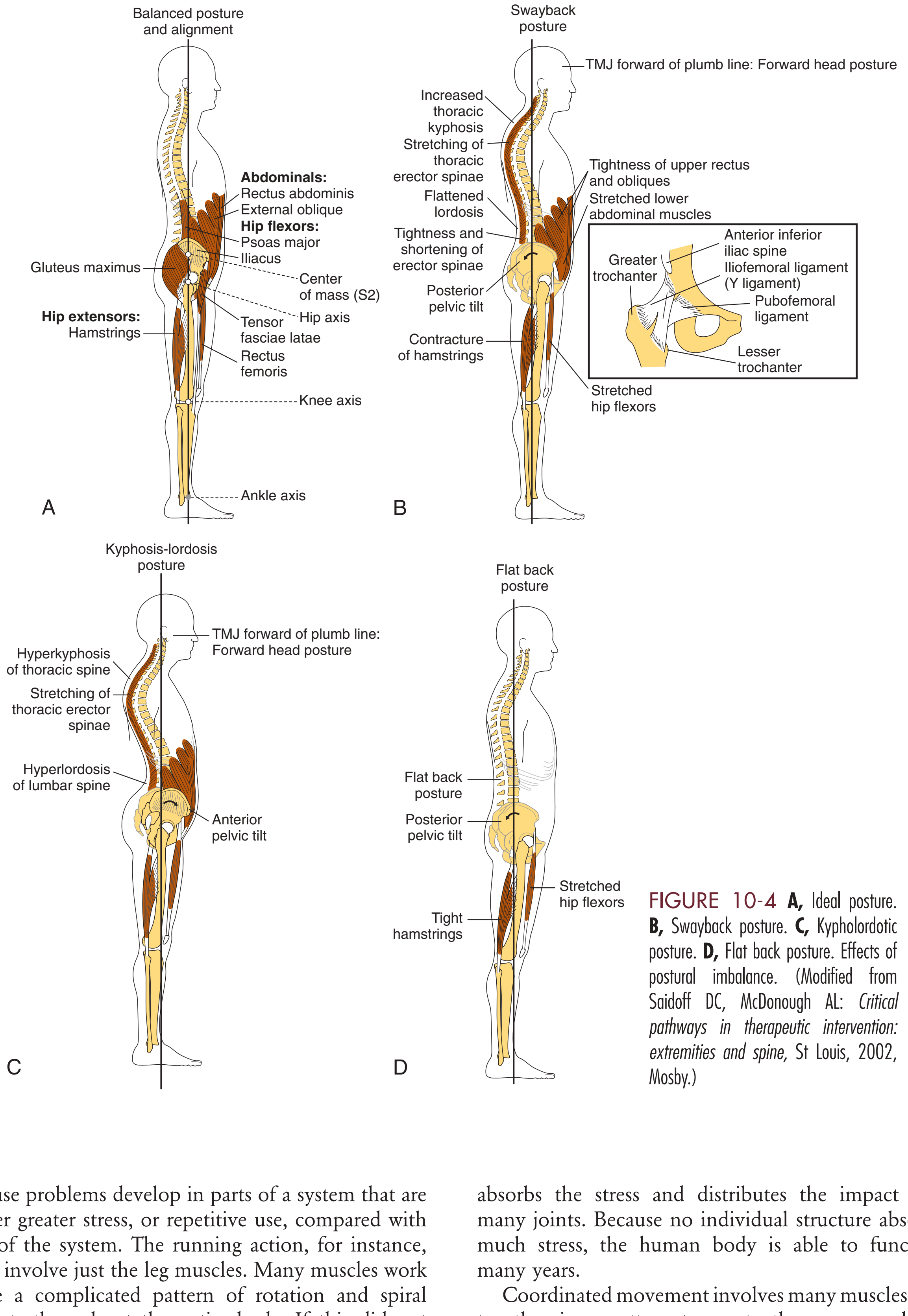


FIGURE 10-4 **A,** Ideal posture. **B,** Swayback posture. **C,** Kypholordotic posture. **D,** Flat back posture. Effects of postural imbalance. (Modified from Saidoff DC, McDonough AL: *Critical pathways in therapeutic intervention: extremities and spine,* St Louis, 2002, Mosby.)

Overuse problems develop in parts of a system that are put under greater stress, or repetitive use, compared with the rest of the system. The running action, for instance, does not involve just the leg muscles. Many muscles work to create a complicated pattern of rotation and spiral movements throughout the entire body. If this did not happen, and if movement is confined to the legs, then all the stress of impact and push-off will be absorbed by the ankle, knee, and hip joints, and the forces on these joints will cause damage. The spiraling movement up the body absorbs the stress and distributes the impact through many joints. Because no individual structure absorbs too much stress, the human body is able to function for many years.

Coordinated movement involves many muscles working together in a pattern to create the power and control needed to accomplish a task. Each muscle has a preferred function within a movement pattern; therefore, a particular movement will involve greater effort from certain individual muscles. For example, kicking a soccer ball involves

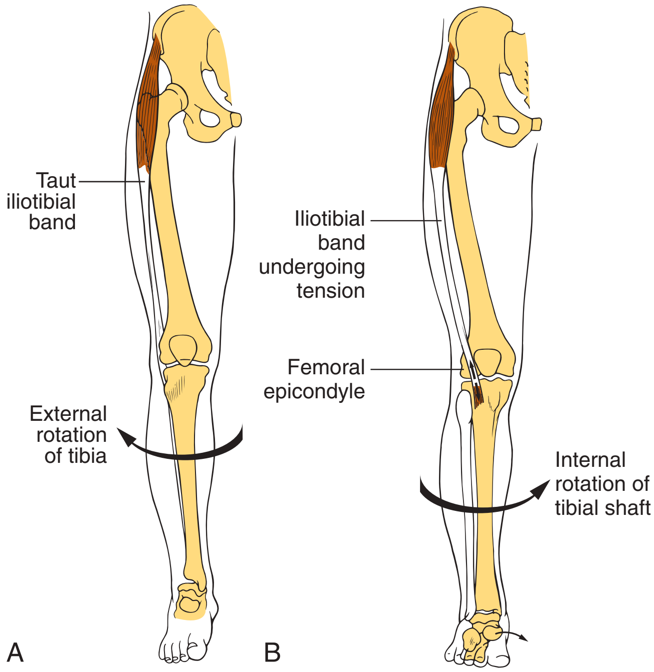


FIGURE 10-5 **A,** Supination. **B,** Pronation. Effects of postural imbalance. (Modified from Saidoff DC, McDonough AL: *Critical pathways in therapeutic intervention: extremities and spine,* St Louis, 2002, Mosby.)

a strong effort from the quadriceps muscles. Each of the four muscles within the group acts on the joint from a different angle; therefore, depending on the degree of rotation in the lower leg and the angle of force, one muscle may have to keep working slightly more than the rest.

The muscular system develops according to how the body is used. Each individual has unique patterns of muscle function adaptation, many of which are beneficial and are in harmony with the person's activities and lifestyle, although some will be negative or excessive. Assessment provides information about beneficial or detrimental function.

For example, a midfield soccer player who often has to pass the ball with the inside of the foot will tend to use the vastus medialis, and the adductors may be involved. Therefore, the soccer player would naturally develop increased strength in the vastus medialis and adductors while training. Although this may appear to create an imbalance within the other quadriceps muscles, it could be natural for the individual; therefore, this may not be a situation requiring remedial treatment. The same imbalance found in a distance runner complaining of patellofemoral syndrome or groin pain would be a treatment priority.

MICROTRAUMA

A muscle can suffer acute strain with its fibers being torn, if overused or overloaded. The same can occur on a microscopic level, even if just a few fibers are overused. When this breakdown occurs on a microscopic level, the pathologic changes that take place are the same as with any soft tissue tear: bleeding, swelling, muscle tension, guarding in surrounding tissues, and scar tissue formation. The delayed-onset muscle soreness experienced in muscles after hard exercise is due in part to this type of trauma **(microtrauma)**.

Scar tissue can continue to build up gradually with repetitive activity. Adhesions can form, affecting the elasticity within that particular area of the muscle and making muscles vulnerable to further microtrauma. This process results in fibrotic changes in the muscle.

As function deteriorates in a small part of the muscle, it can create imbalance within a functional muscle unit (a group of muscles working together). As the condition builds up gradually, it may develop unnoticed in the early stages. Increased tension can then put excessive stress on adjoining structures such as the tendons, which can become more vulnerable to acute trauma. Biomechanical alterations develop as natural movement patterns compensate. In the long run, the overuse syndrome can lead to many problems, both locally and in other parts of the body. Several muscle dysfunctions can develop.

Massage is possibly the most effective way of identifying this type of problem. Palpation assessment identifies fibrotic changes in a muscle. This is the most important benefit of general preventive massage.

These areas should be treated in much the same way as any chronic muscle injury. Mechanical force is applied to break down scar tissue to improve flexibility and to realign tangled fibers.

Static positions, such as standing at attention in the military for long periods of time, put stress on specific tissues, causing microtrauma in a way similar to the active type of overuse, but from isometric overload instead of eccentric or concentric function. Lack of movement in the muscles also slows blood and lymph flow through the area, which can increase congestion and add to the problem.

ACTIVE MOVEMENTS

General understanding of biomechanics is especially important for the massage professional who works with athletes. The assessment question "What do you want your body to do?" will result in answers such as "run," "ride," "throw," "catch," "jump," "bend," "rotate," "lift," and "press." The massage professional needs to break down the movements of the activity, assess for soft tissue changes that interfere with these movements, and then identify massage applications that can support these movements. For example, in response to the assessment question, "What do you need to do that you are having problems with?" I will often hear something like "run backward" or "swing." Then I will ask the athlete to show me, and while I observe the movements, I can begin to target the specific outcomes.

Perhaps the athlete says, "I can't stand on my left foot with the same balance as my right foot" (which is important for many sport activities). I ask the athlete to stand on the right foot, and I observe and palpate to determine the "normal" activity that he or she can perform. This is a general assessment and treatment principle. The least affected movement pattern or structure becomes "normal" for evaluation and comparison purposes. Regardless of the situation, in practical application this works. I then ask the athlete to stand on the left foot, where the problem exists, and I compare it with the more normal function. Then I assess for the difference between the two—tissue texture and pliability, ROM, and firing patterns. Choices about what treatments to use are based on the assessment information.

The next part of the examination is divided into two sections. In active movement assessment, the massage therapist asks the client to perform movements in specific directions in all planes of movement. The squat assessment is particularly beneficial. In passive movement assessment, the massage therapist moves the client.

Injuries and dysfunctions of the musculoskeletal system are symptomatic when the injured area is actively moved. More complex conditions such as inflammation of the nervous system, systemic conditions such as heart disease, and pathologies such as tumors are not significantly affected by movement. If an area does not hurt at rest, but it does hurt with movement, soft tissue dysfunctions are indicated.

Remember that each individual joint movement pattern is part of an interconnected aspect of the neurologic and fascial coordination pattern of muscle movement called the **kinetic chain**. The support system involves the tensegric nature of the body's connective design. Posture and movement dysfunctions identified in an individual joint pattern must be assessed and treated in broader terms of kinetic chain interactions, muscle tension/length relationships, and the effects of stress and strain on the entire system.

Log on to your Evolve website to watch Video 10-1: Multiplanar Assessment (Functional Assessment).

RANGE OF MOTION

Remember that each person is unique, and many factors influence available range of motion. Just because a joint does not have the textbook **range of motion (ROM)** does not mean that what is displayed is abnormal. Abnormality is indicated by nonoptimal function. This can be seen as a limitation or an exaggeration in the "textbook normal" range of motion (Box 10-2).

ROM is measured in degrees. Joint movement is measured from the neutral line of anatomic position. Movement of a joint in the sagittal, frontal, or transverse plane is described as the number of degrees of flexion, extension, adduction, abduction, and internal and external rotation (Figure 10-6). For example, the elbow has approximately 150 degrees of flexion at the end range and 180 degrees of extension. Anything less than this is hypomobility, and anything more is considered hypermobility. Massage therapists typically estimate degrees of movement, and other professionals use specific equipment to obtain precise information. The normal ROM of joints is found in anatomy texts such as *Mosby's Essential Sciences for Therapeutic Massage*.

Each movement pattern (e.g., flexion and extension of the elbow and knee, circumduction and rotation of the shoulder and hip, movement of the trunk and neck) is assessed in sequential positioning in each area of all available movement patterns, testing for strength, range, and ease of movement. Functional assessment is the combination of all previously described assessments.

Range of motion is assessed through joint movement.

When active joint movement is performed, the client moves the joint through the planes of motion that are normal for that joint. Any pain, crepitus, or limitation that is present during the action should be reported.

BOX 10-2 Normal Range of Motion for Each Joint

NORMAL VALUES (IN DEGREES):

- Hip flexion, 0-125
- Hip extension, 105-0
- Hip hyperextension, 0-15
- Hip abduction, 0-45
- Hip adduction, 45-0
- Hip lateral (external) rotation, 0-45
- Hip medial (internal) rotation, 0-45
- Knee flexion, 0-130
- Knee extension, 120-0
- Ankle plantar flexion (movement downward), 0-50
- Ankle dorsiflexion (movement upward), 0-20
- Foot inversion (turned inward), 0-35
- Foot eversion (turned outward), 0-25
- Shoulder flexion, 0-90
- Shoulder extension, 0-50
- Shoulder abduction, 0-90
- Shoulder adduction, 90-0
- Shoulder lateral (external) rotation, 0-90
- Shoulder medial (internal) rotation, 0-90
- Elbow flexion, 0-160
- Elbow extension, 145-0
- Elbow pronation, 0-90
- Elbow supination, 0-90
- Wrist flexion, 0-90
- Wrist extension, 0-70
- Wrist abduction, 0-25
- Wrist adduction, 0-65

This assessment identifies what the client is willing or able to do.

Passive joint movement is performed when the massage therapist moves the joint passively through the planes of motion that are normal for the joint. The assessment identifies limited (hypomobility) or excessive movement (hypermobility) of the joint.

Passive joint movement is done carefully and gently to allow the client to fully relax the muscles while the assessment is performed. The client reports the point at which pain or bind, if present, occurs. The massage therapist stops the motion at the point of pain or bind, unless assessing for joint end-feel. Then a tiny increase in resistance is used to assess the quality of movement just past the bind. Passive joint movement assessment provides information about the joint capsule and ligaments and other restricting mechanisms, such as myofascial soft tissue.

Log on to your Evolve website to watch Video 10-2: Passive Joint Movement (Range of Motion).

BASIC ORTHOPEDIC TESTS

Objective

8. Perform basic orthopedic tests to assess for joint injury.

The main reason for orthopedic tests is to assess for bone, joint, ligament, and tendon injury. Orthopedic tests also identify impingement areas. The most common structures impinged are nerves, blood vessels, and tendons, and occasionally muscles. Performing orthopedic tests can determine whether or not a referral is necessary. Even if you do not perform orthopedic assessment as part of the massage assessment process, it is likely that a client will

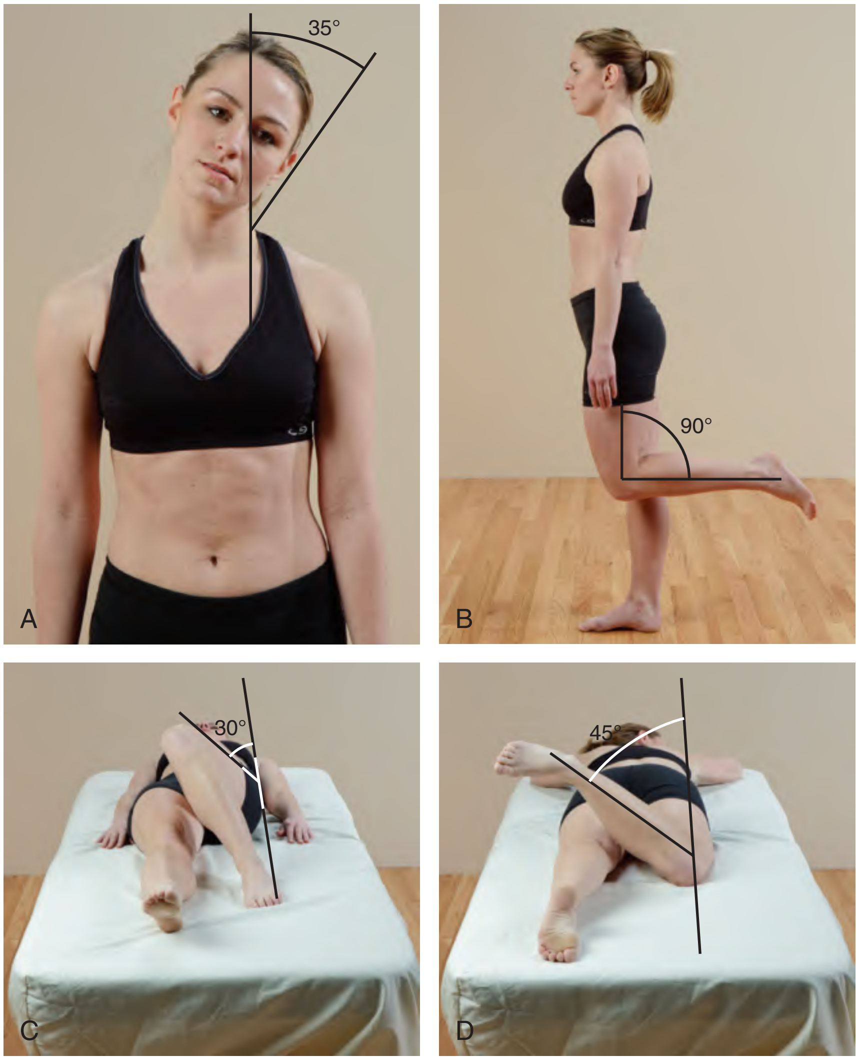


FIGURE 10-6 Examples of approximate degrees of movement. **A,** 35 degrees of lateral flexion. **B,** 90 degrees of knee flexion. **C,** 30 degrees of internal hip rotation. **D,** 45 degrees of external hip rotation.

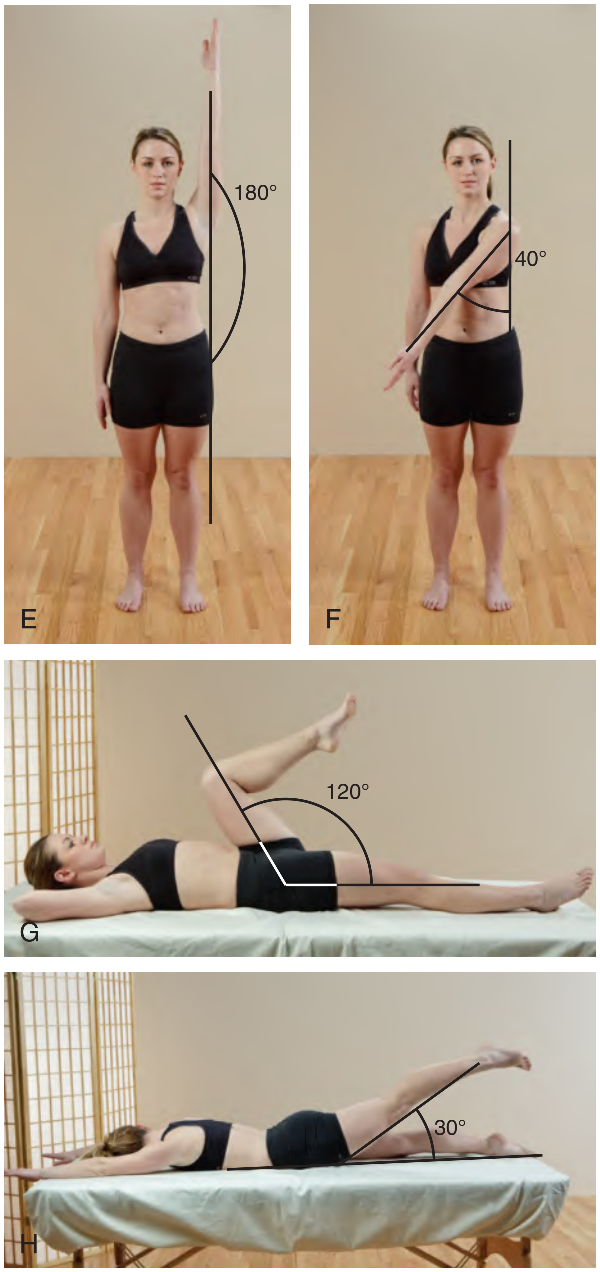


FIGURE 10-6, cont'd **E,** 180 degrees of shoulder abduction. **F,** 40 degrees of horizontal shoulder adduction. **G,** 120 degrees of hip flexion. **H,** 30 degrees of hip hyperextension.

tell you that he or she had a positive result when assessed by another health professional such as an athletic trainer, physical therapist, chiropractic physician, or medical or osteopathic doctor.

Most orthopedic tests assess stress areas to be evaluated in an effort to evaluate pain, joint play, and muscle extensibility. Because of the strain involved during some orthopedic tests, care must be taken to avoid further injury. Before any orthopedic tests are conducted, an area must be free from fracture or neoplasm (an abnormal growth). Furthermore, any client with characteristics such as severe spasm, pain with unknown etiology (cause), or pain that wakes him or her up at night, should not be evaluated with orthopedic tests until a full medical evaluation can be completed to address these unexplained symptoms.

A positive test will reproduce the client's symptoms. If the client does not want you to perform the test, this is called an *apprehension sign*. Additional positive signs are change in stability of the joint and changes in pulses.

TYPES OF ORTHOPEDIC TESTS

Many orthopedic tests are available. Only a few that are most relevant to massage are presented on the Evolve website.

The Evolve website provides step-by-step visual instructions for performing these orthopedic assessments, findings, and intervention suggestions.

ASSESSMENT USING JOINT MOVEMENT

Objective

9. Analyze movement assessment findings.

The ROM of a joint is measured in degrees. A full circle is 360 degrees. A flat horizontal line is 180 degrees. Two perpendicular lines (as in the shape of a capital "L") create a 90-degree angle. When the ROM of a joint allows 0 to 90 degrees of flexion, anything less is hypomobile and anything more is hypermobile. A great degree of variability exists among individuals as to actual normal ROM. The degrees provided are general guidelines. ROM is measured from the anatomic position. Anatomic position is considered 0 degrees of motion, regardless of whether the client is standing, supine, or side-lying.

Decreased ROM may result from pain or changes in joint position, or from soft tissue bind. If loss of motion is not a result of pain, more information is needed to determine whether lack of motion is caused by adhesions in the joint capsule, muscle guarding, joint degeneration, or other factors.

Increased ROM that is significantly different from the other side indicates moderate to severe injury to the ligaments, joint capsule, or both. Increased ROM on both sides compared with normal anatomic ROM suggests a generalized hypermobility syndrome and potential instability in the joints.

During actual movement assessment, the following categories are noted by the massage therapist:

Range of motion (ROM). Is the motion normal, decreased, increased? Determining normal ROM is more complex than it might seem. You need to consider the client's age and sex, sport type, and muscle texture. ROM is lessened as we age. Women typically have greater ROM than men. If the complaint is in the extremities, begin with the noninvolved side, and always compare both sides. The less involved side becomes the "normal side" for comparison.

Limits to joint movement. Joints have various degrees of ROM. Anatomic, physiologic, and pathologic barriers to motion exist. Anatomic barriers are determined by the shape and fit of bones at the joint. The anatomic barrier is seldom reached because the possibility of injury is greatest in this position. Instead the body protects the joint by establishing physiologic barriers.

Physiologic barriers are the result of limits in ROM imposed by protective nerve and sensory function to support optimal function. An adaptation in the physiologic barrier so that the protective function limits instead of supports optimal functioning is called a *pathologic barrier*. Pathologic barriers often are manifested as stiffness, pain, or a "catch."

When using joint movement techniques, remain within the physiologic barriers. If a pathologic barrier limits motion, use massage techniques to gently and slowly encourage the joint to increase the limits of ROM to the physiologic barrier.

The stretch on the soft tissues, such as muscles, tendons, fasciae, and ligaments, and the arrangement of the joint surfaces determine the ROM of the joint and therefore the joint's normal **end-feel**.

Overpressure is the term used when the massage therapist gradually applies more pressure when the end of the available passive range of joint motion has been reached. The sensation transmitted to the therapist's hands by tissue resistance at the end of the available range is the end-feel of a joint.

TYPES OF END-FEEL

Normal End-Feel

Soft tissue approximation end-feel occurs when the full ROM of the joint is restricted by normal muscle bulk; it is painless and has a feeling of soft compression. Muscular/tissue stretch end-feel occurs at the extremes of muscle stretch, as in the hamstrings during a straight leg raise; it has a feeling of increasing tension, springiness, or elasticity. Capsular stretch, or leathery, end-feel occurs when the joint capsule is stretched at the end of its normal range, such as with external rotation of the glenohumeral joint; it is painless and has the sensation of stretching a piece of leather. Bony, or hard, end-feel occurs when bone contacts bone at the end of normal range, as in extension of the elbow; it is abrupt and hard.

Abnormal End-Feel

Many types of abnormal end-feel have been identified. Empty end-feel occurs when there is no physical restriction to movement except the pain expressed by the client. Muscle spasm end-feel occurs when passive movement stops abruptly because of pain; there may be a springy rebound from reflexive muscle spasm. Boggy end-feel occurs when edema is present; it has a mushy, soft quality. Springy block, or internal derangement, end-feel is a springy or rebounding sensation in a noncapsular pattern; this indicates loose cartilage or meniscal tissue within the joint. Capsular stretch (leathery) end-feel that occurs before normal range indicates capsular fibrosis with no inflammation. Bony (hard) end-feel that occurs before normal range indicates bony changes or degenerative joint disease or malunion of a joint after a fracture.

An empty end-feel with no bind or stability indicates a seriously damaged joint, and referral is required.

ANALYSIS OF ACTIVE MOVEMENT

If active movement is painful, ask the client to describe its location, quality, and severity. The three stages of healing that elicit pain at different ranges of the movement are as follows:

1. Acute conditions yield pain before the normal ROM.
2. Subacute conditions give pain at the end of the normal range.
3. Chronic conditions may elicit pain with slight overpressure at the end of active or passive motion.

Pain with passive motion at different ranges of the movement indicates a stage of healing that is the same as for active motion.

Active and passive ROM can identify limits of movement. If an empty capsular or hard end-feel is identified, the joint is damaged. Referral is needed for acute conditions. ROM limited by muscle contraction may indicate an underlying problem with joint laxity, and caution is indicated before muscle guarding is reduced. Proceed slowly until a balance between increased ROM and maintenance of joint stability is achieved. If joint stability is reduced, the client usually experiences pain in the joint for a day or two after the massage. Simple edema around a joint is managed with lymphatic drain. Any unexplained edema should be referred for diagnosis.

ROM should improve as the client's tissues normalize with general massage. Progressive mobilization in ROM is an indication of improved function. Never force an increase in ROM. Instead, allow it to be a natural outcome of effective massage application.

MUSCLE STRENGTH ASSESSMENT

10. Perform muscle strength assessment.

Muscle strength assessment is performed by applying resistance to a specific group of muscles. Resistance (pressure against) applied to the muscles is focused at the end of the lever system (Figure 10-7).

For example, when the function of the shoulder is assessed, resistance is focused at the distal end of the humerus, not at the wrist. When extension of the hip is assessed, resistance is applied at the end of the femur. When flexion of the knee is assessed, resistance is applied at the distal end of the tibia.

Resistance is applied slowly, smoothly, and firmly at an appropriate intensity as determined by the size of the muscle mass. Stabilization is essential to assess movement patterns accurately. Only the area assessed is allowed to

FIGURE 10-7 **A,** Resistance at end of lever. **B,** Resistance at end of lever.

move. Movement in any other part of the body must be stabilized. A stabilizing force is usually applied by the massage therapist. As one hand applies resistance, the other provides stabilization. Sometimes the client can provide stabilization by holding onto the massage table. Some methods use straps to provide stabilization. The easiest way to identify the area to be stabilized is to move the area to be assessed through the ROM. At the end of the range, some other part of the body begins to move; this is the area of stabilization. Return the body to a neutral position. Provide appropriate stabilization to the area identified and begin the assessment procedure (Figure 10-8).

During assessments, muscles should be able to hold against appropriate resistance without strain or pain from the pressure, and without recruiting or using other muscles. Appropriate resistance is applied slowly and steadily and with just enough force to induce muscles to respond to the stimulus. Large muscle groups require greater force than small ones. The position should be easy to assume and comfortable to maintain for 10 to 30 seconds. Contraindications to this type of assessment include joint and disk dysfunction, acute pain, recent trauma, and inflammation.

When a movement pattern is evaluated, two types of information are obtained in one functional assessment.

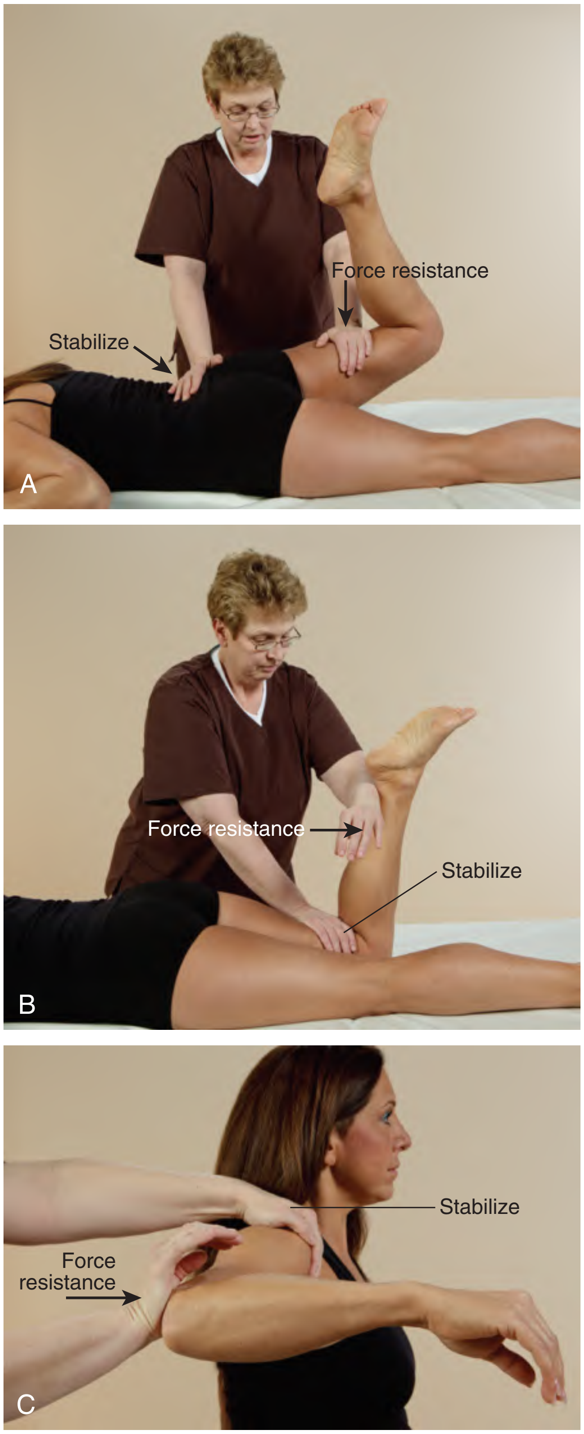


FIGURE 10-8 Examples of muscle testing **A,** Hip extension. **B,** Knee flexion. **C,** Shoulder retraction.

First, when a jointed area moves into flexion and the joint angle is decreased, the prime mover and synergists concentrically contract, the antagonists eccentrically function while lengthening, and the fixators isometrically contract and stabilize. Body-wide stabilization patterns also come into play to assist in allowing the motion. During assessment, resistance can be applied to load the prime mover groups, and synergists to assess for neurologic function of strength and, to a lesser degree, endurance, as the contraction is held for a period of time. At the same time, the antagonist pattern of the tissues that are lengthened during positioning for the functional assessment can be assessed for increased tension patterns or connective tissue shortening. Dysfunction shows itself in limited ROM by restricting the movement pattern. Therefore, when a jointed area is placed into flexion, the extensors are assessed for increased tension or shortening. When the jointed area moves into extension, the opposite becomes the case. The same holds for adduction and abduction, internal and external rotation, plantar flexion and dorsiflexion, and so on.

For a comprehensive strength testing sequence, see the Evolve website.

INTERPRETING MUSCLE-SPECIFIC TESTING FINDINGS

Muscle strength testing determines a muscle's force of concentric contraction. The preferred method is to isolate the muscle or muscle group by positioning the muscle with its attachment points as close together as possible. The muscle or muscle group being tested should be isolated as specifically as possible.

The client holds or maintains the contracted position of the muscle isolation while the therapist slowly and evenly applies counterpressure to pull or push the muscle out of its isolated position. The massage therapist must use sufficient force to recruit a full response by the muscles being tested but not enough to recruit other muscles in the body. The client should not hold his or her breath during assessment. If strength testing is done this way, there is little chance that the therapist will injure the client. As with all assessment, it is necessary to compare the muscle tested with a similar area—usually the same muscle group on the opposite side.

Another muscle testing method is to compare a muscle group's strength with its antagonist pattern. The body is designed so that the flexor, internal rotator, and adductor muscles are about 25% to 30% stronger than the extensor, external rotator, and abductor muscles. It is also designed so that flexors and adductors usually work against gravity to move a joint. The main purposes of extensors and abductors are to restrain and control the movement of flexor and adductor muscles and to return the joint to a neutral position. Less strength is required because gravity is assisting the function. A third form is strength testing to assess for facilitator and inhibitor patterns during gait function.

Strength testing should reveal a difference in the pattern between flexors, internal rotators, and adductors, and between extensors, external rotators, and abductors in an agonist/antagonist pattern. These groups should not be equally strong. Flexors, internal rotators, and adductors should show greater muscle strength than extensors, external rotators, and abductors (Box 10-3).

Muscle strength testing indicates the following possible findings:

- A strong and painless contraction indicates a normal structure.
- A painful but strong contraction indicates an injury or dysfunction in the tested muscle-tendon-periosteal unit.
- A weak and painless contraction may be caused by one or more of the following situations:
  - The muscle is inhibited owing to a hypertonic antagonist pattern.
  - The muscle is inhibited owing to dysfunction or injury to adjacent joint structures.
  - A spinal nerve condition is causing impingement on or irritation of the motor nerve and weakness in the muscles innervated by that nerve.
  - A nerve is injured.
  - The muscle is deconditioned owing to disuse as a result of previous injury or disease.
  - The length-tension relationship is long.
  - The length-tension relationship is short.
  - The gait pattern is dysfunctional.

BOX 10-3 Muscle Strength Grading Scale (Oxford Scale) Medical Research Council [MRC] Grading Scale

5 Normal
- Complete range of motion against gravity with full resistance

4 Good
- Complete range of motion against gravity with some resistance: Full range of motion with decreased strength
- Sometimes this category is subdivided further into 4/5, 4/5

3 Fair
- Complete range of motion against gravity with no resistance; active range of motion

2 Poor
- Complete range of motion with some assistance and gravity eliminated

1 Trace
- Evidence of slight muscular contraction, no joint motion evident

0
- No evidence of muscle contraction

NT, Not testable.
(Medical Research Council: Aids to the examination of the peripheral nervous system, London, 1976, Her Majesty's Stationary Office.)

POSTURAL AND PHASIC MUSCLES

Postural (stabilizer) and phasic (mover) muscles are made up of different kinds of muscle fibers. Postural muscles have a higher percentage of slow-twitch red fibers, which can hold a contraction for a long time before fatiguing. Phasic muscles have a higher percentage of fast-twitch white fibers, which contract quickly but tire easily. These two types of muscle develop different types of dysfunction and are tested differently.

Postural Muscles

Postural (stabilizer) muscles are relatively slow to respond compared with phasic muscles. They do not produce bursts of strength if asked to respond quickly, and they may cramp. They are the deliberate, slow, steady muscles that require time to respond. Using the analogy of the tortoise and the hare, these muscles are the tortoise. Inefficient neurologic patterns, muscle tension, reorganization of connective tissue with fibrotic changes, and trigger points are common in postural muscles.

If posture is not balanced, postural muscles must function more like ligaments and bones. When this happens, additional connective tissue develops in the muscle to provide the ability to stabilize the body in gravity. The problem is that the connective tissue freezes the body in the position because, unlike muscle, which can actively contract and lengthen, connective tissue is static.

Postural muscles tend to shorten and increase in tension when under a strain-tension-length relationship. This information is important when attempting to assess which muscles are tense and short, and therefore in need of lengthening, and which groups of muscle are apt to develop **connective tissue changes** and require stretching. Connective tissue shortening is dealt with mechanically through forms of stretch. Hypertension of concentric contraction muscles is dealt with through muscle energy methods and reflexive lengthening procedures.

Phasic Muscles

Phasic (mover) muscles jump into action quickly and tire quickly. It is more common to find musculotendinous junction problems in phasic muscles. The four most common problems are microtearing of muscle fibers at the tendon, inflamed tendons (tendonitis), tendons adhering to underlying tissue, and bursitis.

Phasic muscles usually weaken in response to postural muscle shortening. Sometimes the weakened muscles also shorten. This shortening allows the weak muscle to retain the same contraction power on the joint. It is important not to confuse this condition with hypertense muscles. These muscles are inhibited and weak.

Phasic muscles occasionally become overly tense and short. This almost always results from some sort of repetitive behavior and is a common problem in athletes. Phasic muscles also become short in response to a sudden posture change that causes the muscles to assist the postural muscles in maintaining balance. These common, inappropriate muscle patterns often result from an unexpected fall or near-fall, an automobile accident, or some other trauma. Basic massage methods discussed in this text can be used to reset and retrain out-of-sync muscles.

KINETIC CHAIN ASSESSMENT OF POSTURE

Objective

11. Describe and assess kinetic chain function.

Consider the body as a circular form divided into four quadrants: a front, a back, a right side, and a left side, with divisions on the sagittal and frontal planes; the body must be balanced in three dimensions to withstand the forces of gravity.

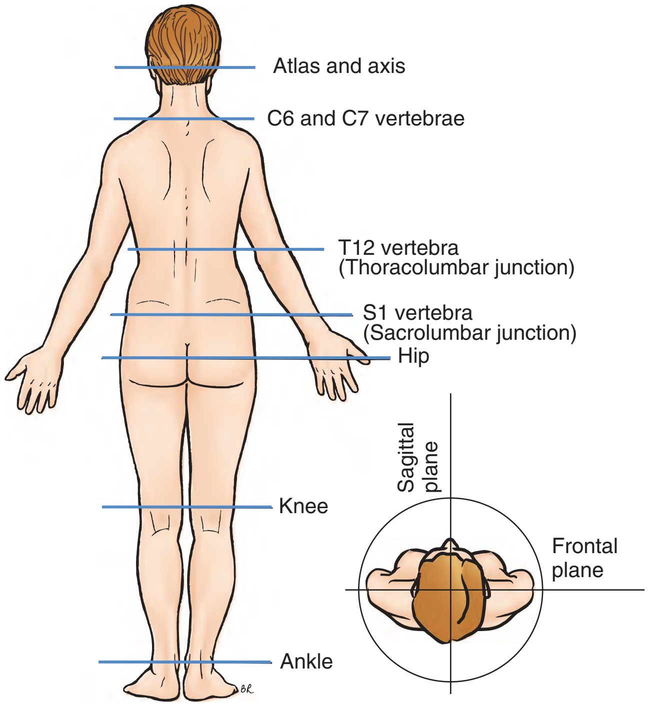


FIGURE 10-9 Quadrants and movement segments. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 3, St Louis, 2004, Mosby.)

The body moves and is balanced in gravity in the following transverse plane areas that easily allow movement: atlas; C6 and C7 vertebrae; T12 and L1 vertebrae (the thoracolumbar junction); L4, L5, and S1 vertebrae (the sacrolumbar junction); and hips, knees, and ankles (Figure 10-9). If a postural distortion exists in any of the four quadrants or within one of the jointed areas, the entire balance mechanism must be adjusted. This occurs as a pinball-like effect that jumps front to back and side to side in the soft tissue between the movement lines (see Figure 10-9).

To gain an understanding of postural balance, use a pole of some type (a broom handle without the broom portion will work). Tie a string around the pole. Now, try to balance the pole on its end with the string. Note that you work opposite the pattern when trying to counter the fall pattern of the pole. If the pole tends to fall forward and to the left, you apply a counterforce back and to the right.

This is also what the body does if part of it moves off the balance line. The body is made up of many different poles stacked on top of one another. The poles stack at each of the movement segments. Muscles between the movement segments must be three-dimensionally balanced in all four quadrants to support the pole in that area. Each area needs to be balanced. If one pole area tips a bit to the right, the body compensates by tipping the adjacent pole areas (above and/or below) to the left. If a pole area is tipped forward, adjacent poles are tipped back. A chain reaction occurs, such that when compensating poles tip back, their adjacent areas must counterbalance the action

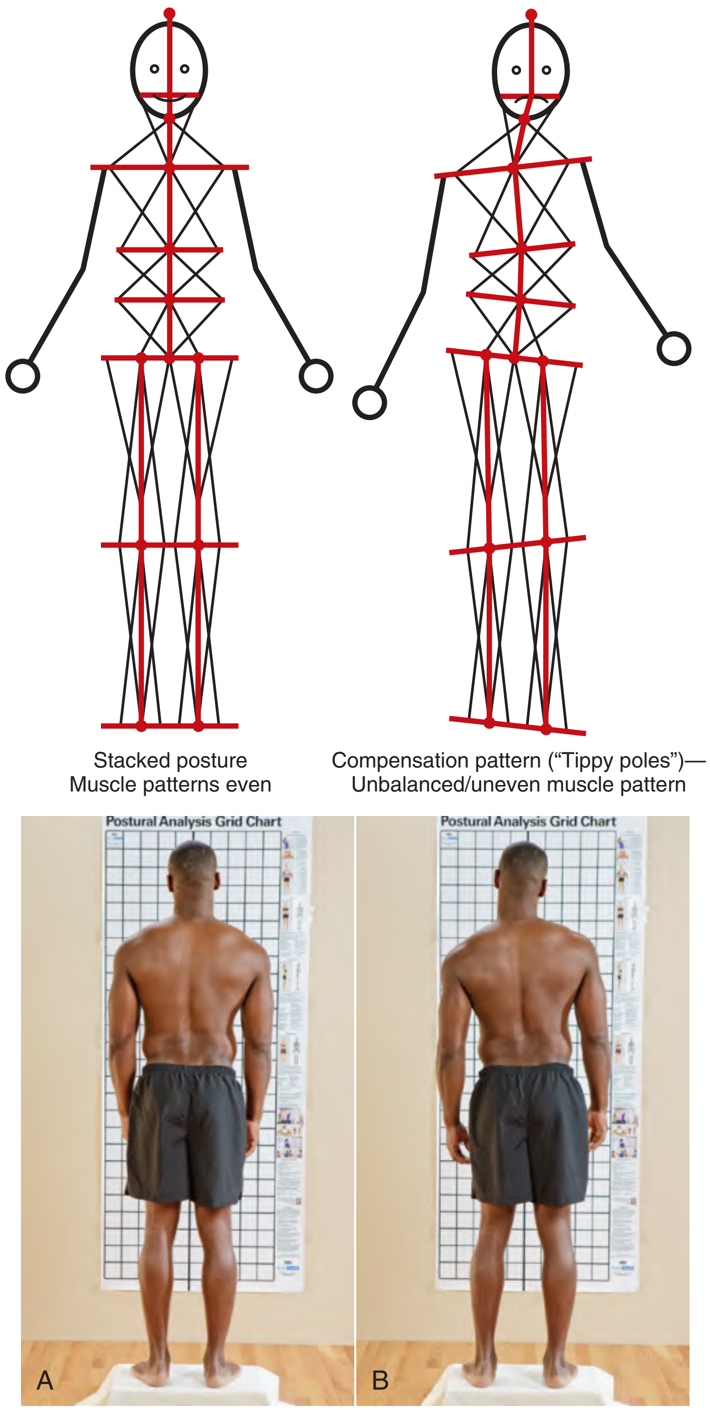


FIGURE 10-10 Posture balance and imbalance. Stacked poles **(A)** versus tippy pole **(B)** postural influences on the body. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 3, St Louis, 2004, Mosby.)

by tipping forward. This is how body-wide compensation patterns occur.

Whether the pole areas sit nicely on top of each other with evenly distributed muscle action or whether they are tipped in various positions and counterbalanced by compensatory muscle actions, the body remains balanced in gravity. However, the "tippy pole" pattern is much more inefficient than the "balanced pole pattern" (Figure 10-10).

Intervention plans attempt to normalize the balance process by relaxing the tension pattern in overly tight and short areas, strengthening muscles in corresponding taut and long but weak areas, and allowing the poles to straighten out. If a pole is permanently tippy, as with scoliosis or kyphosis, intervention plans attempt to support appropriate compensation patterns and prevent them from increasing beyond what is necessary for postural balance.

Muscle imbalance, discovered by observation, by palpation, and through muscle testing procedures, often indicates how the body is compensating for postural and movement imbalances. Muscle testing also can locate the main muscle problems. When the primary dysfunctional group of muscles is concentrically contracted against resistance, the main compensatory patterns are activated, and the other body compensation patterns are activated and exaggerated. The massage professional must then become a detective, looking for clues to unwind the pattern by concentrating on methods that restore symmetry of function.

A major muscle problem is overly tense muscles. If these muscles can be relaxed, lengthened, and, if necessary, stretched to activate connective tissue changes, the rest of the dysfunctional pattern often resolves.

If the extensors and abductors are stronger than the flexors and adductors, major postural imbalance and postural distortion result. Similarly, if the extensors and abductors are too weak to balance the other movement patterns, the body curls into itself, and nothing works properly.

If gait and kinetic chain patterns are inefficient, more energy is required for movement, and fatigue and pain can result.

Shortened postural (stabilizer) muscles must be lengthened and then stretched. This takes time and uses all the massage practitioner's technical skills. Because of the fiber configuration of the muscle tissue (slow-twitch red fibers or fast-twitch white fibers), techniques must be sufficiently intense and must be applied long enough to allow the muscle to respond.

Shortened and weak phasic muscles must first be lengthened and stretched. Eventually, strengthening techniques and exercises will be needed. Long and weak muscles need therapeutic exercise. If the hypertense phasic muscle pattern is caused by repetitive use, the muscles can be normalized with muscle energy techniques and then lengthened. Overly tense muscles often increase in size (hypertrophy). Muscle tissue that has undergone hypertrophy begins to return to normal if it is not used for the activity. The client must reduce the activity of that muscle group until balance is restored, which usually takes about 4 weeks. Athletes often display this pattern and very likely will resist complete inactivity. A reduced activity level and a more balanced exercise program, combined with flexibility training, can be beneficial for them. Refer these individuals to appropriate training and coaching professionals, if indicated.

People usually complain of problems in the tight but long eccentrically functioning and inhibited muscle areas. Massage in these areas makes the symptoms worse because massage further lengthens the area. Instead, identify the shortened tissues and apply massage to lengthen and stretch tense areas. Assessment must identify the concentrically contracted shortened areas so that correction can be applied.

MUSCLE FIRING PATTERNS

Log on to your Evolve website to watch Video 10-3: Muscle Activation Sequences (Muscle Firing Patterns).

A **muscle firing pattern** (or muscle activation sequence) is the sequence of muscle contraction involvement with agonist and synergist that best produces joint motion. Muscles also contract, or fire, in a neurologic sequence to produce coordinated movement. If the muscle firing pattern is disrupted, and if muscles fire out of sequence or do not contract when they are supposed to, labored movement and postural strain result. Firing patterns can be assessed by initiating a particular sequence of joint movements and palpating for muscle activity to determine which muscle is responding to the movement.

The central nervous system recruits appropriate muscles in specific muscle activation sequences to generate the appropriate muscle function of acceleration, deceleration, or stability. If these firing patterns are abnormal, with the synergist becoming dominant, efficient movement is compromised and the joint position is strained. The general activation sequence is (1) prime mover, (2) stabilizer, and (3) synergist. If the stabilizer has to also move the area (acceleration) or control movement (deceleration), it typically becomes short and tight. If the synergist fires before the prime mover, the movement is awkward and labored.

If one muscle is tight and short, reciprocal inhibition occurs. *Reciprocal inhibition* exists when a tight muscle decreases nervous stimulation of its functional antagonist, causing it to reduce activity. For example, a tight and short psoas decreases (inhibits) the function of the gluteus maximus. The activation and force production of the prime mover (gluteus maximus) are decreased, leading to compensation and substitution by the synergists (hamstrings) and stabilizers (erector spinae), creating an altered firing pattern.

The most common firing pattern dysfunction is synergistic dominance, in which a synergist compensates for a prime mover to produce the movement. For example, if a client has a weak gluteus medius, then synergists (the tensor fascia lata, adductor complex, and quadratus lumborum) become dominant to compensate for the weakness. This alters normal joint alignment, which further alters the normal length-tension relationships of the muscles around the joint. See Box 10-4 for the most

BOX 10-4 Common Muscle Firing Patterns

TRUNK FLEXION

1. Normal firing pattern
   a. Transverse abdominis
   b. Abdominal obliques
   c. Rectus abdominis
2. Assessment
   a. The client is supine with knees and hips at 90 degrees.
   b. The client is instructed to perform a normal curl-up.
   c. The massage practitioner assesses the ability of the abdominal muscles functionally to stabilize the lumbo-pelvic-hip complex by having the client draw the abdominal muscle in as when bringing the umbilicus toward the back, and then doing a curl, just lifting the scapula off the table while keeping both feet flat.

Trunk flexion

   d. The inability to maintain the draw-in position or dominance of the rectus demonstrates altered firing of the abdominal stabilization mechanism.
3. Altered firing pattern
   a. Weak agonist: abdominal complex
   b. Overactive antagonist: erector spinae
   c. Overactive synergist: psoas or rectus abdominis
4. Symptoms
   a. Low back pain
   b. Buttock pain
   c. Hamstring shortening

HIP EXTENSION

1. Normal firing pattern
   a. Gluteus maximus
   b. Opposite erector spinae
   c. Same-side erector spinae and hamstring
   OR
   a. Gluteus maximus
   b. Hamstring
   c. Opposite erector spinae
   d. Same-side erector spinae
2. Assessment
   a. With the client prone, the massage practitioner palpates the erector spinae with the thumb and index finger of one hand

BOX 10-4 Common Muscle Firing Patterns—cont'd

and palpates the muscle belly of the gluteus maximus and hamstring with the little finger and the thumb of the opposite hand.
   b. The practitioner instructs the client to extend the hip more than 15 degrees from the table.

Hip extension

3. Altered firing pattern
   a. Weak agonist: gluteus maximus
   b. Overactive antagonist: psoas
   c. Overactive stabilizer: erector spinae
   d. Overactive synergist: hamstring
4. Symptoms
   a. Low back pain
   b. Buttock pain
   c. Recurrent hamstring strains

HIP ABDUCTION

1. Normal firing pattern
   a. Gluteus medius
   b. Tensor fasciae latae
   c. Quadratus lumborum
2. Assessment
   a. With the client side-lying, the massage practitioner stands behind the client and palpates the client's quadratus lumborum with one hand and the tensor fasciae latae and gluteus medius with the other hand.
   b. The practitioner instructs the client to abduct the leg from the table.

Hip abduction

3. Altered firing pattern
   a. Weak agonist: gluteus medius
   b. Overactive antagonist: adductors
   c. Overactive synergist: tensor fasciae latae
   d. Overactive stabilizer: quadratus lumborum
4. Symptoms
   a. Low back pain
   b. Sacroiliac joint pain
   c. Buttock pain
   d. Lateral knee pain
   e. Anterior knee pain

KNEE FLEXION

1. Normal firing pattern
   a. Hamstrings
   b. Gastrocnemius
2. Assessment
   a. With client lying prone, the massage practitioner places fingers on the hamstring and gastrocnemius.
   b. The client flexes the knee.

Knee flexion

3. Altered firing pattern
   a. Weak agonist: hamstrings
   b. Overactive synergist: gastrocnemius
4. Symptoms
   a. Pain behind the knee
   b. Achilles' tendonitis

Continued

BOX 10-4 Common Muscle Firing Patterns—cont'd

KNEE EXTENSION

1. Normal firing pattern
   a. Vastus medialis
   b. Vastus intermedialis and vastus lateralis
   c. Rectus femoris
2. Assessment
   a. The client lies supine with leg extended. The practitioner asks the client to pull the patella cranially (up). The massage practitioner places finger on vastus medialis oblique, vastus lateralis, and rectus femoris.

Knee extension

3. Altered firing pattern
   a. Weak agonist: vastus medius, primarily the oblique portion
   b. Overactive synergist: vastus lateralis
4. Symptoms
   a. Knee pain under patella
   b. Patellar tendonitis
5. Intervention for altered firing patterns
   a. Use appropriate massage application to inhibit dominant muscle and then strengthen the weak muscles.

SHOULDER FLEXION

1. Normal firing pattern
   a. Supraspinatus
   b. Deltoid
   c. Infraspinatus
   d. Middle and lower trapezius
   e. Contralateral quadratus lumborum
2. Assessment
   a. The massage practitioner stands behind the seated client with one hand on shoulder and the other on the contralateral quadratus area.
   b. The practitioner asks the client to abduct shoulder to 90 degrees.

Shoulder flexion

3. Altered firing pattern
   a. Weak agonist: levator scapula
   b. Overactive antagonist: upper trapezius
   c. Overactive stabilizer: ipsilateral quadratus lumborum
4. Symptoms
   a. Shoulder tension
   b. Headache at base of skull
   c. Upper chest breathing
   d. Low back pain

commonly used assessment procedures and interventions for altered firing patterns.

Each jointed area has a movement muscle activation sequence. The movement is a product of the entire mechanism, including the following:

- Bones, joints, and ligaments
- Capsular components and design
- Tendons, muscle shapes, and fiber types
- Interlinked fascial networks, nerve distribution, and myotatic units of prime movers
- Antagonists, synergists, and fixators
- Neurologic kinetic chain interactions
- Body-wide influence of reflexes, including positional and righting reflexes of vision and the inner ear and gait reflex
- Circulatory distribution
- General systemic balance
- Nutritional influences

Assessment of a movement pattern as normal indicates that all parts are functioning in a well-orchestrated manner. When a dysfunction is identified, causal factors can arise from any one or a combination of these elements. Often a multidisciplinary diagnosis is necessary to identify clearly the interconnected nature of the pathologic condition.

Inappropriate firing patterns can be addressed by inhibiting the muscles that are contracting out of sequence and stimulating the appropriate muscles to fire. Compression to the muscle belly effectively inhibits a muscle. Tapotement is a good technique for stimulating muscles. If the problem does not normalize easily, referral to an exercise professional may be indicated.

GAIT ASSESSMENT

Objective

12. Perform gait assessment.

Log on to your Evolve website to watch Video 10-4: Gait Assessment.

Understanding the basic body movements of walking helps the massage therapist recognize dysfunctional and inefficient gait patterns.

Disruption of gait reflexes creates the potential for many problems. Common gait problems include a functional short leg caused by muscle shortening, tight neck and shoulder muscles, aching feet, and fatigue. The massage therapist must understand biomechanics, including posture, interaction of joint functions, and gait, and must expand that knowledge to the demands of sport performance.

This is especially important in rehabilitation progress in which walking is the goal or part of the program. It is important to observe the client from front, back, and both sides. To begin, the massage practitioner should watch the client walk, noticing the heel-to-toe foot placement. The toes should point directly forward with each step.

Observe the upper body. It should be relaxed and fairly symmetric. The head should face forward with the eyes level with the horizontal plane. There is a natural arm swing that is opposite to the leg swing. The arm swing begins at the shoulder joint. On each step, the left arm moves forward as the right leg moves forward and then vice versa. This pattern provides balance. The rhythm and pace of the arm and leg swing should be similar. Increased walking speed increases the speed of the arm swing. The length of the stride determines the arc of the arm swing.

Observe the client walking, and note his or her general appearance. The optimal walking pattern is as follows:

1. Head and trunk are vertical, with the eyes easily maintaining forward position and level with the horizontal plane; shoulders are level.
2. Arms swing freely opposite the leg swing, allowing the shoulder girdle to rotate opposite the pelvic girdle.
3. Step length and step timing are even.
4. The body oscillates vertically with each step.
5. The entire body moves rhythmically with each step.
6. At the heel strike, the foot is approximately at a right angle to the leg.
7. The knee is extended but not locked.
8. The body weight is shifted forward into the stance phase.
9. At push-off, the foot is strongly plantar-flexed, with defined hyperextension of the metatarsophalangeal joints of the toes.
10. During the leg swing, the foot easily clears the floor with good alignment, and the rhythm of movement remains unchanged.
11. The heel contacts the floor first.
12. The weight then rolls to the outside of the arch.
13. The arch flattens slightly in response to the weight load.
14. The weight then is shifted to the ball of the foot in preparation for the spring-off from the toes and shifting of weight to the other foot.

During walking, the pelvis moves slightly in a side-lying figure-eight pattern. Movements that make up this sequence are transverse, medial, and lateral rotation. The stability and mobility of the sacroiliac joints play very important roles in this alternating side figure-eight movement. If these joints are not functioning properly, the entire gait is disrupted. The sacroiliac joint is one of the few joints in the body that is not directly affected by muscles that cross the joint. It is a large joint, and bony contact between sacrum and ilium is broad. It is common for the rocking of this joint to be disrupted (Figure 10-11).

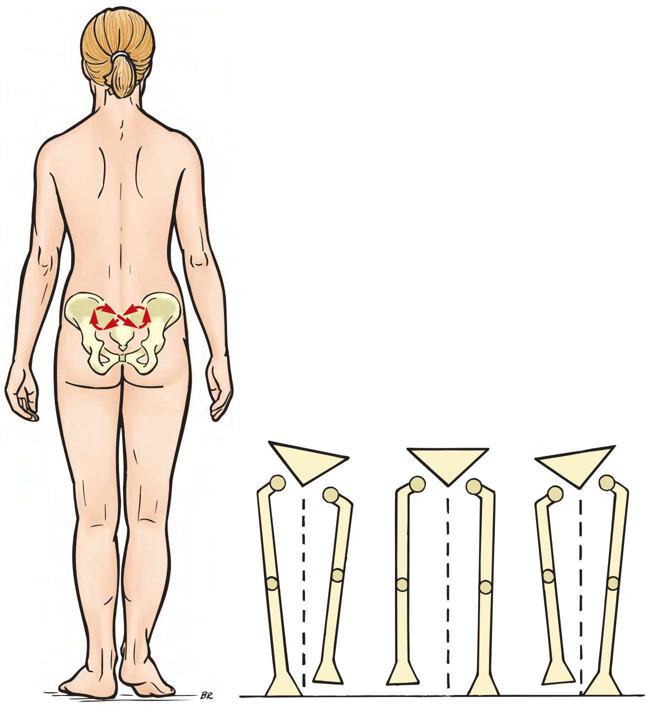


FIGURE 10-11 The mechanism of the slight rocking movement of the sacroiliac joint. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

The hips rotate in a slightly oval pattern, beginning with a medial rotation during the leg swing and heel strike, followed by a lateral rotation through the push-off. The knees move in a flexion and extension pattern opposite each other. The extension phase never reaches enough extension to initiate the normal knee lock pattern that is used in standing. The ankles rotate in an arc around the heel at heel strike and around a center in the forefoot at push-off. Maximal dorsiflexion at the end of the stance phase and maximal plantar flexion at the end of push-off are necessary.

When assessing gait, observing for areas of the body that do not move efficiently during walking is a good means of detecting dysfunctional areas. Pain causes the body to tighten and alters the normal relaxed flow of walking. Muscle weakness and shortening interfere with neurologic control of agonist (prime mover) and antagonist muscle action. Hypomobility (limitation of joint movement) and hypermobility (laxity) result in protective muscle contraction.

If the situation becomes chronic, both muscle shortening and muscle weakness result. Changes in the soft tissue, including all connective tissue elements of the tendons, ligaments, and fascial sheaths, restrict the normal action of muscles. Connective tissue usually shortens and becomes less pliable.

Amputation disrupts the body's normal diagonal balance. Obviously, any amputation of the lower limb disturbs the walking pattern. What is not so obvious is that amputation of any part of the upper limb affects the counterbalance movement of the arm swing during walking. The rest of the body must compensate for the loss. Loss of any of the toes greatly affects the postural information sent to the brain from the feet.

It is possible to have soft tissue dysfunction without joint involvement. Any change in the tissue around a joint has a direct effect on joint function. Changes in joint function eventually cause problems with the joint. Any dysfunction of the joint immediately involves the surrounding muscles and other soft tissue.

Disruption of gait demands that the body compensate by shifting movement patterns and posture. Because of this, all dysfunctional patterns are whole body phenomena. Working only on the symptomatic area is ineffective and offers only limited relief. Therapeutic massage with a whole body focus is extremely valuable in dealing with gait dysfunction. Corrective measures include normalizing muscle firing patterns and gait reflex patterns (see Box 10-4).

The Evolve website provides step-by-step visual instructions for performing gait testing assessments, findings, and intervention suggestions.

Interpreting Gait Assessment Findings

When interpreting the information gathered from **gait assessment**, the massage practitioner should focus on areas that do not move easily when the client walks and areas that move too much. Areas that do not move are restricted; areas that move too much are compensating for inefficient function. By releasing the restrictions through massage and reeducating the reflexes through neuromuscular work and exercise, the practitioner can help the client improve the gait pattern.

The techniques followed are similar to those for postural corrections. The shortened and restricted areas are softened with massage, and then the neuromuscular mechanism is reset with muscle energy techniques, muscle lengthening, stretching, and normalizing of firing patterns.

The client should be taught slow lengthening and stretching procedures. After stimulating the muscles in weakened areas, the practitioner can refer the client for strengthening exercises. The therapist must be sure that the adaptation methods are built into the context of a complete massage rather than spot work on isolated parts of the body. Suggestions can be made to the client to evaluate factors that may contribute to these adaptations, such as posture, footwear, chairs, tables, beds, clothing, workstations, physical tasks (e.g., shoveling), and repetitive exercise patterns.

SACROILIAC JOINT FUNCTION

Log on to your Evolve website to watch Video 10-5: Correction Methods for Gait Assessment and/or Muscle Firing Patterns.

Proper functioning of the sacroiliac (SI) joint is an important factor in walking patterns. Because sacroiliac joint movement has no direct muscular component, it is difficult to use any kind of muscle energy lengthening when working with this joint. The SI joint is embedded deep in supporting ligaments. To keep surrounding ligaments pliable, direct and specific, connective tissue techniques are indicated unless the joint is hypermobile. If that is the case, external bracing combined with rehabilitative movement may be indicated. Sometimes the ligaments restabilize the area. Stabilization of the jointed area should be interspersed with massage and gentle stretching to ensure that the ligaments remain pliable and do not adhere to each other. This process takes time.

To assess for possible SI joint involvement, apply deep broad-based compression over the joint (Figure 10-12). If symptoms increase, SI joint dysfunction is indicated. Another assessment is to have the client stand on one foot and then extend the trunk. This loads the SI joint and would increase symptoms of SI joint dysfunction. Have the client lie prone and extend the hip. Then apply resistance to the opposite arm and have the client push against the resistance by extending the shoulder and arm (Figure 10-13), and then, while doing this, also extend the contralateral hip. If it is easier to lift and symptoms are relieved, SI joint function can be improved by exercise and massage, because force closure mechanisms are able to be addressed. If no improvement is noted, external bracing may help.

FIGURE 10-12 Broad-based compression over the sacroiliac joint. Force closure assessment.

FIGURE 10-13 Sacroiliac joint assessment—force closure.

The diagnosis of specific joint problems and fitting for external bracing are outside the scope of practice for therapeutic massage, and the client must be referred to the appropriate professional.

ANALYSIS OF MUSCLE TESTING AND GAIT PATTERNS

Log on to your Evolve website to watch Video 10-6: Low Back Pain Assessment.

It is important to consider the pattern of muscle interactions that occurs with walking. Remember that gait has a certain pattern for efficient movement. For example, if the left leg is extended for the heel strike, the right arm also is extended. This results in activation of flexors of both the arm and the leg and inhibition of the extensors. It is common to find a strength imbalance in this gait pattern. One muscle out of sequence with the others can set up tense (too strong) or inhibited (weak) muscle imbalances. Whenever a muscle contracts with too much force, it overpowers the antagonist group, resulting in inhibited muscle function. Imbalances can occur anywhere in the pattern.

Strength muscle testing should reveal that the flexor and adductor muscles of the right arm activate, facilitate, and coordinate with the flexors and adductors of the left leg. The opposite is also true: left arm flexors and adductors activate, facilitate, and coordinate with the right leg flexors and adductors. Extensors and abductors in the limbs coordinate in a similar fashion.

If the flexors of the left leg are activated, as occurs during strength testing, the flexors and adductors of the right arm should be facilitated and should be strong in strength testing. The flexors and adductors of the right leg and left arm should be inhibited and should be weak in strength testing. Also, the extensors and abductors in the right arm and left leg should be inhibited. All associated patterns follow suit (i.e., activation of the right arm flexor pattern facilitates the left leg flexor pattern and inhibits left arm and right leg flexor muscles while facilitating extensors and abductors). In a similar way, activation of the adductors of the right leg facilitates the adductors of the left arm and inhibits the abductors of the left leg and right arm. The other adductor/abductor patterns follow the same interaction pattern.

All these patterns are associated with gait mechanisms and reflexes. If any pattern is out of sync, gait, posture, and efficient function are disrupted.

GAIT MUSCLE TESTING AS AN INTERVENTION TOOL

An understanding of gait provides a powerful intervention tool. For example, a person trips and strains the left hip extensor muscles. Gait muscle testing reveals an imbalanced pattern by showing that the left hip extensor muscles are weak, whereas the flexors in the left hip and the right arm/shoulder are overly tense. The hip and the leg are sore and cannot be used for work, but the arm muscles are fine. By activating the extensors in the right shoulder and arm, movement of the left hip extensor muscles can be facilitated. By activating the flexors of the left arm, the flexors of the left hip are inhibited. This process may restore balance in the gait pattern. Many combinations are possible based on gait pattern and reflexes. Gait muscle testing provides the means of identifying these interactions.

PALPATION ASSESSMENT

Objective

13. Perform palpation assessment.

Palpation assessment is a major aspect of the massage. In any given massage, about 90% of the touching is also assessment developed as part of gliding, kneading, or joint movement. Palpation assessment makes contact with tissue but does not override it or encourage it to change.

Palpation assessment is used to identify normal tissue and movement with deviations from the norm. The least affected area is the norm for comparison. The tissues the massage therapist should be able to distinguish are skin, superficial fascia, fascial sheaths, tendons, ligaments, blood vessels, muscle layers, and bone. Palpation also includes assessment for hot and cold and for various body rhythms, including breathing patterns and pulses.

Using palpation assessment, the massage therapist is able to:

- Differentiate between different types of tissue
- Distinguish differences of tissue texture and density in the same tissue types
- Palpate through the various tissue layers from superficial to deep

The acronym *STAR* or *TART* is used in osteopathic medicine to describe changes in tissue and movement that are assessable when dysfunction occurs (Chaitow, 2010):

- S = sensitivity
- T = tissue texture
- A = asymmetry
- R = range of motion

If a client experiences pain during palpation, it is important to first check technique to make sure that palpation is not the cause of the pain. Pain in a particular area does not necessarily mean that there is a problem. Some areas of the body are naturally a little painful when deeply palpated. These points will be located on both sides of the body in the same area and are typically the locations of nerves. If tissues feel normal to the massage therapist but cause pain when palpated, compare them with the same areas on the other side of the body. If there is a difference, then there may be a problem; if they feel the same, there is no problem and the feeling is normal.

The American College of Rheumatology has developed a quantifiable method of assessing tissue tenderness. The response to palpatory stimulus is determined by observing pain behaviors, such as facial grimacing and signs of withdrawal. By comparing the painful sites with uninvolved body areas, it is possible to determine whether the response is due to increased physiologic activity. This same assessment process can be used to detect a change in pain perception at the same pressure. Instruments for gauging pressure, called *algometers,* can further objectify the assessment. A baseline of 4 kg of pressure is used (enough to blanch the tip of a thumbnail pressed on a table), and results are rated as follows:

- Grade 0—No tenderness
- Grade I—Tenderness with no physical or verbal response
- Grade II—Tenderness with grimacing or flinching or both
- Grade III—Tenderness with withdrawal (positive jump sign)
- Grade IV—Withdrawal from non-noxious stimuli

There is no benefit in applying deep pressure to a small area because this shows only what those particular tissues feel like and gives no information about how they compare with surrounding tissues. Instead, it is necessary to palpate all tissues in the area to feel any textural changes. Damage can occur in soft tissue at any level. One mistake sometimes made during palpation assessment is to explore deeper and deeper into the tissues in an effort to find the problem, only to miss it because it is located more superficially. It is therefore necessary to vary the degree of pressure used, from fairly light to very deep, to assess all the different tissue layers. When palpating tissues around a joint, move the joint into different positions to access different surfaces of bones and soft tissues. Pressing into tissue and removing all the slack puts the tissue in tension. Normally, there is no pain with pressing into the soft tissue—only a sense of pressure.

- *Normal:* The soft tissue feels resilient and pliable, blanches when compressed, and then quickly returns to normal color. There is no abnormal movement or pain.
- *Acute injury:* The soft tissue feels boggy, warm, or hot. The client feels pain before tissue is palpated and can often point to the most painful area.
- *Chronic condition:* The soft tissue feels fibrous, thickened, stiff, and tight. Pain sensations are more dull and occur over a larger area.

The recommended sequence of applications of palpation is as follows:

1. Near-touch palpation.
2. Palpation of the skin surface.
3. Palpation of the skin itself.
4. Palpation of the skin and superficial connective tissue.
5. Palpation of the superficial connective tissue only.
6. Palpation of vessels and lymph nodes.
7. Palpation of muscles.
8. Palpation of tendons.
9. Palpation of fascial sheaths.
10. Palpation of ligaments.
11. Palpation of bones.
12. Palpation of abdominal viscera.
13. Palpation of body rhythms.

NEAR-TOUCH PALPATION

The first application of palpation does not involve touching the body. Near-touch palpation detects hot and cold areas and is best performed just off the skin using the back of the hand, because the back of the hand is very sensitive to heat. The general temperature of the area and any variations should be noted. Very sensitive cutaneous (skin) sensory receptors detect changes in air pressure and currents and movement of air. Being able to consciously detect these subtle sensations is an invaluable assessment tool.

Hot areas may be caused by inflammation, muscle spasm, hyperactivity, or increased surface circulation. When the focus of intervention is to cool down hot areas, one method is application of ice (see section on hydrotherapy). Another way to cool an area is to reduce muscle spasm and encourage more efficient blood flow in the surrounding areas.

FIGURE 10-14 **A,** Palpation of skin surface. Stroking of the skin provides information related to skin texture, temperature, moisture, and dryness. **B,** Surface stroking of the skin. Slowly move over the area and sense for differences in relationship to surrounding tissues.

Cold areas often are areas of diminished blood flow, increased connective tissue formation, or muscle flaccidity. Cold areas may have heat applied to them. Stimulation massage techniques increase muscle activity, thus heating up the area. Connective tissue approaches soften connective tissue, help restore space around the capillaries, and release histamine, a vasodilator, to increase circulation. These approaches can warm a cold area.

PALPATION OF THE SKIN SURFACE

The second application of palpation is very light stroking of the skin surface (Figure 10-14). First, determine whether the skin is dry or damp. Damp areas feel a little sticky, or the fingers drag. This light stroking causes the root hair plexus that senses light touch to respond. It is important to notice whether an area reacts with more "goose bumps" than other areas (pilomotor reflex). This is a good time to observe for color, especially blue or yellow coloration. The practitioner also should note and keep track of all moles and surface skin growths, pay attention to the quality and texture of the hair, and observe the shape and condition of the nails.

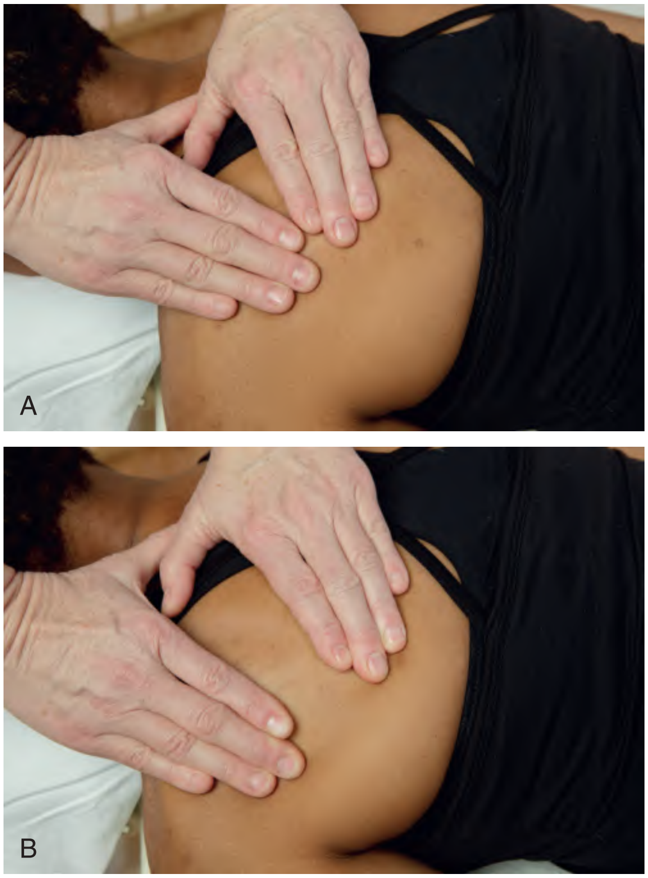


FIGURE 10-15 **A,** Skin stretching used to assess for elasticity. **B,** Skin that seems tight compared with surrounding skin may indicate dysfunctional areas.

PALPATION OF THE SKIN ITSELF

Palpation of the skin itself is done through gentle, slight stretching of the skin in all directions, comparing the elasticity of these areas (Figure 10-15). The skin also can be palpated for surface texture. By applying light pressure to the skin surface, roughness or smoothness can be felt.

Skin should be contained, hydrated, resilient, and elastic, and should have even and rich coloration. Skin that does not spring back into its original position after a slight pinch may be a sign of dehydration. The skin should have no blue, yellow, or red tinges. Blue coloration suggests lack of oxygen; yellow indicates liver problems, such as jaundice; and redness suggests fever, alcohol intake, trauma, or inflammation. Color changes are most noticeable in the lips, around the eyes, and under the nails.

Bruises must be noted and avoided during massage. If a client displays any hot red areas or red streaking, he or she should be referred to a physician immediately. This is especially important when symptoms are present in the lower leg because of the possibility of deep vein thrombosis (blood clot).

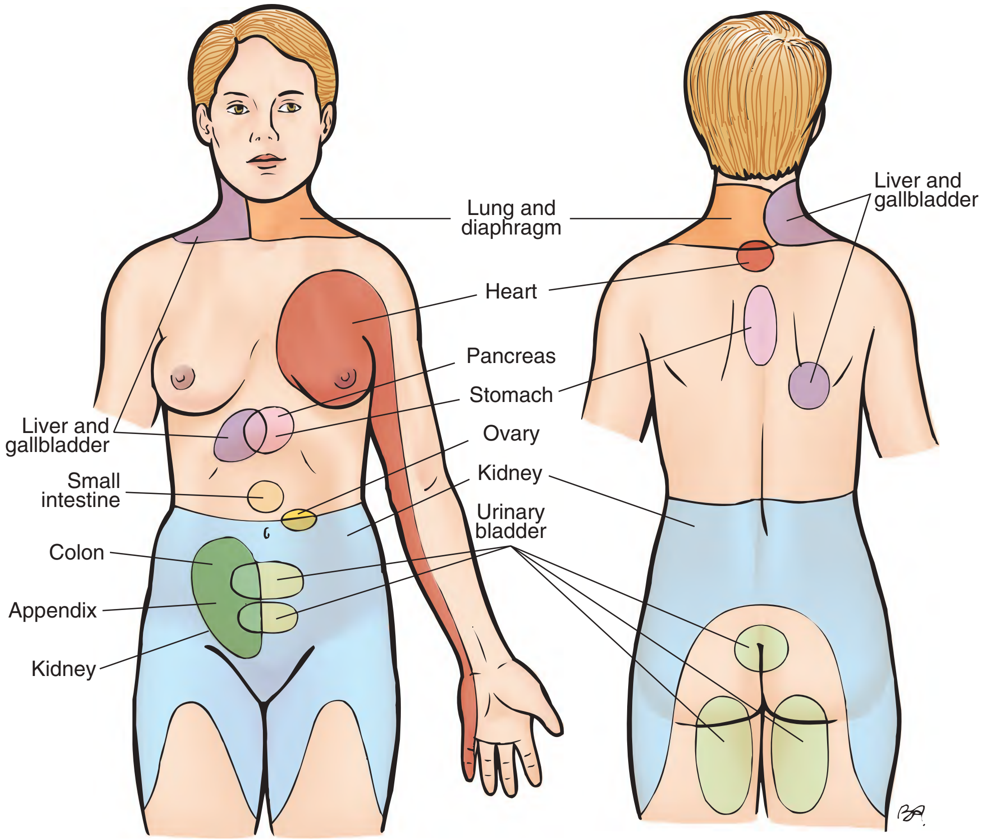


FIGURE 10-16 Referred pain. The diagram indicates cutaneous areas to which visceral pains may be referred. The massage professional encountering pain in these areas needs to refer the client to a physician for diagnosis to rule out visceral dysfunction. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

The skin should be watched carefully for changes in any moles or lumps. As massage professionals, we often spend more time touching and observing a person's skin than anyone else, including the person being massaged. If we keep a keen eye out for changes and refer clients to physicians early, many skin problems can be treated before they become serious.

Depending on the area, the skin may be thick or thin. The skin of the face is thinner than the skin of the lower back. The appearance of the skin in each particular area, however, should be consistent. The skin loses its resilience and elasticity over areas of dysfunction. It is important to be able to recognize visceral referred pain areas in the skin (Figure 10-16). If changes occur to the skin in these areas, refer the client to a physician.

The skin is a blood reservoir. At any given time it can hold 10% of available blood in the body. The connective tissue in the skin must be soft to allow the capillary system to expand to hold the blood. Histamine, which is released from mast cells found in the connective tissue of the superficial fascial layer, dilates the blood vessels. Histamine is also responsible for the sense of "warming and itching" in an area that has been massaged.

Damp areas on the skin are indications that the nervous system has been activated in that area. This small amount of perspiration is part of a sympathetic activation called a *facilitated segment.* Surface stroking with enough pressure to drag over the skin elicits a red response over the area of a hyperactive muscle. Deeper palpation of the area usually elicits a tender response. The small erector pili muscles attached to each hair are under the control of the sympathetic autonomic nervous system. Light fingertip stroking produces goose bumps over areas of nerve hyperactivity. All of these responses can indicate potential activity, such as trigger points in the layers of muscle under the indicated area.

The hair and nails are part of the integumentary system and reflect health conditions. The hair should be resilient and secure; hair loss should not be excessive when the scalp is massaged.

The nails should be smooth. Vertical ridges may indicate nutritional difficulties, and horizontal ridges may be signs of stress caused by changes in circulation that affect nail growth. Clubbed nails may also indicate circulation problems. The skin around the nails should be soft and free of hangnails.

It is important to continuously monitor the skin and associated structures. During times of stress, the epithelial tissues are affected first. Signs of prolonged stress, medication side effects, and pathologic conditions include hangnails, split skin around the lips and nails, mouth sores, hair loss, dry scaly skin, and excessively oily skin. This area is

FIGURE 10-17 Skin roll examples. Posterior neck lift **(A)** and roll **(B).** Lumbar area lift **(C)** and roll **(D).**

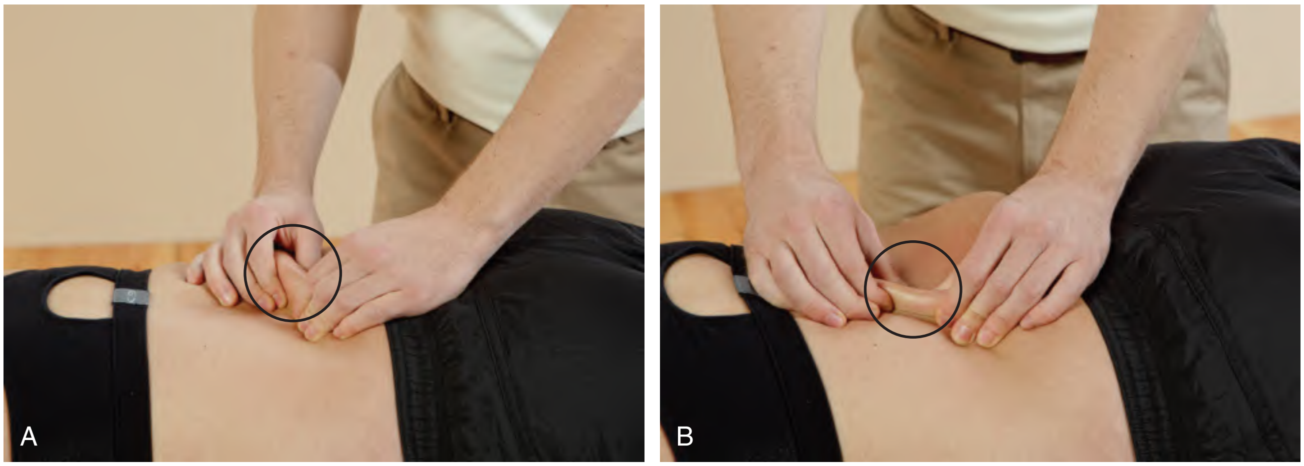


FIGURE 10-18 Measuring skin fold during skin roll. **A,** Normal: thick and lifts. **B,** Abnormal: thin and bound.

one of the best for assessing adaptive capacity. For example, slow wound healing would indicate strain in the system.

PALPATION OF THE SKIN AND SUPERFICIAL CONNECTIVE TISSUE

In palpation of both the skin and superficial connective tissue, a method such as skin rolling is used to further assess the texture of the skin by lifting it from the underlying fascial sheath (Figure 10-17) and measuring the skin fold, or comparing the two sides for symmetry (Figure 10-18). The skin should move evenly and should glide on the underlying tissues. Areas that are stuck, restricted, or too loose should be noted, as should any areas of the skin that become redder than surrounding areas.

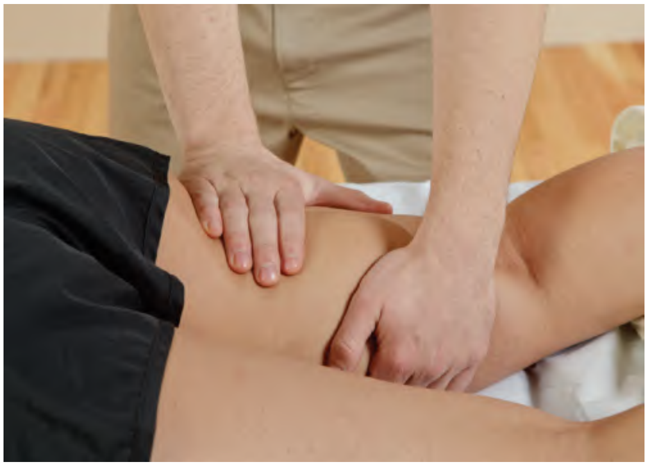


FIGURE 10-19 Use of kneading to assess the skin and superficial connective tissues by lifting of the tissues.

FIGURE 10-20 Areas of reddening indicate connective tissue changes.

PALPATION OF SUPERFICIAL CONNECTIVE TISSUE ONLY

The fifth application of palpation is the superficial connective tissue, which separates and connects the skin and muscle tissue. It allows the skin to glide over the muscles during movement. This layer of tissue is found by applying compression until the fibers of the underlying muscle are felt. The pressure then should be lightened so that the muscle cannot be felt, but if the hand is moved, the skin also moves. This area feels a little like a very thin water balloon. The tissue should feel resilient and springy, like gelatin. Superficial fascia holds fluid. If surface edema is present, it is found in the superficial fascia. This water-binding quality gives this area the feel of a water balloon, but it should not feel boggy or soggy or show pitting edema (i.e., the dent from the pressure remains in the skin).

Methods of palpation that lift the skin, such as kneading and skin rolling, provide much information. Depending on the area of the body and the concentration of underlying connective tissue, the skin should lift and roll easily (Figure 10-19). Loosening of these areas is very beneficial, and the practitioner can achieve this by applying assessment methods (kneading and skin rolling) slowly and deliberately, allowing a shift in the tissues. A constant drag should be kept on the tissues, because both skin and superficial connective tissue are affected.

Any area that becomes redder than the surrounding tissue or that stays red longer than other areas is suspect for connective tissue changes (Figure 10-20). Usually, lifting and stretching (bend, shear, and torsion forces) of the reddened tissue or use of myofascial approaches (tension forces) will normalize these areas.

PALPATION OF VESSELS AND LYMPH NODES

The sixth application of palpation involves circulatory vessels and lymph nodes. Just above the muscle and still in the superficial connective tissue lie the more superficial blood vessels. These vessels are distinct and feel like soft tubes. Pulses can be palpated, but if pressure is too intense, the feel of the pulse is lost (Figure 10-21). Palpating for pulses helps detect this layer of tissue.

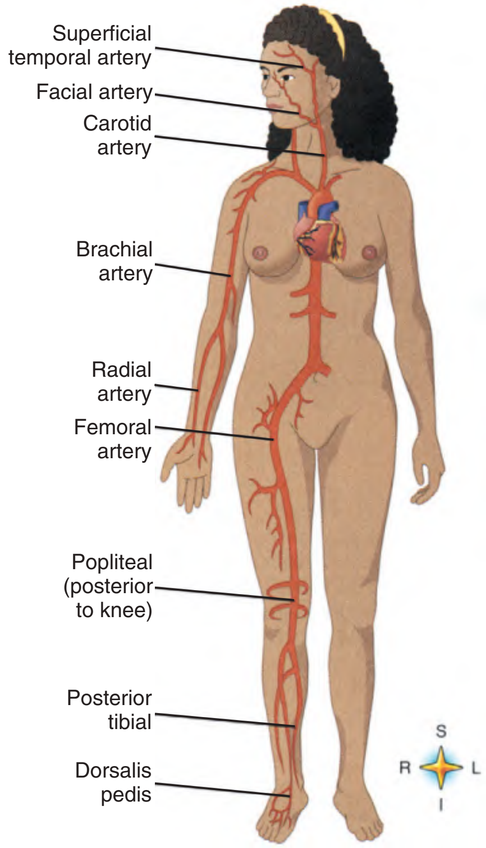


FIGURE 10-21 Pulse points. Each pulse point is named after the artery with which it is associated. (From Thibodeau GA, Patton KT: *Anatomy and physiology,* ed 5, St Louis, 2003, Mosby.)

In this same area are the more superficial lymph vessels and lymph nodes. Lymph nodes usually are located in joint areas and feel like small, soft "gelcaps." The compression of the joint action assists in lymphatic flow. A client with enlarged lymph nodes should be referred to a medical

FIGURE 10-22 Sliding of muscle layers. **A** and **B,** Sliding rectus femoris. **C** and **D,** Sliding hamstrings.

professional for diagnosis. Very light, gentle palpation of lymph nodes and vessels is indicated in this circumstance.

Vessels should feel firm but pliable and supported. If bulging, mushiness, or constriction is noted in any areas, the massage therapist should refer the client to a physician.

Pulses should be compared by feeling for a strong, even, full-pumping action on both sides of the body. If differences are perceived, the massage practitioner should refer the client to a physician. Sometimes the differences in pulses can be attributed to soft tissue restriction of the artery or to a more serious condition that can be diagnosed by the physician. Refill of capillaries in nail beds after compression of the nail should take approximately 3 to 5 seconds and should be equal in all fingers.

Enlarged lymph nodes may indicate local or systemic infection or a more serious condition. The client should be referred to a physician immediately.

PALPATION OF SKELETAL MUSCLES

The seventh application of palpation is skeletal muscle. Muscle is made up of contractile fibers embedded in connective tissue. Muscle has a distinct fiber direction. Its texture feels somewhat like corded fabric or fine rope. The area of the muscle that becomes the largest when the muscle is concentrically contracted is in the belly of the muscle. Where the muscle fibers end and the connective tissue continues, the tendon develops; this is called the *musculotendinous junction.*

It is a good practice activity to locate both of these areas for all surface muscles and for as many underlying ones as possible. Almost all muscular dysfunctions, such as trigger points or microscarring from minute muscle tears, are found at the musculotendinous junction or in the belly of the muscle. Most acupressure points, often classified as *motor points,* also are located in these areas.

Often three or more layers of muscle are present in an area. These layers are separated by fascia, and each muscle layer should slide over the one beneath it (Figure 10-22).

Muscle tends to push up against palpating pressure when it is concentrically contracting. Having the client slowly move the joint that is affected can help in identifying the proper locations of muscles being assessed (Figure 10-23).

In palpation of the muscles, compressing systematically through each layer until the bone is felt is important (Figure 10-24). Pressure used to reach and palpate the deeper layers of muscle must travel from the superficial layers down to the deeper layers. To accomplish this, the compressive force must be even, broad-based, and slow. There should be no “poking” quality to the touch or

FIGURE 10-23 Specific palpation of a muscle. **A,** Place hand on target muscle belly (biceps brachii) and have client contract against resistance to initiate concentric action, making the tissues push up and feel hard. **B,** Example of specific palpation of hamstrings.

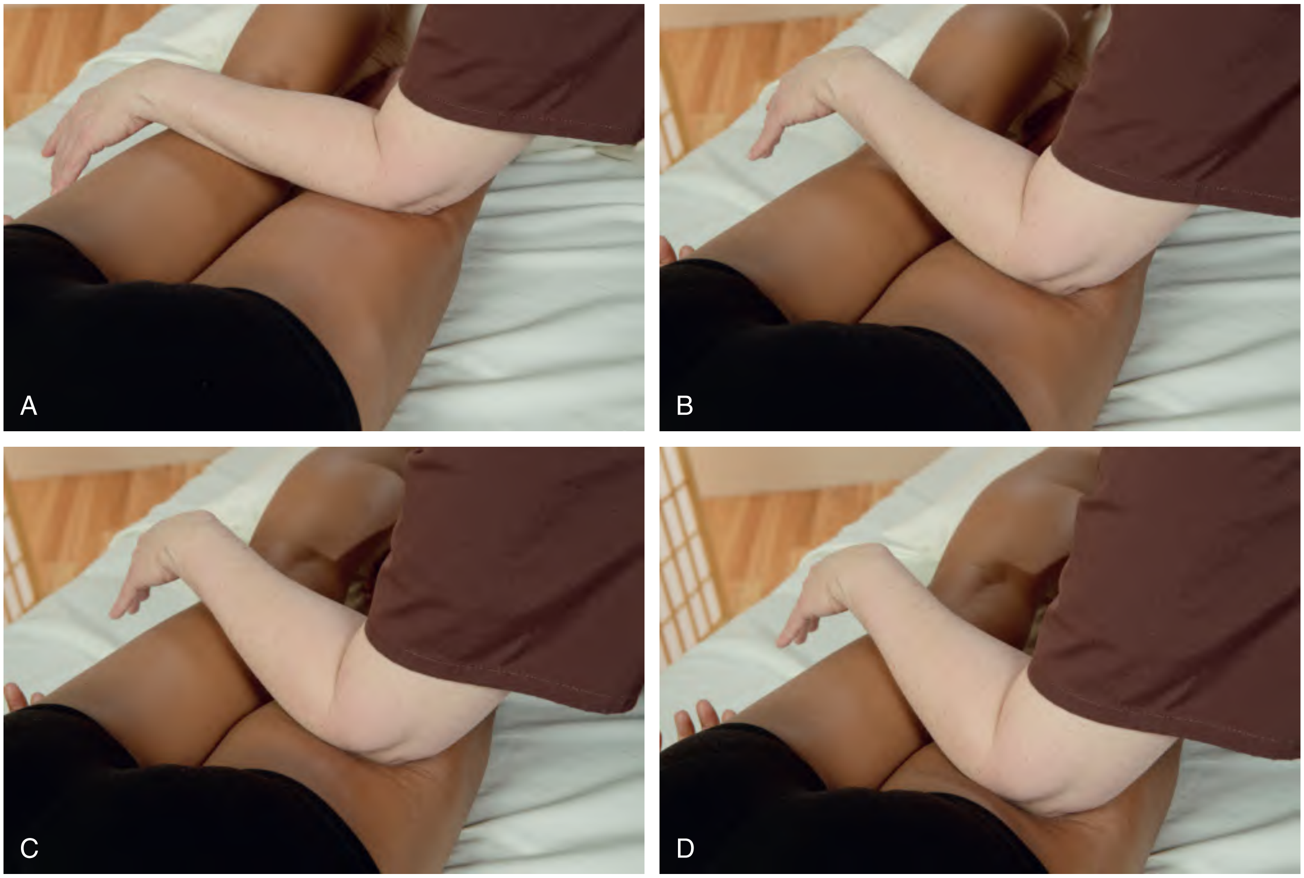


FIGURE 10-24 Massage applications systematically generate force through each tissue layer. This figure provides a graphic representation of force applied, which would begin with light superficial applications, progressing with increased pressure to the deepest layer. **A,** Surface. **B,** First muscle layer. **C,** Second muscle layer. **D,** Third muscle layer.

abrupt pressure pushing through muscle layers, because the surface layers of muscle will tense up and guard, preventing access to deeper layers.

Palpation of each specific muscle area involves sliding each layer of muscle back and forth over the underlying layer to make sure there is no adherence between muscle layers.

Muscle layers usually run cross-grain to each other. The best example of this is the abdominal muscle group. Even in the arm and leg, where all muscles seem to run in the same direction, a diagonal crossing and spiraling of the muscle groups is evident.

Interpreting Skeletal Muscle Assessment Findings

Muscles can feel tense and ropy in both concentric (short) and eccentric (long) patterns. Therefore think of muscle functioning as short and tight, and long and tight.

Skeletal muscle is assessed both for texture and for function. It should be firm and pliable. Soft, spongy muscle or hard, dense muscle indicates connective tissue dysfunction. Muscle atrophy results in a muscle that feels smaller than normal. Hypertrophy results in a muscle that feels larger than normal. Application of appropriate techniques can normalize the connective tissue component of the muscle. Excessively strong or weak muscles can be caused by problems with neuromuscular control or imbalanced work or exercise demand. Weak muscles can be a result of wasting (atrophy) of the muscle fibers.

Tension can be felt in muscles that are concentrically short or eccentrically long. Tension that manifests in short muscles that are concentrically contracted results in tissue that feels hard and bunched. When muscles are tense from being pulled into an extension pattern, they feel like long, taut bundles with some contraction and shortened muscle fiber groups. Usually, flexors, adductors, and internal rotators become short, whereas extensors, abductors, and external rotators palpate tense but are long and have eccentric contraction patterns. Massage treatment most often first addresses the short concentrically contracted muscles to lengthen them, rather than the long muscles, because massage methods usually result in longer tissues, which would ultimately worsen the problem. Therapeutic exercise is necessary to restore normal tone to the "long muscles."

Spot work on isolated areas is seldom effective. Neurologic muscle imbalances are kinetic chain interactions linked by reflex patterns, most notably gait reflexes and the interaction between postural and phasic muscles.

Important areas are the musculotendinous junction and the muscle belly, where the nerve usually enters the muscle. As was pointed out earlier, motor points cause a muscle contraction with a small stimulus. Disruption of sensory signals at the motor point causes many problems, including trigger points and referred pain, hypersensitive acupressure points, and restricted movement patterns caused by an increase in the physiologic barrier and the development of pathologic barriers.

PALPATION OF TENDONS

The eighth application of palpation is the tendons. Tendons have a higher concentration of collagen fibers and feel more pliable and less ribbed than muscle. Tendons feel like duct tape. Under many tendons is a cushion of fluid-filled bursae that assists the movement of the bone under the tendon.

Tendons should feel elastic and mobile. Tendon pathology is called *tendinopathy*. If a tendon has been torn, it may adhere to the underlying bone during the healing process. Some tendons, such as those of the fingers and toes, are enclosed in a sheath and must be able to glide within the sheath. If they cannot glide, inflammation builds up, and the result is *tenosynovitis*. Overuse also can cause inflammation. Inflammation signals the formation of connective tissue, which can interfere with movement and cause the tendons to adhere to surrounding tissue. In tendons without a sheath, this condition is called *tendonitis*. Frictioning techniques help these conditions. Usually, tight tendon structures are normalized when the resting length of the muscle is normalized.

PALPATION OF FASCIAL SHEATHS

The ninth application of palpation is fascial sheaths. Fascial sheaths feel like sheets of plastic wrap. They separate muscles and expand the connective tissue area of bone for muscular attachment. Some, such as the lumbodorsal fascia, the abdominal fascia, and the iliotibial band, run on the surface of the body and are thick, like a tarp. Others, such as the linea alba and the nuchal ligament, run perpendicular to the surfaces of the body and the bone like a rope. Still others run horizontally through the body. The horizontal pattern occurs at joints (Figure 10-25), the diaphragm muscle (which is mostly connective tissue), and the pelvic floor. Fascial sheaths separate muscle groups. They provide a continuous, interconnected framework for the body that follows the principles of tensegrity. Fascial sheaths are kept taut by the design of the cross-pattern and the action of muscles that lie between the sheaths, such as the gluteus maximus, which lies between the iliotibial band and the lumbodorsal fascia.

The larger nerves and blood vessels lie in grooves created by the fascial separations. Careful comparison reveals that the location of the traditional acupuncture

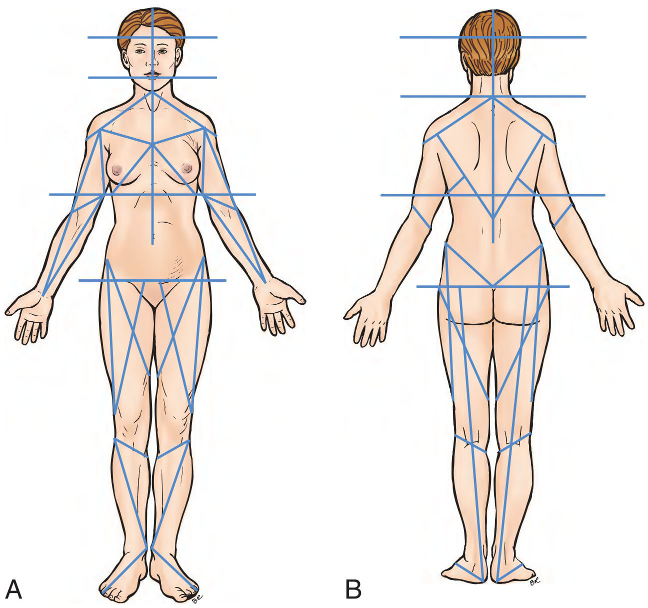


FIGURE 10-25 Fascial sheaths. **A,** Anterior view. **B,** Posterior view. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

meridians corresponds to these nerve and blood vessel tracts. The fascial separations can be made more distinct and more pliable by palpating with the fingers. With sufficient pressure, the fingers tend to fall into these grooves, which can then be followed. These areas need to be resilient and pliable but distinct, because they serve as both stabilizers and separators.

Fascial sheaths should be pliable, but because they are stabilizers, they may be denser than tendons in some areas. Problems arise if the tissues these sheaths separate or stabilize become stuck to the sheath, or if the fascial sheath becomes less pliable.

Myofascial approaches are best suited to dealing with the fascial sheaths. Mechanical work, such as slow, sustained stretching, and methods that pull and drag on the tissue are used to soften the sheaths. Because it often is uncomfortable, creating a burning, pulling sensation, the work should not be done unless the client is committed to regular appointments until the area is normalized. This may take 6 months to 1 year.

Chronic health conditions almost always show dysfunction of the connective tissue and fascial sheaths. Any techniques categorized as connective tissue approaches are effective as long as the practitioner proceeds slowly and follows the tissue pattern. The massage therapist should not override the tissue or force the tissue into a corrective pattern. Instead, the tissue must be untangled or unwound gradually, following ease and bend directions.

Fascial separations between muscles create pathways for the nerves and blood vessels. When palpated, these pathways feel like grooves running between muscles. If these areas become narrow or restricted, blood vessels may be constricted and nerves impinged. A slow, specific, stripping gliding along these pathways can be beneficial (Figure 10-26). The nerves run in these fascial pathways, and the nerve trunks correlate with the traditional meridian system.

FIGURE 10-26 Gliding in fascial grooves. **A,** Identify the separation between muscle compartments. **B,** Glide slowly, assessing for adherence and binding.

Therefore, most meridian and acupressure work takes place along these fascial grooves (Figure 10-27). Muscle layers are also separated by fascia, and because muscles must be able to slide over each other, it is necessary to make sure that there is no adherence between muscles. This situation often occurs in the legs. If assessment indicates that the muscles are stuck to each other, kneading and gliding can be used to slide one muscle layer over the other.

Water is an important element of connective tissue. To keep connective tissue soft, the client must remain hydrated.

PALPATION OF LIGAMENTS

Ligaments feel like bungee cords, and some are flat when palpated. Ligaments should be flexible enough to allow the joint to move, yet stable enough to restrict movement. It is important to be able to recognize a ligament and not mistake it for a tendon. With the joint in a neutral position, if muscles are isometrically contracted, the tendon moves but the ligament does not. If ligaments are not pliable or are tender, shear force is used to normalize the tissue.

PALPATION OF JOINTS

The eleventh application of palpation is the joints. Careful palpation should reveal the space between synovial joint ends. Joints often feel like hinges. Most assessment is of active and passive joint movements. An added source of information is palpation of a joint while it is in motion. There should be a stable, supported, resilient, and unrestricted range of motion.

Log on to your Evolve website for a summary of joint function.

When palpating joints, it is important to assess for end-feel, as previously discussed. Simply put, end-feel is the perception of the joint at the limit of its ROM, and it may be soft or hard. In most joints, it should feel soft. This means that the body is unable to move any more through muscular contraction, but a small additional move by the therapist still produces some give. A hard end-feel is what bony stabilization of the elbow feels like on extension. No more active movement is possible, and passive movement is restricted by bone.

For the massage practitioner, it is important to be able to palpate the bony landmarks that indicate tendinous attachment points of the muscles and to trace the shape of the bone.

Movement of the joints through a comfortable ROM can be used as an evaluation method. Comparison of the symmetry of ROM (e.g., comparing the circumduction pattern of one arm with that of the other) is effective for detecting limitations of a particular movement. Muscle energy methods, as well as all massage manipulations, can be used to support symmetric ROM functions.

All these tissues and structures are supported by general massage applications, which result in increased circulation,

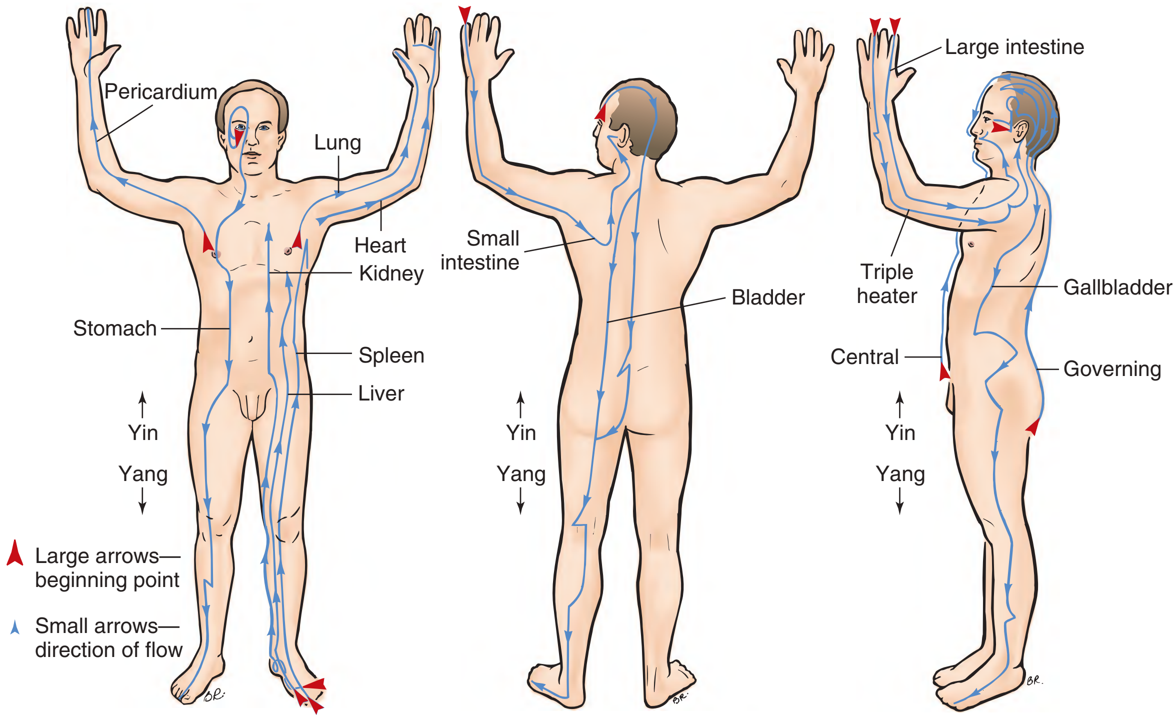


FIGURE 10-27 Typical location of meridians. Meridians tend to follow nerves and grooves. Yin and yang meridians are paired as follows: (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 3, St Louis, 2004, Mosby.)

Yin Meridian	Yang Meridian
Pericardium	Triple heater
Liver	Gallbladder
Kidney	Bladder
Heart	Small intestine
Spleen	Stomach
Lung	Large intestine

increased pliability of soft tissue, and normalized neuromuscular patterns.

Massage can positively affect the normal limits of the physiologic barrier. When joints are traumatized, the surrounding tissue becomes "scared," almost as if saying, "This joint will never get in that position again." When this happens, all proprioceptive mechanisms reset to limit ROM, setting up a pathologic barrier. Massage and appropriate muscle lengthening and general stretching, combined with muscle energy techniques and self-help, can have a beneficial effect on ligaments and joint function. Ligaments are relatively slow to regenerate, and it takes time to notice improvement.

PALPATION OF BONES

The twelfth application of palpation is the bones. Those who have developed their palpation skills find a firm but detectable pliability when palpating bone. Bones feel like young sapling tree trunks and branches.

PALPATION OF ABDOMINAL VISCERA

The thirteenth application of palpation is the viscera. The abdomen contains the viscera, or internal organs of the body. It is important for the massage professional to be able to locate and to know the positioning of the organs in the abdominal cavity (Figure 10-28). The massage therapist should be able to palpate the distinct firmness of the liver and the location of the large intestine.

Refer the client to a physician if any hard, rigid, stiff, or tense areas are noted in the abdomen, or if pain is increased when palpation pressure ceases. Close attention must be paid to visceral referred pain areas. If tissue changes are noted in these areas, the practitioner must refer the client to a physician.

The skin often is tighter in areas of visceral referred pain. As a result of cutaneous/visceral reflexes, benefit may be obtained by stretching the skin in these areas. There is some indication that normalizing the skin over these areas has a positive effect on functioning of the organ. If nothing

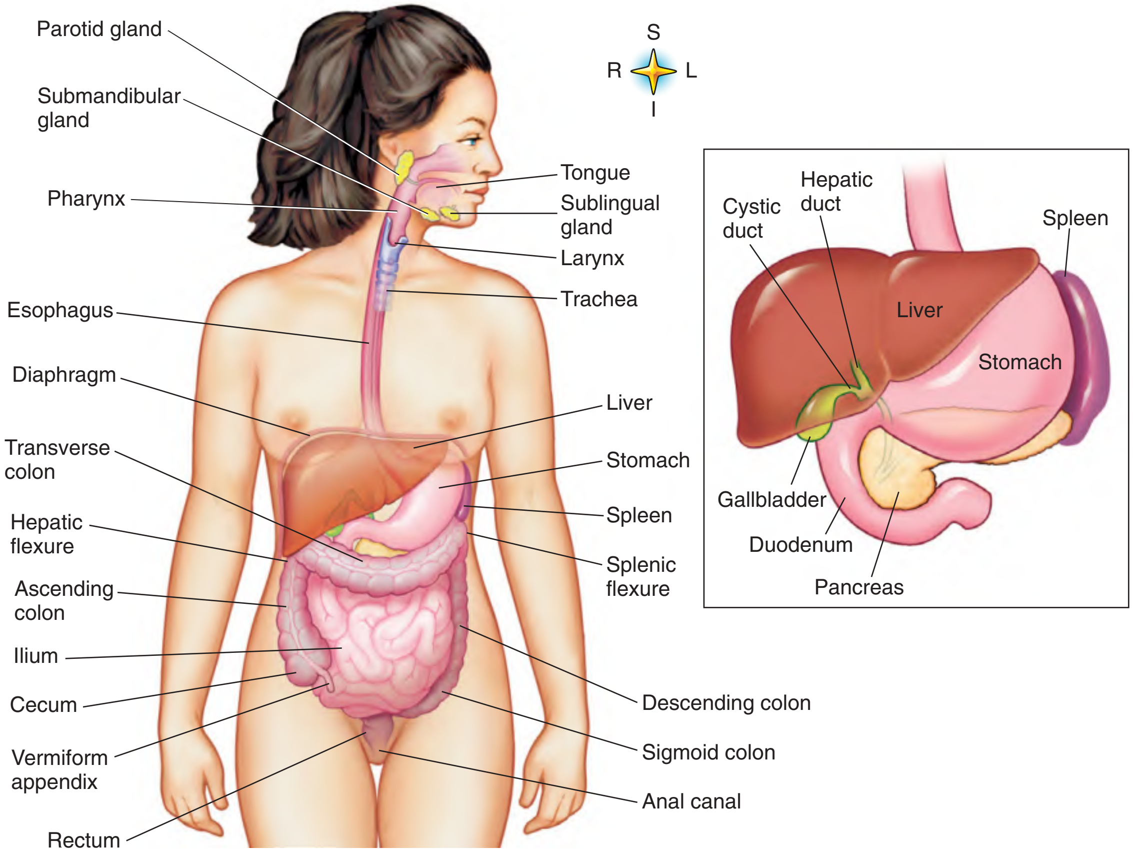


FIGURE 10-28 Location of digestive organs. (From Thibodeau GA, Patton KT: *The human body in health and disease*, ed 5, St Louis, 2010, Mosby.)

else, circulation is increased and peristalsis (intestinal movement) may be stimulated.

In accordance with the recommendations for colon massage, repetitive stroking in the proper directions may stimulate smooth muscle contraction and can improve elimination problems and intestinal gas (Figure 10-29). Psoas work is often done through the abdomen.

PALPATION OF BODY RHYTHMS

The fourteenth application of palpation is the body rhythms. Body rhythms are felt as even pulsations or undulations. Body rhythms are designed to operate in a coordinated, balanced, and synchronized manner. In the body, all rhythms are entrained. When palpating body rhythms, the practitioner should get a sense of this harmony. Although the trained hand can pick out some of the individual rhythms, just as one can hear individual notes in a song, it is the whole connected effect that is important. When a person feels "off" or "out of sync," often he or she is speaking of disruption in the entrainment process of body rhythms.

Respiration

The breathing rhythm is easy to feel. It should be even and should follow good principles of inhalation and exhalation. To palpate the breath, while the client goes through three or more breathing cycles, the practitioner places his or her hands over the client's ribs and evaluates the evenness and fullness of the breaths. Relaxed breathing should result in slight rounding of the upper abdomen and lateral movement of the lower ribs during inhalation. Movement in the shoulders or upper chest indicates potential difficulties with the breathing mechanism.

Improved breathing function helps the entire body. The muscular mechanism for inhalation and exhalation of air is like a simple bellows system and depends on unrestricted movement of the musculoskeletal components of the thorax. Muscles of respiration include scalenes, intercostals, anterior serratus, diaphragm, abdominals, and pelvic floor muscles. If a breathing pattern disorder is a factor and the person is prone to anxiety, intervention softens and normalizes the upper body and supports the mechanism of breathing.

Because of the whole body interplay between muscle groups in all actions, including breathing, it is not uncommon to find tight lower leg and foot muscles interfering with breathing. Disruption of function in any of these muscle groups inhibits full and easy breathing.

General relaxation massage and stress reduction methods seem to help breathing the most. The client can be taught slow lengthening and stretching methods and the breathing retraining pattern. The client also can be

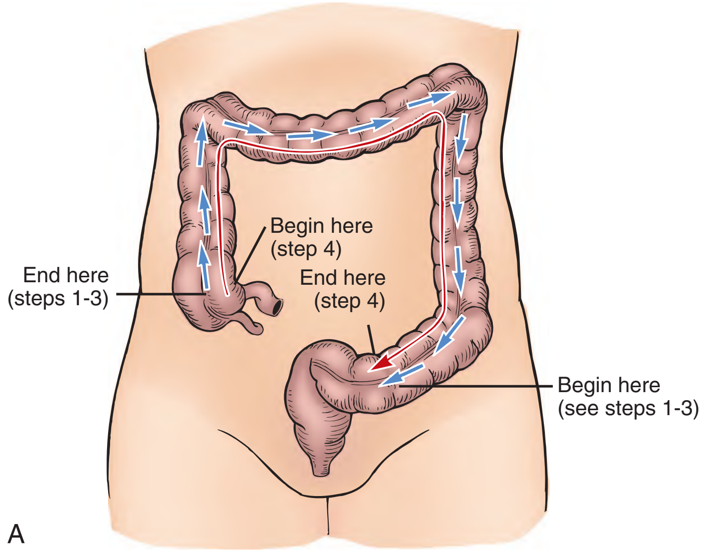


FIGURE 10-29 **A,** Colon with flow pattern arrows. All massage manipulations are directed in a clockwise fashion. Manipulations begin in the lower left-hand quadrant (on the left side as one views the illustration) at the sigmoid colon. The methods progressively contact all of the large intestine as they eventually end up encompassing the entire colon area.

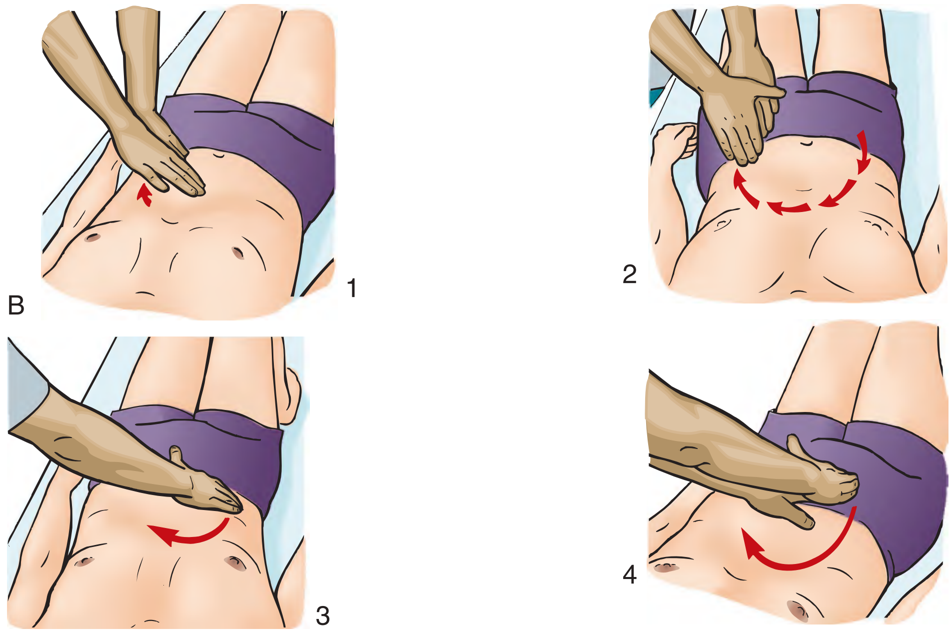


FIGURE 10-29 **B,** Abdominal sequence. The direction of flow for emptying of the large intestine and colon is as follows: *1,* Massage down the left side of the descending colon using short strokes directed to the sigmoid colon. *2,* Massage across the transverse colon to the left side using short strokes directed to the sigmoid colon. *3,* Massage up the ascending colon on the right side of the body using short strokes directed to the sigmoid colon. End at the right side of the ileocecal valve located in the lower right-hand quadrant of the abdomen. *4,* Massage entire flow pattern using long, light to moderate strokes from the ileocecal valve to the sigmoid colon. Repeat sequence. (Modified from Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

advised to not wear restrictive clothing and not to hold in the stomach. (See specific protocol for breathing dysfunction.)

Circulation

The movement, or circulation, of the blood is felt at the major pulse points. The pulses should be balanced on both sides of the body. Basic palpation of the movement of blood is done by placing the fingertips over pulse points on both sides of the body and comparing for evenness.

The vascular refill rate is another means of assessing the efficiency and rhythm of the circulation. To assess this rate, press the nail beds until they blanch (push blood out), then let go and count the seconds until color returns. A normal rate is 3 to 5 seconds.

Assessment of Subtle Body Rhythms

Many other biological oscillators function in a rhythmic pattern, but they are more difficult to palpate. Body rhythms are assessed before and after massage. Improvement in rate and evenness should be noted after the massage. Massage offered by a centered practitioner with a focused, rhythmic intent provides patterns for the client's body to use to entrain its own rhythms. The massage practitioner must remain focused on the natural rhythms of the client. Although the entrainment pattern of the practitioner and the massage provides a pattern for the client, it should not superimpose an unnatural rhythm on the client. Any foreign patterns ultimately will be rejected by the client's body. Instead, the practitioner should support the client in reestablishing his or her innate entrainment rhythm. Supported by rocking methods and a rhythmic approach to the massage and the appropriate use of music, the body can reestablish synchronized rhythmic function.

UNDERSTANDING ASSESSMENT FINDINGS

Objectives

14. Integrate clinical reasoning into the treatment plan using assessment findings.
15. Relate assessment data to first-degree, second-degree, and third-degree dysfunction, and categorize the adaptation response to stage 1, 2, or 3 pathology.

Functional biomechanical assessment defines mobility based on active and passive movements of the body through the use of palpation and observation to detect distortion in these movements. Muscle testing and identification of the functional relationships of muscles also are performed.

Typical dysfunction includes the following:

- Local joint hypermobility or hypomobility
- Gait dysfunction
- Altered firing patterns (activation sequences)
- Postural imbalance (tippy pole)

Any one or a combination of these conditions can lead to changes in motor function and can be accompanied by temporary or chronic joint, muscular, and nervous system disorders. The results of an assessment identify appropriate function or dysfunction in each area. When all assessments have been completed, the overall result is described as normal or as stage 1, stage 2, or stage 3 dysfunction. Typical dysfunction includes local functional block, local hypermobility or hypomobility, altered firing patterns, and postural imbalance, all of which lead to changes in motor function and are accompanied by temporary or chronic disorders of the joints, muscles, and nervous system.

Functional assessment defines mobility through active and passive movements of the body and by palpation and observation of distortion in these movements. Muscle testing and definition of the functional relationships of muscles are also performed.

Distortions in functioning are often measured and categorized in the following manner:

First-degree distortion—Shortening or weakening of some muscles or the formation of local changes in tension or connective tissue in these muscles. For usual and simple movements, a person has to use additional muscles from different parts of the body. As a result, movement becomes uneconomical and labored.

Second-degree distortion—Moderately expressed shortening of postural muscles and weakening of antagonist muscles. Moderately peculiar postures and movements of some parts of the body are evident. Postural and movement distortions, such as altered firing patterns, begin to occur.

Third-degree distortion—Clearly expressed shortening of postural muscles and weakening of antagonist muscles, with the appearance of specific, nonoptimal movement. Significantly expressed peculiarity in postures and movement occurs. Increased postural and movement distortions result.

It is important to define which muscles are shortened and which are inhibited and likely long and taut, to determine the appropriate therapeutic intervention.

Based on the three levels of distorted function, three stages apparently occur in the development of postural and movement pathology:

Stage 1 Dysfunction (Functional Tension). At stage 1 dysfunction (functional tension), a person tires more quickly than normal. This fatigue is accompanied by the first- or second-degree limitation of mobility, painless local myodystonia (changes in muscle length-tension relationship and motor tone), postural imbalance of the first or second degree, and nonoptimal motor function of the first degree.

Stage 2 Dysfunction (Functional Stress). Stage 2 dysfunction (functional stress) is characterized by a feeling of fatigue following moderate activity, discomfort, slight pain, and the appearance of one or more degrees of limited mobility that is painless or that results in first-degree pain. It may be accompanied by local hypermobility or hypomobility. Functional stress is also characterized by reflex vertebral-sensory dysfunction, fascial/connective tissue changes, and regional postural imbalance. It is accompanied by distortion of motor function of the first- or second-degree increase in motor tone and firing pattern alterations.

Stage 3 Dysfunction (Connective Tissue Changes in the Musculoskeletal System). Reasons for connective tissue changes include overloading, disturbances of tissue nutrition, microtrauma, microhemorrhage, unresolved edema, and other endogenous (inside the body) and exogenous (outside the body) factors. Hereditary predisposition is also a consideration. In stage 3 dysfunction, changes in the spine and weight-bearing joints may appear, with areas of local hypermobility and instability of several vertebral motion segments, hypomobility, widespread painful muscle tension, fascial and connective tissue changes in the muscles, regional postural imbalance of the second or third degree in many joints, and temporary nonoptimal motor function with second- or third-degree distortion. Visceral disturbances may be present.

IMPLICATIONS FOR MASSAGE TREATMENT

Functional tension can often be managed effectively by massage methods applied by practitioners with training equivalent to 500 to 1000 hours that includes an understanding of the information presented in this text and technical training in the chosen method. Working with stages 2 and 3 (functional stress and connective tissue changes) usually requires more training and proper supervision within a multidisciplinary approach.

Assessment also identifies areas of resourceful and successful compensation. These compensation patterns occur when the body has been required to adapt to some sort of trauma or repetitive use pattern. Permanent adaptive changes, although not as efficient as optimal functioning, are the best pattern that the body can develop in response to an irreversible change in the system. Resourceful compensation is not to be eliminated but supported.

Years of clinical experience have taught many therapists that most symptoms and dysfunctional patterns are compensatory patterns. Some problems are recent, and others qualify for archaeologic exploration, having developed in early life and having been compounded through time. Compensatory patterns often are complex, but the client's body frequently can show us the way if we can listen to the story it tells.

There are many instances of *resourceful compensation,* a term used for the adjustments the body makes to manage a permanent or chronic dysfunction. Protective muscle spasm (guarding) around a compressed disk is an example. The splinting action of the spasms protects the nerves and provides additional stability in the area.

Decisions must be made regarding how and to what degree the compensatory pattern should be altered. It seems prudent to assume that the body knows what it is doing. The wise therapist spends time learning to understand the reasons for the compensatory patterns presented by the body. When resourceful compensation is present, therapeutic massage methods are used to support the altered pattern and prevent any further increase in postural distortion over what is necessary to support the body change.

Some compensatory patterns are set up for short-term situations that do not require permanent adaptation. Having a leg in a cast and walking on crutches for a period of time is a classic example. The body catching itself during an "almost" fall is another classic setup pattern. Unfortunately, the body often habituates these patterns and maintains them well beyond their usefulness. As a result, over time the body begins to show symptoms of pain or inefficient function, or both.

Many compensatory patterns develop to maintain a balanced posture, and even though the posture becomes distorted during compensation, the overall result is a balanced body in a gravitational line. It also is important to consider the pattern of muscle interactions, such as the ones that occur when walking, and to recognize that gait has a certain pattern for the most efficient movement that the body can manage.

There is no set system for figuring out compensatory patterns. All these factors must be considered in devising a plan that best serves the client.

Remember, as indicated earlier, first-degree and stage 1 dysfunction can usually be managed by general massage application. Stage 2 and stage 3 dysfunction should be referred to the appropriate health care professional, and cooperative multidisciplinary treatment plans should be developed. Keeping this in mind, the massage therapist honors the limits of their scope of practice.

If the massage therapist is working in a sports team environment, the athletic trainer in conjunction with the team doctor and the physical therapist would do most of the assessment. These professionals would also provide the treatment plan and outcome goals to be carried out by the massage therapist. This does not mean that the massage therapist does not also do an assessment to identify the focus for massage application. Findings are submitted to the trainer.

ORGANIZING ASSESSMENT INFORMATION INTO TREATMENT STRATEGIES

Objective

16. Integrate ongoing assessment data channeled into appropriate massage treatment strategies.

The body is an interrelated, relatively symmetric functional form. For both assessment purposes and treatment approaches, it is helpful to consider these interrelationships. Science does not totally explain how our molecules stay together, let alone how the body constantly adapts second by second to internal and external environmental demands. Yet natural design is usually very simple and is set up in repeating patterns that function together for efficiency.

SYMPATHETIC/PARASYMPATHETIC BALANCE

In general, excessive sympathetic activation should be balanced by a relaxing massage, and excessive parasympathetic activation should be balanced by a stimulating massage. However, it is not quite that easy. To establish rapport and ultimately entrainment, it is recommended that the practitioner work with the client by addressing the client's current state. This is also very true when deciding whether the general massage approach will be stimulation or relaxation.

If the client is functioning from sympathetic nervous system dominance, and relaxation methods such as rocking and slow gliding are used initially, the work often seems irritating to the client. If the session is begun with a more stimulating approach, using such strokes as rapid compression, muscle energy methods, lengthening, and tapotement, the design of the massage fits the physiologic level of the client. After some of the nervous energy has been discharged, the client is ready for the more relaxing methods.

The same is true with parasympathetic dominance patterns. If the client is feeling "down," beginning with a stimulating approach may feel like an attack. It is better to begin with more subtle relaxation methods and progress slowly into stimulating approaches to encourage balance.

If the client seems "out of sorts," operating more as a collection of parts than the sum of the parts, entrainment processes may be off. The centered, coordinated presence of the professional providing a harmonized approach to the massage is beneficial.

BODY SYMMETRY

Body symmetry interrelationships can be seen in the nervous system, especially various reflexes–oculopelvic, crossed-extensor, withdrawal, gait, and other such patterns. Observation of the body reveals structural similarity in the design of the shoulder and pelvic girdles and of the upper and lower limbs. It is logical to assume that similarly shaped areas function in similar ways.

The axial skeleton does not seem to show a design similar to that of the appendicular skeleton; however, with a bit of imagination, one can see that it is there. Consider the rib cage as the central point: above it you have the cervical vertebrae and the head; below it, the lumbar vertebrae, sacrum, and coccyx (what is left of a tail). Most biological forms have a head at one end and a tail at the other. Imagine if we removed the head or added a tail, and there you go–symmetry.

The principles of postural balance and mobility factor in. The axial skeleton displays a mirror image as a top/bottom with the midpoint about the navel. Therefore, the imaginary tail pairs with the real head, the coccyx pairs with the atlas, and the axis with the sacrum; the lumbar and cervical areas pair together. This mirror image can be considered functional for posture and stability. The muscles pair as follows: occipital base and suprahyoids with pelvic floor, sternocleidomastoid and longus coli with the psoas and rectus abdominis, scalenes with quadratus lumborum, internal and external intercostals with internal and external obliques, and transversus thoracis with transversus abdominis. On the dorsal aspect of the thorax, you find the posterior serratus superior and inferior paired. Muscles that are oriented more vertically, such as the rectus abdominis and erector spinae group, pair on the dorsal and ventral aspects. If the pairs are also agonist/antagonists, then a reciprocal inhibition pattern can occur, or a co-contraction situation is noted.

Therefore, if a client has a short psoas, the sternocleidomastoid and the longus colli may also be short. If the scalenes are short, the quadratus lumborum may show reflex shortening. Dysfunction in the occipital base may also involve pelvic floor dysfunction.

The girdles and limbs that attach to the axial skeleton move in contralateral patterns–the left lower with right upper, and so forth. The scapula and the clavicle pair with the pelvis. The sacroiliac joints pair with both sternoclavicular joints. Other pairs include humerus and femur, tibia/fibula and radius/ulna, carpals and tarsals, metacarpals and metatarsals, phalanges and corresponding phalanges, hip and shoulder joints, elbow and knee, ankle and wrist, and foot and hand.

A corresponding symmetry is evident in the functional aspects of the axial soft tissue: the rotator cuff muscles with the deep lateral hip rotators, the deltoid with the gluteal group, the pectoralis minor and coracobrachialis with the pectineus, the pectoralis major and latissimus dorsi with the adductors, the quadriceps with the triceps and anconeus, the hamstrings with the biceps brachii, the brachialis with the popliteus, the wrist and finger flexors with the ankle plantar flexors, the wrist and finger extensors with the dorsiflexors, the supinators with the inverters, the pronators with the everters, and finally, the palm of the hand with the sole of the foot. These relationships should be easy to conceptualize.

Remember that in the appendicular skeleton, a counterbalancing crossed pattern exists, so again the left arm pairs with the right leg, and the right arm with the left leg. Thus, if a client has a short hamstring on the left, he or she may also have a short biceps brachii on the right. A bruise on the right quadriceps may result in reflex guarding in the left triceps. A sprain of the great toe on the right foot may result in reflexive guarding in the left thumb. A short gastrocnemius bilateral may also reflexively include short wrist flexors bilaterally. Guarding patterns for a knee injury may occur reflexively around the opposite elbow. Right sacroiliac pain may be paired with left sternoclavicular joint dysfunction. Short deep lateral hip rotators on the left may involve reflexive guarding in the right rotator cuff, with changes in movement of the shoulder. Restricted shoulder/arm movement on the right may be a lingering response to a previous adductor/groin injury on the left. The possible interactions are countless.

These potential patterns may be used in analysis of assessment and development of massage application (Figure 10-30).

For example, if a baseball pitcher has restricted ROM in the pitching arm (right arm) that has appeared over time and seems unrelated to the common strain in the arm, ask whether there was a previous groin injury or increased groin tightness on the left. For treatment, first address the adductors of the leg and the deep lateral hip rotators on the left while the client moves the right arm slowly through ROM. Continually palpate for areas in the thigh and hip muscles that seem to overrespond to the arm movement, and focus inhibition methods (usually compression in the muscle belly but sometimes in the attachments) in these areas. Then reassess the shoulder and arm for change. Finally, address the remaining arm symptoms.

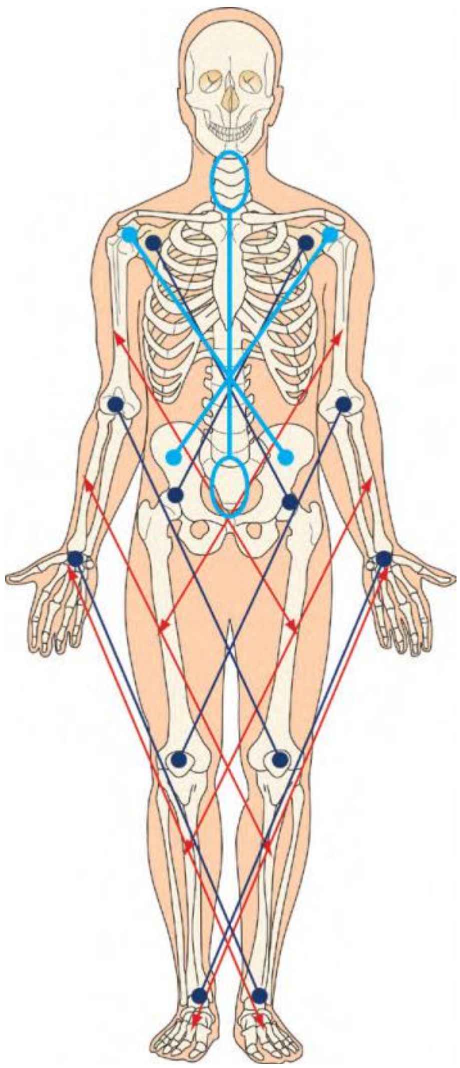


FIGURE 10-30 Areas of symmetry. Arm—Thigh; Forearm—Leg; Hand—Foot; Shoulder—Hip; Elbow—Knee; Wrist—Ankle; Cervical—Sacrum; Shoulder Girdle—Pelvic Girdle.

Another example: A client has quadratus/psoas shortening related to low back pain. Ask whether he is also experiencing any symptoms in the neck. Assess the ROM of the neck and palpate for especially tender areas. Before addressing the low back pain, make sure that the scalenes and the sternocleidomastoid muscles are normal, and treat dysfunction with muscle energy methods or direct inhibition while the client rotates the pelvis in various directions. As in the previous example, continue to assess for areas that overrespond to activation of the quadratus lumborum and psoas movement. Focus on those areas and reassess the low back pain. Treat the remaining symptoms of low back pain. While addressing the quadratus lumborum and the psoas, have the client rotate the head in slow large circles to activate the pattern and facilitate the release.

Another example: A soccer player has a thigh bruise, and it cannot be directly massaged other than by lymphatic drain. To create a reduction in reflexive guarding and pain, massage is applied to the opposite triceps group. A surprisingly sore area may correspond to the location of the bruise.

When working with these patterns, remember the focus of the massage. If the goal of the massage is to increase mobility of the left ankle, it may be helpful for the client to slowly move the right wrist in circles; the intent is not to treat the wrist, but to influence the dysfunctional ankle. If the goal of the massage is to manage short hamstrings, the biceps muscle of the arm will be part of the treatment approach. Although the client may notice changes in the arm when massage is being applied, the client should be moving the knees back and forth so that the hamstrings are affected because this is the goal of the massage. A client with a groin pull will likely benefit from massage of the arm adductors and abductors, but the intent of the massage of this area is to influence the groin.

The general protocol and many of the other specific recommendations for massage incorporate these concepts. It is prudent for the massage therapist to become proficient with this strategy for organizing and understanding injury and training adaptation. Seemingly unrelated symptoms are indeed part of the same process.

Additional guidelines for analyzing problems found through the functional biomechanical assessment include the following:

- If an area is hypomobile, consider tension or shortening in the antagonist pattern as a possible cause.
- If an area is hypermobile, consider instability of the joint structure or muscle weakness in the fixation pattern or problems with antagonist/agonist co-contraction function.
- If an area cannot hold against resistance, consider weakness from reciprocal inhibition of the muscles of the prime mover and synergist pattern, and tension in the antagonist pattern as possible causes.
- If pain or heaviness occurs on passive movement, consider joint capsule dysfunction and nerve entrapment syndrome as possible causes.
- If pain occurs on active movement, consider muscle firing patterns with fascial involvement as a possible cause.
- Always consider as possible causes body-wide reflexive patterns, as discussed in the sections on posture, gait assessment, and kinetic chain assessment.
- The following guidelines also are important:
  - During muscle testing, the ability to easily resist applied force should be the same or very similar bilaterally.
  - Opposite movement patterns should be easy to assume.
  - Bilateral asymmetry, pain, weakness, inability to assume the isolation position or to move into the opposite position, fatigue, or a heavy sensation may indicate dysfunction.

- Intervention or referral depends on the severity of the condition (stage 1, 2, or 3) and whether the dysfunction is joint-related, neuromuscular-related, or myofascial-related.

Log on to your Evolve website to view an assessment sequence for an 80-year-old marathon runner.

SUMMARY

The main purpose of intervention is to help the body regain symmetry and ease of movement. Therefore, when observing gait or posture, the practitioner notes areas that seem pulled, twisted, or dropped. The massage practitioner's job is to use massage methods to lengthen shortened areas, untwist twisted areas, raise dropped areas, drop raised areas, soften hard areas, harden soft areas, warm cold areas, and cool hot areas.

During assessment, careful attention should be paid to the order of priority in which the client relays the information. If the headache is mentioned first, the knee ache second, and the tight elbow last, the areas should be dealt with in that order, if possible, in the massage flow.

The importance of listening to understand is paramount. Many experienced professionals have learned that if we listen to our clients, they will tell us what is wrong and how to help them restore balance. Athletes are especially attuned to their body function. Slow down, do not jump to conclusions, pay attention, and let the information unfold. Realize that each client is the expert about himself or herself. Clients are your teachers about themselves, and in teaching you, they often begin to understand themselves better. In every session, approach each client with fascination about what you will learn from him or her. No textbook, class, or instructor can equal the teaching provided by careful attention to the client.

REFERENCE

Chaitow L: *Palpation and assessment skills: assessment through touch*, ed 3, Philadelphia, 2010, Churchill Livingstone.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

Note: This chapter does not adapt well to written question responses. The information is skill-based; therefore, the following exercises are recommended.

1 Develop a checklist of all history components covered.
2 Develop a checklist of all physical assessment components covered.
3 Complete ten comprehensive assessments using all methods covered in this chapter and your checklists.
4 Develop a treatment plan based on each assessment.
5 Implement the treatment plan and reassess after ten sessions. Chart each.
6 Write a post-assessment narrative describing the outcomes achieved or not achieved by the client.

CHAPTER 11

Review of Massage Methods

OUTLINE

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1. Achieve determined outcomes by adjusting depth of pressure, drag, duration, frequency, direction, speed, and rhythm of all massage applications.
2. Apply all massage applications.
3. Apply joint movement methods.
4. Use efficient body mechanics during massage application.

KEY TERMS

Active Assisted Movement	Duration	Passive Joint Movement
Active Joint Movement	Frequency	Percussion
Active Range of Motion	Friction	Perpendicularity
Active Resistive Movement	Gliding	Rhythm
Bending	Holding Position	Shear
Bind	Joint Movement Methods	Skin Rolling
Body Mechanics	Joint Oscillation	Speed
Compression	Joint Stacking	Stretching
Counterpressure	Kneading	Tension
Depth of Pressure	Mechanical Forces	Torsion
Direction	Methods	Weight Transfer
Drag	Oscillation	

Massage is the application of stimulus and force to create beneficial and physiologic changes in the body. The premise of this textbook is that you already have a solid foundation of therapeutic massage skills. Therefore, this chapter presents only a brief review and overview of massage application. I strongly suggest that you reread or read for the first time the following books: *Mosby's Fundamentals of Therapeutic Massage* and *Mosby's Essential Sciences for Therapeutic Massage*.

COMPONENTS OF MASSAGE APPLICATION

Objective

1. Achieve determined outcomes by adjusting depth of pressure, drag, duration, frequency, direction, speed, and rhythm of all massage applications.

All massage consists of a combination of the following qualities of touch:

- **Depth of pressure** (compressive force), which can be light, moderate, deep, or variable. Depth of pressure is important. Most soft tissue areas of the body consist of three to five layers of tissue, including the skin; the superficial fascia; the superficial, middle, and deep layers of muscle; and the various fascial sheaths and connective tissue structures. Pressure must be delivered through each successive layer to reach deeper layers without damage and discomfort to more superficial tissues. The deeper the pressure, the broader the base of contact required with the surface of the body. It takes more pressure to address thick, dense tissue than delicate tissue. Depth of pressure is determined at the very beginning of the massage stroke. This means that every time a massage stroke is applied, compressive force is used before any other forces–first down, then out (Figure 11-1).

- **Drag** is the amount of pull (stretch) on the tissue (tensile force) (Figure 11-2).
- **Direction** can move from the center of the body out (centrifugal), or in from the extremities toward the center of the body (centripetal). Direction can proceed from origin to insertion (or vice versa) of the muscle following the muscle fibers, transverse to the tissue fibers, or in circular motions (Figure 11-3).
- **Speed** of manipulations can be fast, slow, or variable (Figure 11-4).
- **Rhythm** refers to the regularity of application of the technique. If the method is applied at regular intervals, it is considered even, or rhythmic. If the method is disjointed or irregular, it is considered uneven, or nonrhythmic.
- **Frequency** is the rate at which the method repeats itself in a given time frame. In general, the massage practitioner repeats each method about 3 times before moving or switching to a different approach. The first application is assessment, second is treatment, and third is post-assessment. If the post-assessment indicates remaining dysfunction, then the frequency is increased to repeat the treatment/post-assessment several more times.
- **Duration** is the length of time that the method lasts or that the manipulation stays in the same location. Typically, duration should not be longer than 30 to 60 seconds.

Through these varied qualities of touch, the practitioner adapts simple massage **methods** to the desired outcomes of the client. These qualities of touch provide therapeutic benefit. The mode of application (e.g., **gliding, kneading**) determines the most efficient application. Each method can be varied, depending on the desired outcome, by adjusting depth, drag, direction, speed, rhythm, frequency, and duration. In perfecting massage application, the quality of touch is important, even more important than the method. The practitioner alters quality of touch when there is a contraindication or caution for massage. For example, when a person is fatigued, the practitioner often reduces the duration of the application; if a client has a fragile bone structure, the practitioner alters depth of pressure.

All massage manipulations introduce forces into the soft tissues. These forces stimulate various physiologic responses. Force may be perceived as mechanical, which we are going to discuss in this chapter, or as field forces, such as gravity or magnetism. **Mechanical forces** are actions that involve pushing, pulling, friction, or sudden loading, such as a direct blow. Mechanical forces can act on the body in a variety of ways. It is helpful to identify the different types of mechanical forces and to understand the ways in which mechanical forces applied during massage act therapeutically on the body.

The five kinds of force that can affect the tissues of the body are compression, tension, bending, shear, and torsion. Not all tissue is affected the same way by each type of force. We will look at each of the five types of force, the different ways they can produce tissue injury, and, more important, the ways in which they produce therapeutic benefits when applied by a skilled massage therapist.

Visit your Evolve website to watch these videos:
11-1: Depth of Pressure
11-2: Drag
11-3: Direction
11-4: Speed
11-5: Rhythm
11-6: Frequency

COMPRESSION

Compressive forces occur when two structures are pressed together (Figure 11-5). Compressive force is a component of massage application and is described as depth of pressure. This kind of force may be sudden and strong, as with a direct blow (tapotement), or it may be slow and gradual, as with gliding strokes. The magnitude and duration of the force are important in determining the outcome of the application of compression. Some tissues are resilient to compressive forces, whereas others are more susceptible. Nerve tissue is an interesting example. Nerve tissue is capable of withstanding moderately strong compressive forces if they do not last long (such as a sudden blow to the back of your elbow that hits your "funny bone"). However, even slight force applied for a long time (as occurs with carpal tunnel syndrome) can cause severe nerve damage. The practitioner needs to consider this when determining the duration of a massage application using compression.

Ligaments and tendons are sturdy and resistant to strong compressive loads. Muscle tissue, however, with its extensive vascular structure, is not as resistant to compressive forces. Excess compressive force will rupture or tear muscle tissue, causing bruising and connective tissue damage. This is a concern when pressure is applied to deeper layers of tissue. To avoid tissue damage, the massage therapist must distribute the compressive force of massage over a broad contact area on the body. The more compressive the force that is being used, the broader the base of

FIGURE 11-1 Depth of pressure. **A,** Surface. **B,** Light. **C,** Medium. **D,** Deep. **E,** Identify depth of pressure first—DOWN—then add glide—OUT. **F,** When kneading, identify depth of pressure first—DOWN—then add tissue movement forward—OUT—then introduce torsion force.

contact with the tissue. Compressive force is used therapeutically to affect circulation, nerve stimulation, and connective tissue pliability. As was previously mentioned, compression is the first aspect of any massage stroke.

TENSION

Tension forces (also called tensile force) occur when two ends of a structure are pulled apart from one another (Figure 11-6). This is different from muscle tension. Muscular tension is created by excessive amounts of muscular contraction and not by strong levels of pulling force applied to the tissue. Muscles that are long from being pulled apart are affected by tensile force. Certain tissues, such as bone, are highly resistant to tensile forces. It would take an extreme amount of force to break or damage a bone by pulling its two ends apart. However, soft tissues

FIGURE 11-2 Drag. **A,** Drag is produced when the contact on the skin of the client is secure and minimal lubricant is used. **B,** Drag pulls or pushes tissues into bind.

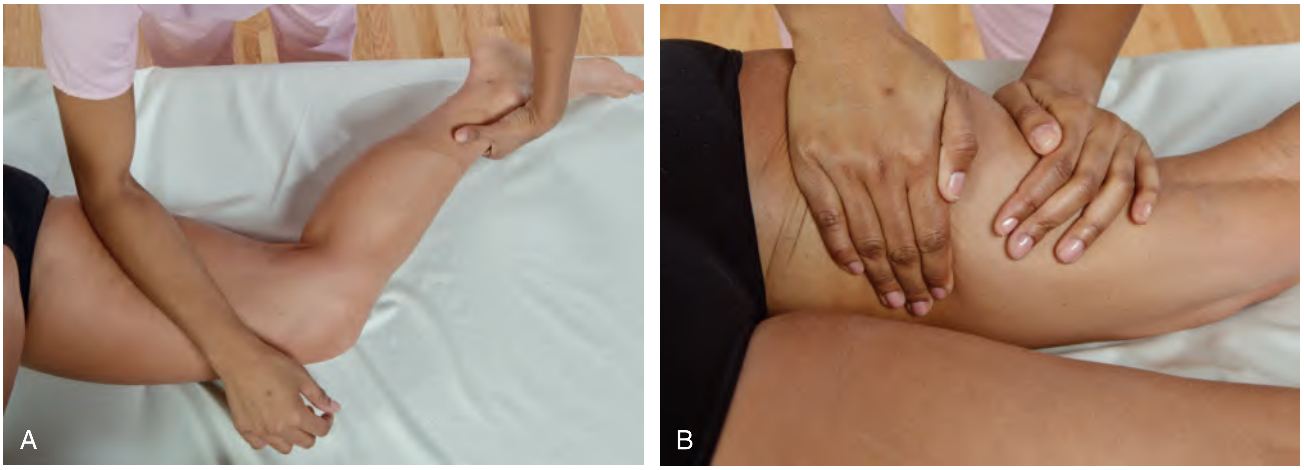


FIGURE 11-3 Direction. **A,** Example of direction toward the torso following muscle fiber direction. **B,** Example of direction is transverse and across the muscle fiber direction.

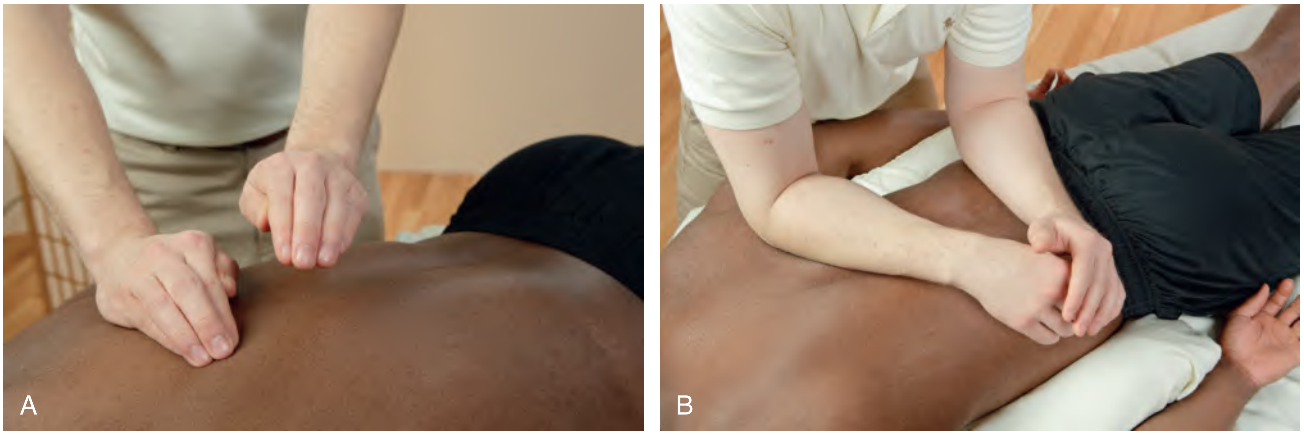


FIGURE 11-4 Speed. **A,** Speed—fast. *Example:* percussion. **B,** Speed—slow. *Example:* glide with drag.

FIGURE 11-5 Compression. Example of forearm compression on a client's arm. Compression creates compressive forces and is applied at a 90-degree angle.

FIGURE 11-7 Bending. Bending forces compress tissue on one side, creating a concavity with a convexity on the other side.

FIGURE 11-6 Tension. Tension force occurs when the ends are pulled apart.

FIGURE 11-8 Shear. Shear forces lift and slide tissues back and forth.

are susceptible to tension injury. In fact, tensile stress injuries are the most common injuries to soft tissues. Examples of such injuries include muscle strains, ligament sprains, tendonitis, fascial pulling or tearing, and nerve traction injuries (i.e., sudden nerve stretching such as occurs in whiplash).

Tension force is used during massage with applications that drag, glide, lengthen, and stretch tissue to elongate connective tissues and lengthen short muscles.

BENDING

Bending forces are a combination of compression and tension (Figure 11-7). One side of a structure is exposed to compressive forces, while the other side is exposed to tensile forces. Bending occurs during many massage applications. Pressure is applied to the tissue, or force is applied across the fiber or across the direction of the muscles, tendons or ligaments, and fascial sheaths. Bending forces rarely damage soft tissues; however, they are a common cause of bone fracture. Bending force is effective in increasing connective tissue pliability and affecting proprioceptors in the tendons and belly of the muscles.

SHEAR

Shear is a sliding force (Figure 11-8). As a result, significant friction often is created between the structures that are sliding against each other. The massage method of **friction** uses shear force to generate physiologic change by increasing connective tissue pliability and creating therapeutic inflammation.

Excess friction (shearing force) used inappropriately may result in an inflammatory irritation due to tissue damage.

TORSION

Torsion forces are best thought of as twisting forces (Figure 11-9). Massage methods that use kneading introduce torsion forces.

FIGURE 11-9 Torsion. Torsion forces twist tissues.

Torsion force to a single soft tissue structure is not common and is rarely the cause of significant tissue injury. However, torsion force applied to a group of structures (e.g., a joint) is much more likely to be the cause of significant injury. For example, when the foot is on the floor and the individual turns the body, the knee as a whole is exposed to significant torsion force. The methods of massage described next introduce one or a combination of these forces to the body for therapeutic benefit. This process is influenced by the qualities of application: depth of pressure, drag, direction, duration, speed, rhythm, and frequency. Appropriate use of force is necessary. If insufficient force is used, the application will not be effective; conversely, excessive use of force can also make the application ineffective and can cause tissue damage.

THE METHODS

Objective

2. Apply all massage applications.

Visit your Evolve website to watch Video 11-7: Holding, Gliding, Kneading, Skin Rolling, Compression, Oscillation, Percussion, Friction.

An area of confusion in the massage profession involves consistent use of descriptive terminology. Any type of massage application can have multiple names. Definitions of massage-related terms were used for clarifying purposes during development of the Massage Therapy Body of Knowledge project (Box 11-1). This terminology has been used in this textbook.

HOLDING POSITION

The practitioner must make initial contact with respect and a client-centered focus. The body needs time to process all the sensory information it receives during massage. The **holding position** involves stopping the motions, and simply resting the hands on the body provides moments of integration (Figure 11-10).

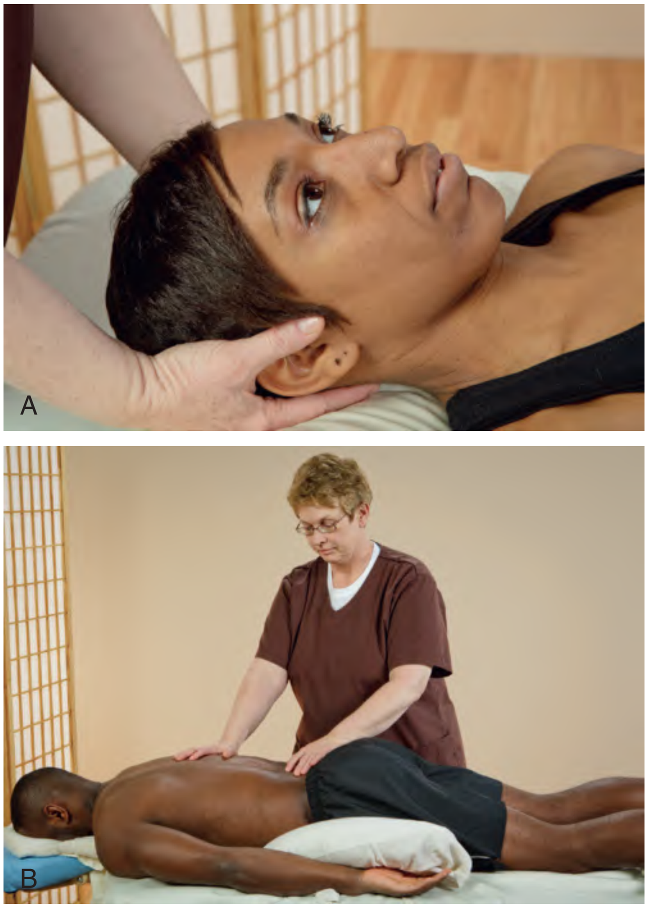


FIGURE 11-10 **A** and **B,** Examples of holding position.

COMPRESSION

Massage application always begins with **compression**. Compression moves down into the tissues, with varying depths of pressure adding bending and compressive forces (Figure 11-11). The manipulations of compression usually penetrate the subcutaneous layer, whereas in the resting position, they stay on the skin surface. Much of the effect of compression results from pressing tissue against underlying bone, causing it to spread.

Compression used in the belly of the muscle spreads the spindle cells, causing the muscle to sense that it is **stretching**. To protect the muscle from overstretching, the spindle cell signals for the muscle to contract. The lift-press application stimulates the muscle and nerve tissue. These two effects combine to make compression a good method for stimulating muscles and the nervous system. Because of this stimulation, compression is a little less desirable for a relaxation or soothing massage.

Compression is an excellent method for enhancing circulation. Pressure against the capillary beds changes the pressure inside the vessels and encourages fluid exchange. Compression appropriately applied to arteries allows back

BOX 11-1 Massage Therapy Body of Knowledge (MTBOK) Terminology

The Massage Therapy Body of Knowledge (MTBOK) is designed as a living document that informs all of the domains of massage therapy: practice, accreditation, research, certification, education, and licensure. The vocabulary presented defines how the MTBOK Stewards and task force intended the meaning of the terms in the MTBOK only. The value of this work is that it helps the greater profession begin the process of developing a unified language.

Discipline: An area of study with shared concepts, vocabulary, etc., such as Swedish massage, sports massage, myofascial release, etc.

Modality: A method of application or the employment of any physical agents and devices. This term is commonly misused to describe forms of massage (such as NMT, myofascial, Swedish).

Technique: A procedure or skill used in massage therapy including, but not limited to, the following:

- **Compression:** Involves use of compressive force without slip, commonly applied at a 90-degree angle to the tissue, followed by lift or release of force. Force varies in depth and pressure.
- **Friction:** Strokes involve rubbing one surface over another, with little to no surface glide, providing both compressive and shearing forces. Pressure may be superficial (light) to deep, providing friction effects between various tissue levels. Examples of friction may include warming, rolling, wringing, linear, stripping, cross-fiber, chucking, and circular. Most friction strokes are administered with the use of little or no lubricant.
- **Gliding/Stroking** (effleurage): Involves gliding movements that contour to the body. The pressure may be either superficial (light) or deep. Variations may include one-handed, two-handed, alternate hand, forearm, and nerve stroke.
- **Holding:** Involves holding tissue without movement and with little to no force/weight in the contact.
- **Kneading** (petrissage): Strokes involve lifting, rolling, squeezing, and releasing of tissue, most commonly using rhythmic alternating pressures. Variations may include one-handed, two-handed, alternate hand, pulling. and skin rolling.
- **Lifting:** Strokes entail pulling tissue up and away from their current position.
- **Movement and mobilization** (stretching, traction, range of motion, and gymnastics): Strokes entail shortening and/or lengthening of soft tissues with movement at one or more joints. Variations include active movements (client/patient moving structures without practitioner help), passive movements (therapist moving structures without client/patient help), resistive movement (client/patient moving structures against resistance provided by the therapist) and active assisted (client/patient moving structures with support and assistance from the therapist).
- **Percussion** (tapotement): Strokes involve alternating or simultaneous rhythmic striking movement of the hands against the body, allowing the hand to spring back after contact, controlling the impact. Hand surfaces commonly used include ulnar surface of the hand, tips or flats of the fingers, open palm, cupped palm and back ulnar surface, knuckles, and sides of a loosely closed fist. Technique variations may include tapping, pincement, hacking, cupping, slapping, beating, pounding, and clapping.
- **Vibration:** Strokes involve shaking, quivering, trembling, swinging, oscillation, or rocking movements most commonly applied with the fingers, the full hand, or an appliance. Variations may include fine or coarse vibration, rocking, jostling, or shaking. Speed varies from slow to rapid.

Modified from Massage therapy body of knowledge, version 1.0, May 15, 2010. http://www.mtbok.org/downloads/MTBOK_Version_1.pdf. Accessed February 27, 2012.

pressure to build, and when the compression is released, increased arterial flow is encouraged.

Compression can be done with stabilized fingers, palm and heel of the hand, fist, knuckles, forearm, and, in some systems, the leg and heel of the foot. Even though the compressive pressure is perpendicular to the tissue, the position of the forearm in relation to the wrist is about 110 to 130 degrees. Application against a 45-degree angle of the body (hill) plus the 45-degree angle of the practitioner's hand and forearm results in 90-degree contact on the tissue. If you are using your knuckles or fist, make sure the forearm is in a direct line with the wrist. Avoid use of the thumb if possible because the thumb can be damaged by extensive use, especially on large muscle masses.

The tip or the radioulnar side of the elbow should not be used for compression. Because the ulnar nerve passes just under the skin and damage can result from extensive compression, use the forearm near the elbow for compression. The massage professional's arm and hand must be relaxed, or neck and shoulder tension will occur. Leverage applied through appropriate body mechanics, not muscle strength, does the work.

Compression proceeds downward into the tissues; the depth is determined by what is to be accomplished, where compression is to be applied, and how broad or specific the contact with the client's body is to be.

Deep compression presses tissue against underlying bone. Because of the diagonal pattern of the muscles, the massage practitioner should stay perpendicular or at a 90-degree angle to the bone, with actual compression somewhere between 60- and 90-degree angles to the body. Beyond those angles, the stroke may slip and turn into a glide.

GLIDING

The distinguishing characteristic of gliding strokes is that they are applied horizontally in relation to the tissues, generating a tensile force (Figure 11-12).

FIGURE 11-11 Examples of compression. **A,** Using braced fingers to apply focused narrow-based compression. **B,** Using the fist to apply compression. **C,** Using the forearm to apply broad-based compression. **D,** Using the leg to apply broad-based compression.

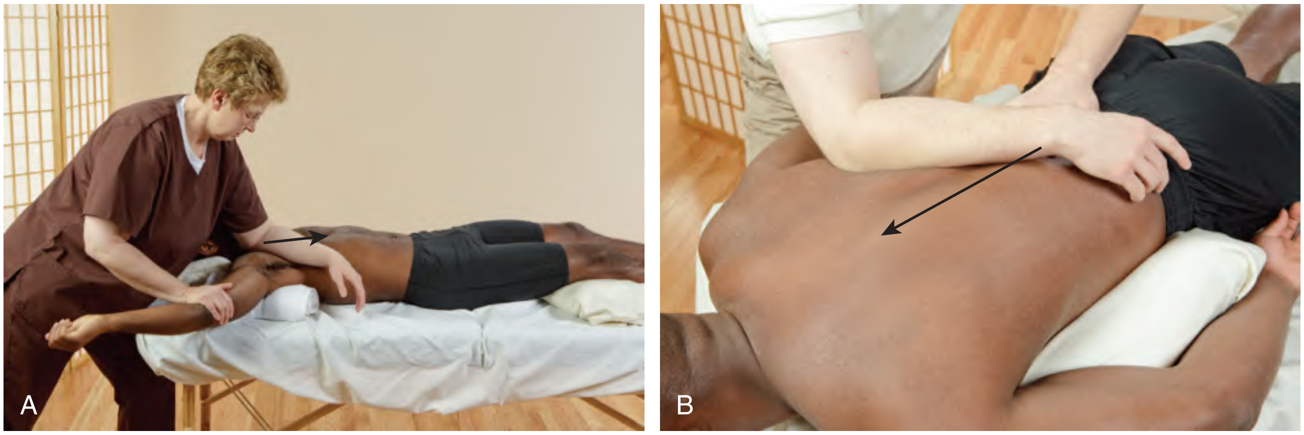


FIGURE 11-12 Examples of gliding. **A,** The forearm lends itself to application of gliding and minimizes strain on the wrists and hands. **B,** Gliding with the forearm is efficient because large areas can be addressed by this method.

During gliding stroke, light pressure remains on the skin and moderate pressure extends through the subcutaneous layer of the skin to reach muscle tissue, but not so deep as to compress the tissue against the underlying bony structure. Moderate to heavy pressure that puts sufficient drag on the tissue mechanically affects the connective tissue and proprioceptors (spindle cells and Golgi tendon organs) found in the muscle. Heavy pressure produces a distinctive compressive force of soft tissue against bone.

Depth of pressure is a result of leverage and leaning on the body. Pressure increases as the angle of the lean increases. Increases in pressure are not achieved by pushing with muscle strength.

Strokes that use moderate pressure from the fingers and toes toward the heart following the muscle fiber direction are excellent for mechanical and reflexive stimulation of blood flow, particularly venous return and lymphatics. Light to moderate pressure with short, repetitive gliding following the patterns for the lymph vessels serves as the basis for manual lymph drainage.

KNEADING

Soft tissue is lifted, rolled, and squeezed. The main purpose of this manipulation is to lift tissue, applying bend, shear, and torsion forces.

Kneading is good for reducing muscle tension. The lifting, rolling, and squeezing action affects spindle cell proprioceptors in the muscle belly. As the belly of the muscle is squeezed (thus squeezing the spindle cells), the muscle feels less tense. When lifted, the tendons are stretched, thus increasing tension in the tendons and in the Golgi tendon receptors, which have a protective function.

Kneading also is good for mechanically softening the superficial fascia. Kneading methods are effective in supporting circulation by squeezing the capillary beds in tissues and supporting fluid exchange.

Kneading may incorporate a wringing or twisting component (torsion) after the tissue is lifted. Changes in depth of pressure and drag determine whether the client perceives the manipulation as superficial or deep. By the nature of the manipulation, pressure and pull peak when the tissue is lifted to its maximum and decrease at the beginning and the end of the manipulation (Figure 11-13).

FIGURE 11-13 Example of kneading.

SKIN ROLLING

A variation of the lifting manipulation is **skin rolling**. Whereas deep kneading attempts to lift the muscular component away from the bone, skin rolling lifts only the skin from the underlying muscle layer. Skin rolling has a warming and softening effect on the superficial fascia, causes reflexive stimulation of the spinal nerves, and is an excellent assessment method. Areas of "stuck" skin often suggest underlying problems. Skin rolling is one of the few massage methods that is safe to use directly over the spine. Because only the skin is accessed and the direction of pull to the skin is up and away from underlying bones, the spine risks no injury, unlike when any type of downward pressure is used.

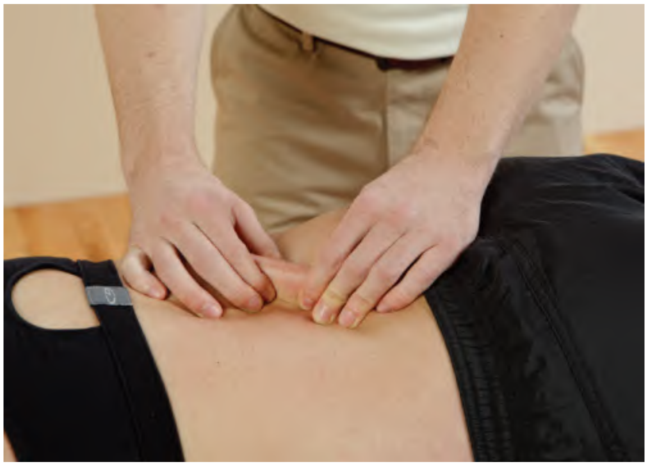


FIGURE 11-14 Example of skin rolling.

Sometimes a client's tissue will not lift. This may be a result of excessive edema (swollen tissue), a heavy fat layer, scarring that extends into deeper body layers, or thickened areas of connective tissue, especially over aponeuroses (flat sheets of superficial connective tissue). If these conditions exist, applications of kneading or skin rolling will be uncomfortable for the client. Shifting to gliding and compression may soften the tissue enough that kneading can be used more effectively if applied later in the massage session (Figure 11-14).

OSCILLATION: SHAKING, ROCKING, VIBRATION

Shaking is a massage method that is effective in relaxing muscle groups or an entire limb. Shaking manipulations confuse the positional proprioceptors because sensory input is too unorganized for the integrating systems of the brain to interpret; muscle relaxation is the natural response in such situations. Athletes respond well to shaking.

Shaking warms and prepares the body for deeper bodywork and addresses the joints in a nonspecific manner.

Shaking is effective when the muscles seem extremely tight. This technique is reflexive in effect, but a small mechanical influence may be exerted on the connective tissue as well because of the lift-and-pull component of the method. Shaking begins with a lift-and-pull component. The practitioner grasps, lifts, or shakes a muscle group or a limb.

Shaking is not a manipulation to be used on the skin or superficial fascia, nor is it effective to use on the entire body. Rather, shaking is best applied to any large muscle groups that can be grasped and to the synovial joints of the limbs. Good areas for shaking are the upper trapezius and shoulder area, biceps and triceps groups, hamstrings, quadriceps, gastrocnemius, and, in some instances, the abdominal muscles and the pectoralis muscles close to the axilla. The joints of the shoulders, hips, and extremities also respond well to shaking.

The larger the muscle or joint, the more intense is the method required to be effective. If movements are performed with all the slack out of the tissue, the focus point of the shake is small and is extremely effective. The more purposeful the approach, the smaller the focus of the shaking applied. You should always stay within the limits of range of motion of a joint and "elastic give" of the tissue.

Vibration is a smaller, more focused **oscillation** that involves very fast, small movements.

Rocking is a soothing, rhythmic method used to calm persons. Rocking is reflexive and chemical in its effects.

Rocking also works through the vestibular system of the inner ear and feeds sensory input directly into the cerebellum. Other reflex mechanisms probably are affected as well. Because of this, rocking is one of the most productive massage methods used to achieve entrainment. For rocking to be most effective, the client's body must move so that the fluid in the semicircular canals of the inner ear is affected, initiating parasympathetic mechanisms.

Rocking is rhythmic and should be applied with a deliberate full-body movement.

This attunement to the client's rhythm is a powerful interface point to synchronize entrainment. The easiest way to do this is to take the client's pulse and match the rhythm to that of the pulse. The massage therapist works within the rhythm to maintain and amplify it by attempting to gently extend the limits of movement or by slowing the rhythm. Incorporation of a rocking movement that supports this entrainment process into all massage applications effectively individualizes the application and speed of the method. The client seems to relax more easily when a subtle rocking movement, matching his or her innate rhythm pattern, is incorporated as part of the generalized massage approach, along with techniques such as gliding, kneading, compression, joint movement, and especially passive movements (Figure 11-15).

PERCUSSION (TAPOTEMENT)

Percussion is divided into two classifications: light and heavy. The difference between light and heavy percussion is determined by whether the compressive force of the blows penetrates only to the superficial tissue of the skin and subcutaneous layers (light) or deeper into the muscles, tendons, and visceral (organ) structures, such as the pleura in the chest cavity (heavy).

Percussion is a stimulating manipulation that operates through the response of the nerves. Because of its intense stimulating effect on the nervous system, percussion initiates or enhances the sympathetic activity of the autonomic nervous system. The effects of manipulations are reflexive, except for the mechanical results of percussion in loosening and moving mucus within the chest.

When applied to the joints, percussion affects the joint kinesthetic receptors responsible for determining position and movement of the body. The quick blows confuse the system, similar to the effect of joint-focused rocking and shaking, but the body muscles tense instead of relax. This method is useful for stimulating weak muscles. The force used must move the joint but should not be strong enough to damage the joint. For example, one finger may be used over the carpal joints, whereas the fist may be used over the sacroiliac joint.

Percussion is effective when used at motor points that usually are located in the same area as traditional acupuncture points. The repetitive stimulation causes the nerve to fire repeatedly, stimulating the nerve tract (Figure 11-16).

Percussion focused primarily on the skin affects the superficial blood vessels of the skin, initially causing them to contract. Heavy percussion or prolonged lighter application dilates the vessels as a result of the release of histamine, a vasodilator. Although prolonged percussion seems to increase blood flow, surface percussion enhances the effect of cold application used in hydrotherapy.

Heavy percussion should not be done over the kidney area or anywhere there is pain or discomfort.

FRICTION

Friction consists of small, deep movements performed on a local area. It provides shear force to the tissue. Friction burns may result if the fingers are allowed to slide back and forth over the skin. Friction creates therapeutic inflammation. Friction manipulation prevents and breaks up local adhesions in connective tissue, especially over tendons, ligaments, and scars, by creating therapeutic inflammation. This method is not used over an acute injury or a fresh scar and should be used only if the adaptive capacity of the client can respond to superimposed tissue trauma.

Modified use of friction, after the scar has stabilized or the acute phase has passed, may prevent adhesions and can promote a more normal healing process.

Application also provides pain reduction through the mechanisms of counterirritation and hyperstimulation analgesia.

Movement in friction is usually transverse to the fiber direction. Friction generally is performed for 30 seconds to 10 minutes, although some authorities have suggested a duration of 20 minutes. The result of this type of friction

FIGURE 11-15 Examples of oscillation. **A,** Shaking, direct. Lift tissue and push tissues forward. **B,** Shaking, direct. Maintain lift, and pull tissue back; repeat multiple times. **C,** Shaking, direct. Flip tissue rhythmically back and forth. **D,** Shaking with joint movement. Grasp area and briskly move back and forth in multiple directions. **E,** Rocking. Rhythmically move target area back and forth. **F,** Rocking. Continue rhythmic movement of rocking back and forth.

is initiation of a small, controlled inflammatory response. Experts disagree on whether an area that is to receive friction should be stretched or relaxed. Because both ways have merit, the practitioner should include both positions when frictioning.

Chemicals released during inflammation result in activation of tissue repair mechanisms with reorganization of connective tissue. This type of work, coupled with proper rehabilitation, is valuable.

Friction is a mechanical approach best applied to areas of high connective tissue concentration such as the musculotendinous junction. Microtrauma from repetitive movement and overstretching are common in this area. Microtrauma predisposes the musculotendinous junction

FIGURE 11-16 Examples of percussion. **A,** Percussion using fists. **B,** Percussion with cupped hands.

to inflammatory problems, connective tissue changes, and adhesion.

Another use for friction is to combine it with compression. The combination adds a small stretch component. The movement includes no slide. This application has mechanical, chemical, and reflexive effects and is the most common approach today for the use of friction. The main focus when using friction is to move tissue under the skin. No lubricant is used because the tissues must not slide. The practitioner should place the area to be frictioned in a soft or slack position. Movement is produced by beginning with a specific and moderate to deep compression using the fingers, palm, or flat part of the forearm near the elbow. After the pressure required to contact the tissue has been reached, the practitioner moves the upper tissue back and forth across the grain or fiber of the underlying tissue for transverse or cross-fiber friction or around in a circle for circular friction.

As the tissue responds to the friction, gradually begin to stretch the area and increase the pressure. The feeling for the client may be intense, but if it is painful, modify the application to a tolerable level so that the client reports the sensation as a "good hurt." The recommended way to work within the client's comfort zone is to use pressure sufficient for him or her to feel the specific area but not complain of pain. The practitioner should continue friction until the sensation diminishes. Gradually increase pressure until the client again feels the specific area. Begin friction again and repeat the sequence for up to 10 minutes.

The area being frictioned may be tender to the touch for 48 hours after use of the technique. The sensation should be similar to mild after-exercise soreness. Because the focus of friction is the controlled application of a small inflammatory response, heat and redness are caused by the release of histamine. Also, increased circulation results in a small amount of puffiness as more water binds with the connective tissue. The area should not bruise.

Application of Deep Transverse Friction

Use the following procedure to apply deep transverse friction:

1. Identify the exact location.
2. The therapist's fingers and the client's skin must move as one. Take care not to cause a blister. The client must understand that deep friction massage can be painful during application and for a few days after treatment.
3. The friction must be given across the fibers composing the affected structure.
4. The friction must be given with sufficient sweep. Pressure only accesses the tender area; it does not replace the friction. Circular friction is not recommended. Only a back-and-forth friction is effective.
5. The friction must reach deeply enough. If friction does not reach the lesion, it is of no value.
6. The client must be placed in a suitable position that ensures the appropriate degree of tension or relaxation of the tissues to be frictioned.
7. Muscles must be kept relaxed while being frictioned. Because the connective tissue of the muscle is affected, the massage must penetrate into the muscle and not stay on the surface.
8. Tendons with a sheath must be kept taut during friction massage.
9. Broadening contractions are used between sessions to promote circulation and mobilize scar development during the healing process.

Another effective way to produce friction consists of a combination of compression and **passive joint movement**, with the bone under the compression used to perform the friction. The process begins with a compression as just described, but instead of moving the tissue back and forth, the massage practitioner moves the client's body under the compression. This automatically adds the slack and stretch positions for the friction methods. The result is the same. This method is much easier for the massage professional to perform and may be more comfortable for the client as well. Movement of the joint provides a distraction from the specific application of pressure and generalizes the sensation. Broad general methods can be used with a higher degree of intensity than can be attained with a pinpointed specific focus (Figure 11-17).

FIGURE 11-17 Examples of friction. **A,** Transverse friction. **B,** Circular friction. **C,** Compression with movement to create friction. **D,** Maintain compression while client moves.

JOINT MOVEMENT METHODS

Objective

3. Apply joint movement methods.

Visit your Evolve website to watch Video 11-8: Joint Movement (Passive, Active Assisted, and Active Resisted).

Joint movement methods are effective because they provide a means of controlled stimulation to joint mechanoreceptors. Movement initiates muscle tension readjustment through the reflex center of the spinal cord and lower brain centers. As positions change, the supported movement gives the nervous system an entirely different set of signals to process. It is possible for the joint sensory receptors to learn not to be so hypersensitive. As a result, the protective spasm and movement restriction may lessen.

Joint movement also encourages lubrication of the joint and contributes an important enhancement to the lymphatic and venous circulation systems. Much of the pumping action that moves these fluids within the vessels results from compression against the lymph and blood vessels during joint movement and muscle contraction. The tendons, ligaments, and joint capsule are warmed from the movement. This mechanical effect helps keep these tissues pliable.

TYPES OF JOINT MOVEMENT METHODS

Joint movement involves moving the jointed areas within the physiologic limits of range of motion of the client. The two types of joint movement are active and passive.

Active joint movement means that the client moves the joint by active contraction of muscle groups. The two variations of active joint movement are as follows:

1. **Active assisted movement**, which occurs when the client and the massage practitioner move the area.
2. **Active resistive movement**, which occurs when the client actively moves the joint against a resistance provided by the massage practitioner.

FIGURE 11-18 Joint movements. **A,** Active joint movement—client moves area. **B,** Active assisted movement. Client moves area while the massage therapist assists. **C,** Active resistive joint movement. Client moves area while the massage therapist applies a resistance force. **D,** Passive joint movement. Massage therapist moves joint while client remains passive and relaxed.

Passive joint movement occurs when the client's muscles stay relaxed and the massage practitioner moves the joint with no assistance from the client. When doing passive joint movement, feel for the soft or hard end feel of the joint range of motion. This is an important evaluation. **Joint oscillation** is a passive joint movement (Figure 11-18).

Whether active or passive, joint movements are always done within comfortable limits of the range of motion of the client.

The client's body must always be stabilized, allowing only the joint being worked on to move. Occasionally, the entire limb is moved to allow for coordinated interaction among all joints in the area, but the rest of the body is stabilized. Slow movement is essential because quick changes or abrupt moves may cause the muscles to initiate protective contractions.

Working within the physiologic ranges of motion for the particular client is within the scope of practice of the massage professional. Let the trainer, physical therapist, or chiropractor deal with joint pathology. The specific method section describes a simple joint play method based on indirect functional techniques, which means identifying the ease position and then having the client move the joint.

Joint movement becomes part of the application of muscle energy techniques to lengthen muscles and of stretching methods to elongate connective tissues. Because of this, the massage professional should concentrate on developing the ability to use joint movement efficiently and effectively.

Hand placement with joint movement is important. Make sure that the area is not squeezed, pinched, or restricted in its movement pattern. The practitioner should place one hand close to the joint to be moved to act as a stabilizer and for evaluation. The practitioner places the other hand at the distal end of the bone, and that hand actually provides the movement. Proper use of body mechanics is essential when using joint movement. The stabilizing hand must remain in contact with the client and must be placed near the joint being affected.

Another method of placement of the stabilizing hand is to move the jointed area without stabilization while observing where the client's body moves most in response to the range-of-motion action. Place the stabilizing hand at this point.

Avoid working cross-body. Usually, the hand closest to the joint is the stabilizing hand.

Before joint movement begins, the moving hand lifts and leans back to produce the slight traction necessary to put a small stretch on the joint capsule. If this is not done, the technique is much less effective. When tractioning has been mastered and the joint is moved simultaneously, the size of the movement becomes smaller and the effectiveness is increased. Having the client's limbs flailing about in the air is not necessary or desirable. Joint oscillation simply means that the joint is moved rhythmically in small, controlled movements.

Active Joint Movement

In active joint movement, the client moves the area without any type of interaction by the massage practitioner. This is a good assessment method and should be used before and after any type of joint work because it provides information about the limits of range of motion and improvement after the work is complete. As was mentioned previously, two variations of **active range-of-motion** methods may be used: active assisted range of motion and active resistive range of motion.

Active Assisted Joint Movement. Active assisted joint movement involves the client moving the joint through the range of motion and the massage practitioner helping or assisting the movement. This approach is useful in cases of weakness or pain with movement. The action remains within the comfortable limits of movement for the client. The focus is to create movement within the joint capsule, encouraging synovial fluid movement to warm and soften connective tissue and support muscle function.

Active Resistive Joint Movement. In active resistive joint movement, the massage practitioner firmly grasps and holds the end of the bone just distal to the joint being addressed. The massage therapist places small traction to take up the slack in the tissue. Then the practitioner instructs the client to push slowly against a stabilizing hand or arm while moving the joint through its entire range. A tap or light slap against the area to begin the movement works well to focus the client's attention.

Another method is to stabilize the entire circumference of the limb and instruct the client to pull gently or move the area. The job of the massage practitioner is to maintain a gentle traction to prevent slack in the tissue, keep the movement slow, and give the client something to push or pull against, discharging the nervous system so that the area can relax.

The counterforce applied by the massage therapist does not exceed the pushing or pulling action of the client but rather matches it and then allows movement.

After a form of active joint movement has been completed, the client's body is more apt to accept passive joint movement.

Log on to your Evolve website to view examples of integrating joint movement into massage.

SUGGESTED SEQUENCE FOR JOINT MOVEMENT METHODS

When incorporating joint movement into the massage, follow these basic suggestions:

- If possible, do active joint movement first. Assess range of motion by having the client move the area without participation by the practitioner.
- Have the client move the area against a stabilizing force supplied by the practitioner to increase the intensity of signals from the contracting muscles; this discharges the nervous system.
- Incorporate any or all of the previously discussed massage methods.
- After the tissue is warm and the nervous system normalized, do the passive range of motion/joint movement.
- During a massage session, strive to move every joint about 3 times. Each time, take up any slack in the tissues and gently encourage an increase in the range of motion.

BODY MECHANICS

Objective

4. Use efficient body mechanics during massage application.

Visit your Evolve website to watch Video 11-9: Body Mechanics.

Effective **body mechanics** are essential for working with the sport and fitness population. In general, the therapeutic massage community does a poor job of teaching and practicing proper body mechanics. The concepts of massage as a fluid movement, with flexed knees and arms, are not effective. Concepts of yoga, martial arts, and tai chi do not translate to effective body mechanics. Contrary to common perception, massage is *not* a dynamic movement system. Massage is a repeated series of static activities. If you are going to be successful with the sport and fitness population, effective and ergonomically correct body mechanics are essential. These clients have toned, bulked muscles and often request deep pressure. However, the client does not want to be poked and prodded and dug into. Instead, the client wants all layers of soft tissue from superficial to deep to be addressed. Because of the tissue density, more compressive force may be required to move sequentially through the tissue layers.

The massage therapist needs to provide a sustained, restrained, and somewhat static movement with pressure focused downward and forward to deliver the various levels of compressive force. Use of forearms, wrists, hands, fingers, thumbs, knees, and feet is effective in delivering the compressive force. Four basic concepts pertaining to body mechanics are common to all techniques used to apply compressive force against the body tissues during massage application. These concepts are as follows:

- Weight transfer
- Perpendicularity
- Stacking of the joints in closed packed position
- Keeping the back straight

Weight transfer allows the massage practitioner to transfer body weight by shifting the center of gravity forward to achieve a pressure that is comfortable to the client. To transfer weight, the practitioner stands (or kneels) with one foot forward and the other foot (or knee) back in an asymmetric stance. In the standing position, the front leg is in a relaxed knee flexion with the foot forward enough to be in front of the knee. The back leg is straight, and the hips and shoulders are aligned so that the back is straight. The transfer happens by taking the weight off the front leg and moving it to the heels of the hands, the thumbs, or whichever part of the arm is being used to apply pressure. Pressure is increased or decreased by moving the back leg farther away from, or closer to, the client. The weight of the body is distributed to the heel of the weight-bearing leg, not to the toes.

Perpendicularity is an important concept that ensures that the pressure is sinking straight into the tissues. The line from the shoulders to the point of contact (e.g., forearm, heel of the hand) must be 90 degrees to the plane of the contact point on the client's body. The client needs to be positioned so that pressure is applied against a 45-degree incline whenever possible.

Stacking the joints one on top of another is essential to the concepts of perpendicularity and **weight transfer**. The practitioner's body must be a straight line from the heel of the weight-bearing rear foot through the knee, hip, and shoulder, and then from the shoulder to the forearm, or through the elbow acting as an extension of the shoulder, to the heels of the hands. The ankle, knee, hip of the back leg, and spine are stacked and stable in a closed packed joint position. The pelvic girdle and the shoulder girdle are lined up. The shoulder is stacked over the elbow, which in turn is stacked over the wrist. **Joint stacking** in this way allows the pressure to go straight into the client's body effortlessly as the therapist's center of gravity moves forward.

A straight back and a pressure-bearing leg are other essential components of body mechanics. If the back is not straight, the practitioner often ends up pushing with the upper body instead of using the more effortless feeling of transferred weight. The muscles of the torso, especially of the abdomen, are considered the core. Core stability is necessary for back stability.

Most massage therapists will need to develop core stability. The practitioner's weight should be borne on the back leg and on the heel of the foot. At first this may feel uncomfortable; however, some of the biggest muscles in the body are in the legs. At least 15 degrees of dorsiflexion in the ankles needs to occur to do this well. Most massage therapists will need to increase their ankle flexibility.

Massage uses primarily a force generated forward and downward with 90-degree contact against the body. The combination of a 45-degree slant from the contours of the client's body plus the 45-degree angle of force used during appropriate body mechanics results in the 90-degree contact. Therefore, redistribution of the center of gravity and of the weight force is necessary and is attained by keeping the weight on the back foot (heels and not toes), the knee and back straight, the weight distribution coming from the abdomen, and the balance point at the object-contact point. The joints of the wrist, arm, shoulder, back, hip, weight-bearing knee, and ankle are stacked for effective delivery of force. As the stance of the body widens, the base of support enlarges. The arm generating the pressure is opposite the weight-bearing leg, which allows proper counterbalance and prevents twisting of the body at the shoulder and the pelvic girdle. The shoulder girdle must stay in line with the pelvic girdle, with the head held up and the eyes forward.

Creative use of the massage therapist's body is essential when working with athletes. The ability to use the knee/leg and foot during massage is helpful.

The thumb is seldom used. The braced hand and supported fingers provide the proper application because hinge joints effectively move into a stable, closed packed position.

COUNTERPRESSURE

Because of the density and bulk of some athletes' muscle structure, it may be necessary to use a body mechanics strategy to allow you to apply deep compressive force. By using **counterpressure**, the massage therapist can reach deep tissue layers safely without poking the client.

The principle is simple. Combining the forward weight transfer with a pull-back motion squeezes the forces together.

1. Apply compressive force as presented by leaning and weight transfer.
2. Make sure weight is on the heel of the back foot.
3. Use the non–pressure-bearing arm to hold the table and pull up to squeeze the forces together. The practitioner may use a body part as well (Figure 11-19).

WORKING ON A MAT

Visit your Evolve website to watch Video 11-10: Mat Work/Body Mechanics on the Mat.

Some clients will be more comfortable on a mat. This is especially true of large athletes who really do not fit on a standard massage table. The body mechanics principles do not change. The only difference is that the weight-bearing contacts on the floor most often are the back knee and shin, whereas the forward upper limb (e.g., hand, forearm) used to apply massage becomes the point of contact. The practitioner can easily use the leg and foot when working on a mat (Figure 11-20).

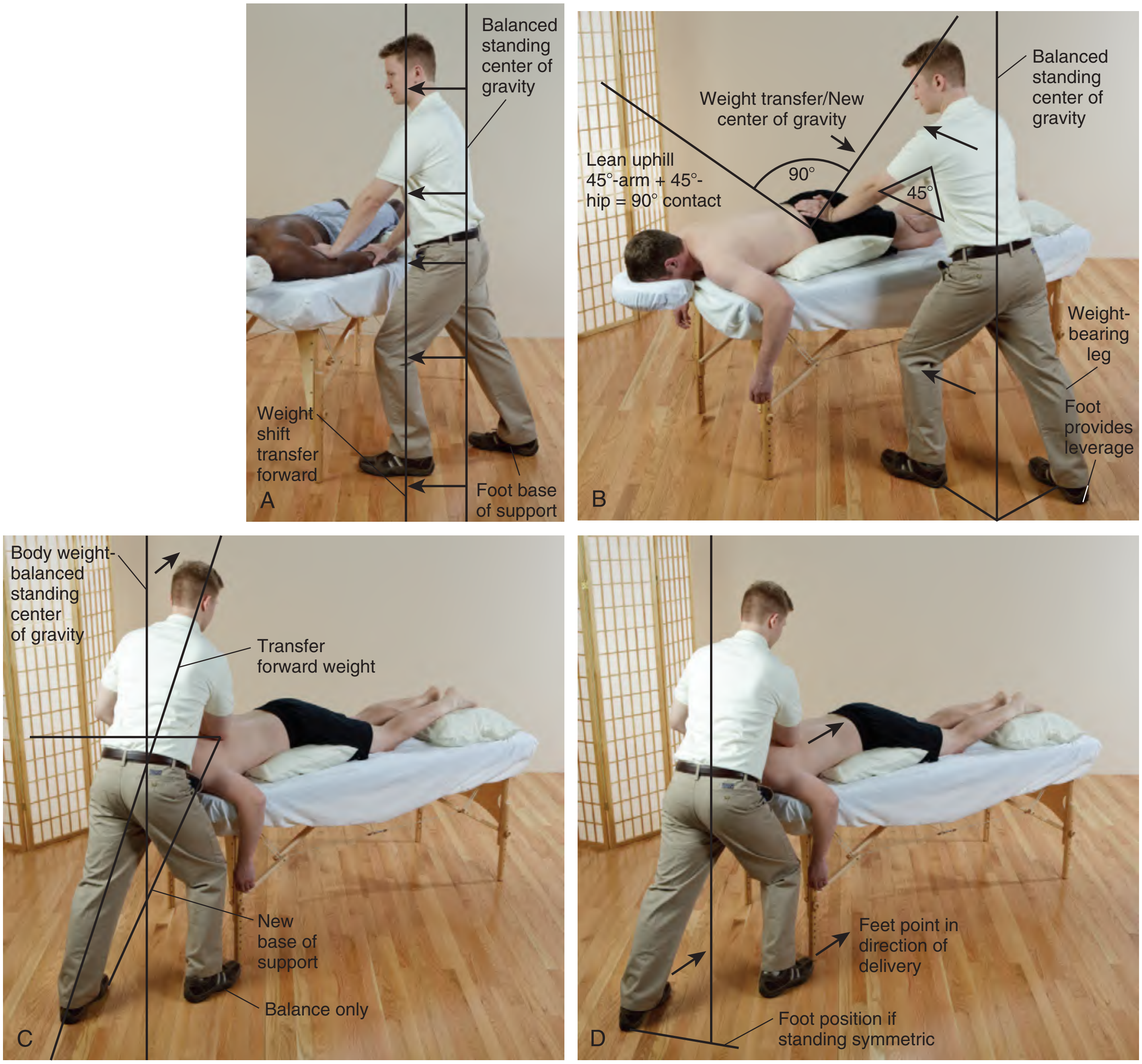


FIGURE 11-19 Efficient and effective body mechanics for working with athletes. **A,** Using the principles of body mechanics in a weight shift. **B,** During a weight shift, the center of gravity moves between the legs to between the contact point and the original balanced center of gravity, allowing leaning to achieve a 90-degree contact on the body, with the massage therapist's shoulder stabilized at approximately 45 degrees and the client's body sloped at 45 degrees. **C,** As the therapist moves from a standing center of gravity, the front leg moves forward for balance while the back leg weight-bears into the floor, transferring weight forward to apply compression. **D,** Keep the feet shoulder-width apart and in an asymmetric stance.

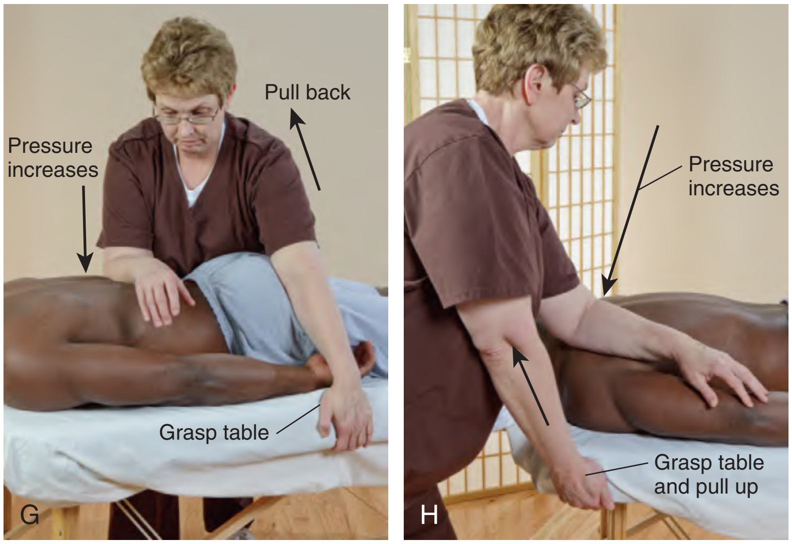


FIGURE 11-19, cont'd **E,** The ground reaction force from weight on the back leg during a weight shift results in the application of forces at the client contact. **F,** Weight transfer while kneeling. **G** and **H,** Application of counterpressure. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

FIGURE 11-20 Examples of mat work. **A,** Basic position for working on mat. **B,** Using foot/heel with a cane for additional balance.

SUMMARY

This chapter provides a review and a detailed population focus on massage methods. A comprehensive step-by-step written general massage protocol is provided, along with extensive illustrations and video footage on the Evolve website, which presents many examples for additional review. Focused massage application as described in Chapter 13 of this unit is based on the methods discussed in this chapter, which then are applied intelligently based on assessment findings to achieve determined outcome. Almost all of the methods described in this chapter are also assessment methods. Indeed, most massage is a form of assessment.

The actual massage is a weaving of palpation and movement assessment with treatment and then post-assessment. Gliding first is palpation that can discern surface edema. Gliding then becomes a method to move the fluid. Kneading is assessment to identify connective tissue **bind** and then is the method to introduce forces into the tissue to reduce bind. Active and passive joint movement is range-of-motion assessment that can become some type of application of muscle energy technique to lengthen and then stretch an area of restricted movement. Post-assessment is again active and passive joint movement. One thing becomes the other and then back again in the assessment/treatment/post-assessment continuum.

You should be able to work a solid 7 to 9 hours per day at least 5 days per week. If you cannot do this, your body mechanics are incorrect. Possibly, you will have to unlearn your current approach and relearn the more effective methods presented in this text.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1 Identify a current bodywork modality or technique with which you are familiar (Swedish, reflexology, shiatsu, deep tissue), and describe it in terms of stimulus and forces.

Examples:
Deep tissue
Depth of pressure—moderate to deep
Drag—moderate to intense
Duration—intermediate (45 seconds)
Frequency—two to three repetitions
Speed—slow
Rhythm—even

2 Watch someone give a massage (can be a video) and describe the application by stimulus and force.

Example: Massage begins with superficial glide to assess for skin temperature, texture, and bind. Glide assessment identified area of bind in the midscapular region. Compressive force was increased to moderate and direction changed, which moved tissue into ease position. Tissue was held for 30 seconds and then moved into bind direction. At bind, drag was increased and sustained for 30 seconds. Then tissue was kneaded …

3 Give a massage, providing an ongoing narrative of the process by describing the application, using terminology from this chapter and the previous assessment chapter. Be particularly attentive to joint movement applications.

Example: I am beginning the massage with palpation assessment using near touch to identify heat. Now, I am gently touching the skin and using a light pressure with drag to assess for areas of ease and bind … assessment of shoulder using active joint movement … position leg so that hip abduction and adduction can be assessed … stretch short hip adductors using active and passive hip abduction.

4 Do a comprehensive evaluation of your body mechanics while giving a massage. Identify areas of strength and weakness, and develop a corrective action plan.

CHAPTER

12 Stretching

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1 Define stretching.
2 Explain stretching as an intervention.
3 List assessments used to determine whether stretching would be beneficial.
4 Define active and passive stretching.
5 Define flexibility.
6 Use joint movement methods to assess for reduced or excessive range of motion.
7 Describe symptoms related to hypomobility or hypermobility.
8 Describe anatomic, physiologic, and pathologic barriers.
9 Use stretching methods effectively and safely.
10 Define muscle energy techniques.
11 Explain why muscle energy techniques complement stretching methods.
12 Define and demonstrate three types of muscle contractions used during muscle energy techniques.
13 Explain and demonstrate the use of breath and eye movement during muscle energy techniques.
14 Explain and demonstrate seven variations of muscle energy techniques.
15 Define direct tissue stretching.
16 Demonstrate longitudinal and cross-directional direct tissue stretching.
17 Combine stretching methods for increased effect.
18 Define and demonstrate active release and pin and stretch.

KEY TERMS

Active Assisted Stretching
Active Release
Comfort Barrier
Contract and Stretch
Contract Antagonist and Stretch
Contract-Relax-Antagonist-Contract
Counterpressure
Cross-Directional Stretching
Direct Tissue Stretching
Direction of Ease
Dynamic Stretching
Flexibility
Integrated Approach
Isometric
Isometric Contraction
Isotonic
Isotonic Contractions
Longitudinal Tissue Stretching
Muscle Energy Techniques
Pin and Stretch
Positional Release
Pulsed Muscle Energy
Strain-Counterstrain
Stretching

OUTLINE

There is confusion about what is meant by *stretching*. The typical dictionary definition describes stretching as the process of extending, expanding, and lengthening. Stretching for the purposes of this textbook is a method used to increase flexibility. **Flexibility** is the ability of soft tissues to yield to tension forces without tissue damage during joint range of motion.

STRETCHING

Objectives

1. Define stretching.
2. Explain stretching as an intervention.
3. List assessments used to determine if stretching would be beneficial.
4. Define active and passive stretching.

Stretching is an intervention that is used purposefully to cause an adaptation in the soft tissues, including tissue around joints of the body. Joint movement and palpation are the assessments used to determine whether stretching should be used to address areas of tissue shortening and increased density involved in lack of flexibility. See Chapter 10 for more assessment information.

Stretching methods are often included in the athlete's training program. Stretching methods used by athletes can be passive or active. Passive stretching occurs when a second person applies the force to stretch the tissue. Active is seen when individuals stretch themselves. Stretching of both types can also be included in the massage session. During massage, each jointed area should be moved actively, passively, or both ways as part of an assessment to determine the available range of motion. It is important to not confuse joint movement with stretching. Joint movement assesses the limits of movement as indicated by palpation of the resistance barrier, often called *bind*. Stretching begins at the bind and moves into it to change the amount of movement available (Box 12-1).

Because stretching is an intervention that requires adaptation, it is important to determine whether:

- The current condition is resourceful compensation that is productive and should not be changed.
- The client has sufficient adaptive capacity and time to respond to the change.
- The change positively affects performance.

Stretching as an intervention method needs to be used carefully to avoid adverse outcomes (McHugh and Cosgrave, 2010). Refer back to Chapter 3 to read about the research on stretching.

FLEXIBILITY

Objectives

5. Define flexibility.
6. Use joint movement methods to assess for reduced or excessive range of motion.
7. Describe symptoms related to hypomobility or hypermobility.
8. Describe anatomic, physiologic, and pathologic barriers.

As described, *flexibility* refers to the ability of joints to move through a full range of motion. Range of motion (ROM) is the distance and direction of movement of a joint. As described in Chapter 10, each specific joint has a normal range of motion that is expressed in degrees. Gender, age, and genetics are important when determining appropriate levels of flexibility.

BOX 12-1 Palpating Bind

The sensation of bind occurs when tissue is restrained from motion. To experience the sensation, do the following activities.

ACTIVITY ONE

1. Hold cloth, tissue, piece of paper, rubber band, etc., with one hand holding one end and the other holding the other end and the material in between.
2. Then hold one hand still, and begin to slowly pull the material with the other.
3. When you feel a tiny tug on the hand that is still, you have reached bind.

ACTIVITY TWO

1. Using one of your hands, grasp the lower edge of your shirt at one of the side seams.
2. Pull the shirt down a little, and then hold it still.
3. Side-bend away from the side being held down.
4. When you feel the tug in the hand holding the shirt down, you have reached the point of bind.

REDUCED RANGE OF MOTION

Limited range of motion is a reduction in the normal distance and direction through which a joint can move. Loss of flexibility can be a predisposing factor for physical issues such as pain syndromes or balance disorders. Motion may be limited by a mechanical problem within the joint, by swelling of tissue around the joint, by stiffness of soft tissues, or by pain. When a joint does not move fully and easily in its normal manner, it is considered to have a limited range of motion. Motion may be limited by a mechanical problem within the joint, swelling of tissue around the joint, spasticity of the muscles, altered connective tissue pliability, pain, or disease. Diseases that prevent a joint from fully extending may, over time, produce contracture deformities, causing permanent inability to extend the joint beyond a certain fixed position.

When range of motion is found to be limited through joint movement assessment, stretching methods may be indicated to increase flexibility. Stretching should be directed at the muscle's fascia, because fascial tissue has the most elastic tissue, and because ligaments and tendons (because they have less elastic tissue) are not intended to stretch very much at all (Morse et al, 2008). Overstretching of ligaments may weaken the joint's integrity, causing destabilization (which increases the risk of injury). Once the fascia associated with the muscle has reached its maximum length, attempting to stretch further only serves to stretch the ligaments and put undue stress upon the tendons (two parts of the body that you do not want to stretch). Through proper stretching techniques, we can safely elongate the myofascia (the connective tissues surrounding a muscle). This is important because our fascial network allows muscles, bones, and blood vessels to communicate down to a cellular level, continuously coordinating and restoring the body's proper physiologic functions.

EXCESSIVE JOINT RANGE OF MOTION

It is possible for a joint to become too flexible. Excessive flexibility can be just as bad as not enough flexibility because both increase the risk of injury. *Joint hypermobility* means that some or all of the joints have an unusually large range of movement. Joint hypermobility can cause symptoms such as

- Joint pain
- Back pain
- Dislocated joints, when the joint comes out of its correct position
- Soft tissue injuries, such as tenosynovitis (inflammation of the protective sheath around a tendon)

Excessive joint range of motion affects women more than men because female hormones increase flexibility. Joint hypermobility is treated with an exercise program to improve fitness and muscle strength resulting in increased stability. Do not overstretch hypermobile joints.

STRETCHING PRINCIPLES

Objective

9. Use stretching methods effectively and safely.

During stretching, the client should experience a pulling sensation in the short soft tissue and never a pain or strain in the joint or any other part of the body that is not being stretched. Anatomic barriers are determined by the shape and fit of bones at the joint. Do not stretch any jointed area beyond anatomic barriers, to prevent serious joint injury. Physiologic barriers are caused by the limits of the range of motion imposed by nerve and sensory function. When the physiologic barrier is reached, the client experiences appropriate stiffness and a pulling sensation into the area being stretched; this acts as a protective mechanism and prevents movement to the anatomic limits and potential injury. The pathologic barrier is of two types:

- Where pain and stiffness occur when joint movement assessment identifies reduced ROM, or hypomobility. Stretching may be indicated.
- Where lack of resistance is experienced when normal ROM is reached during assessment, indicating hypermobility. Do not stretch—strengthening is required.

When moving a joint during assessment, it is important to stay within the normal physiologic barriers, and if limits of ROM are identified, to gently and slowly encourage the joint to increase the range of motion only if hypomobility exists. It may take multiple sessions supported by client self-stretching for sustained results to become evident. Expect flexibility to increase gradually.

STRETCHING PROCEDURES

- Stretch tissues only when they are warm and pliable.
- Begin the stretch sequence by using massage to prepare the tissues.
- Stabilize the body so that only the target area moves during stretching.
- Move the area to the pathologic barrier, and back off a bit.
- Instruct the client to breathe in (inhale) right before the stretch, and then to breathe out (exhale) slowly as you move him or her into the stretch.
- Stretching should always be done within comfortable limits of ROM of the client.
- Stretching should be controlled and performed at a slow pace.
- A stretch does not need to be held longer than 20 seconds and is performed in sets of 2 to 5 repetitions, with a 15- to 30-second rest between stretches.
- Static stretches are done so that the joints are placed in the outer limits of the available range of motion and held (considered passive).
- **Dynamic stretching** occurs when opposing muscles are used to produce the force needed to stretch the short tissues (considered active).
- An increase of 10% in ROM is sufficient during a massage session. Do not attempt to increase the ROM by more than 25% during a massage session.

MUSCLE ENERGY TECHNIQUES

Objectives

10. Define muscle energy techniques.
11. Explain why muscle energy techniques complement stretching methods.
12. Define and demonstrate three types of muscle contractions used during muscle energy techniques.
13. Explain and demonstrate the use of breath and eye movement during muscle energy techniques.
14. Explain and demonstrate seven variations of muscle energy techniques.

Muscle energy techniques (MET) involve voluntary contraction of the client's muscles in a specific and controlled direction, at varying levels of intensity, against a specific counterforce applied by the massage therapist.

Muscle energy procedures have a variety of applications and are considered active techniques in which the client contributes the corrective force. The amount of effort may vary from a small muscle twitch to a maximal muscle contraction. The duration may be a fraction of a second to several seconds. All contractions begin and end slowly, gradually building to the desired intensity.

Research (see Chapter 3) indicates that use of proprioceptive neuromuscular facilitation (PNF)/muscle energy techniques (MET) to facilitate stretching is more efficient than static passive stretching. Our understanding of the mechanism of benefit of MET has changed over the past few years; most notable is the realization that post-isometric and reciprocal inhibition effects do not account for the ability to increase tissue length. Instead, increased tolerance to stretch that results from MET application is now considered to be the mechanism of benefit (Fryer, 2006). Theories as to why stretch sensation tolerance increases include the following:

- Nociceptive inhibition of the dorsal horn of the spinal cord via mechanoreceptor stimulation during MET
- Localized activation of the periaqueductal grey, producing descending pain modulation
- Increased activity of analgesic endocannabinoids (Fryer and Fossum, 2009)
- Altered fluid content of connective tissue due to sponge-like behavior during contractions (and compression) associated with MET-isometric contractions (Klingler et al, 2004)
- Viscoelastic changes in connective tissue pliability (Lederman, 1997), and/or
- Other unknown influences

Regardless, using controlled contraction before stretching is more effective than stretching alone.

As has been mentioned, the focus of muscle energy techniques is to increase tolerance to stretch. Muscle energy techniques are focused on dysfunctional movement patterns, primarily where hypomobility exists. To effectively perform MET methods, it is important for the practitioner to be able to position muscles so that the muscle attachments are close together or in a lengthening phase with the attachments separated. Study muscle charts until you understand the configuration of the muscle patterns, and practice isolating as many functional movements as possible, keeping in mind that proper positioning is important. When practicing, make sure that the muscle structures can be isolated, regardless of whether the client is in a supine, prone, side-lying, or seated position.

The massage practitioner uses three types of muscle contraction to activate muscle energy techniques.

Counterpressure is the force applied to an area that is contracting that is designed to match the effort or force exactly (**isometric contraction**) or partially (isotonic contraction) and multiple **isotonic contractions.** In an **isometric** contraction, the distance between the proximal and distal (origin and insertion) attachments of the target muscle(s) is maintained at a constant length. A fixed tension develops in the target muscle(s) as the client contracts the muscle against an equal counterforce applied by the massage therapist, preventing shortening of the muscle. In this contraction; the effort of the muscle, or group of muscles, is matched exactly by a counterpressure, so that no movement occurs, only effort.

An **isotonic** contraction is one in which the effort of the target muscle or muscles is not matched by the counterpressure, allowing a degree of resisted movement to occur. With a concentric isotonic contraction, the massage practitioner applies a counterforce but allows the client to move the proximal and distal (origin and insertion) attachments of the target muscle(s) together against the pressure. In an eccentric isotonic movement, the massage practitioner applies a counterforce but allows the client to move the jointed area so that the proximal and distal (origin and insertion) attachments of the target muscle separate as the muscle lengthens against the pressure.

Multiple isotonic contractions require the client to move the joint through a full range of motion against partial resistance applied by the massage practitioner.

Muscle energy techniques usually do not use the full contraction strength of the client. With most isometric work, the contraction should start at about 25% of the strength of the muscle. Subsequent contractions can involve progressively greater degrees of effort, but never more than 50% of available strength. Many experts such as Dr. Leon Chaitow use only about 10% of available strength in muscles being treated in this way, and find that they can increase effectiveness by using longer periods of contraction. Pulsed contractions (a rapid series of repetitions) using minimal strength are also effective.

BREATHING AND EYE MOVEMENT

Use of coordinated breathing to enhance particular directions of muscular effort is helpful. During muscle energy applications, all muscular effort is enhanced by inhaling as the effort is made and exhaling on the lengthening phase. Eye position is also effective. Looking toward the direction of the contraction causes or facilitates contraction of the target muscles. Looking away from the direction of contraction inhibits the target muscles. Use of eye movement is valuable with athletes who are prone to cramping or are having difficulty using only a small contraction force. It is recommended that eye movement be used first before active target muscle contraction. The following are common examples:

- To increase tension in neck flexors (tense and then relax), have clients look toward their belly, while rolling eyes down.
- To decrease tension in neck flexion, have clients look up over their head, while rolling the eyes up.
- To increase tension in left neck rotation or lateral flexors, have the client look left.

FIGURE 12-1 Use of eyes during muscle energy technique. **A,** Eyes looking down. Facilitates flexors, adductors, and internal rotators. Inhibits extensors, abductors, and external rotators. **B,** Eyes looking up. Facilitates extensors, abductors, and external rotators. Inhibits flexors, adductors, and internal rotators. **C,** Eyes looking left facilitates all muscle movement to the left. Inhibits all muscle movement to the right. **D,** Eyes looking right. Facilitates all muscle movement to the right. Inhibits all muscle movement to the left.

- To decrease tension in left neck rotators or lateral flexors, have the client look right.
- Reverse for right rotation or lateral flexor patterns (Figure 12-1).

Almost all flexor patterns–trunk, hip, knee, ankle, shoulder, arm, and wrist–are increased in tension (facilitated) when the client looks toward the abdomen and are inhibited when the eyes roll up.

Extensor patterns–for example, trunk, hip, knee, and ankle–are facilitated when the client looks up and are inhibited when the client rolls eyes down.

When in doubt about the position, just instruct clients to roll their eyes in big circles slowly and deliberately. The result will be a contract/relax antagonist contract pattern.

The eye movement replaces contraction of the target muscles, or it can enhance the contraction being used with muscle energy techniques.

A successful application is to lengthen the target area to bind and hold it there. Then begin the eye movement (usually big circles) as facilitation (contraction) and inhibition (relaxation) take place, slowly increasing the lengthening force on the target muscles until a more normal resting length is achieved (Figure 12-2).

MUSCLE ENERGY TECHNIQUES METHODS

Different methods can be classified as muscle energy techniques. Each method involves a series of controlled contractions of the muscles in the area to be stretched or the antagonists to those muscles. Methods begin at the comfort barrier. The **comfort barrier** is the first point of resistance short of the client perceiving any discomfort at the physiologic or pathologic barrier. The isometric contraction involves minimal effort lasting 7 to 10 seconds. Then the target area is stretched. Repetitions continue until no further gain is noted.

Log on to your Evolve website to watch Video 12-1: Muscle Energy Techniques.

Contract and Stretch

Following is the procedure for **contract and stretch** (Figure 12-3):

1. Lengthen the target tissue to the comfort barrier. Back off slightly.
2. Tense the target tissue for 7 to 10 seconds, or use eye position, or do both.
3. Stop the contraction and lengthen the target tissue.

FIGURE 12-2 Examples of using eye movement as part of MET. **A,** Instruct client to look down. Apply gentle pressure. Flexors hold strong. **B,** Instruct client to move eyes up. Apply gentle pressure. Flexors will inhibit and will be more tolerant of stretch. **C,** Eyes look right. Muscles on the right contract. **D,** Instruct client to look left to increase tolerance to stretching of the right neck flexors.

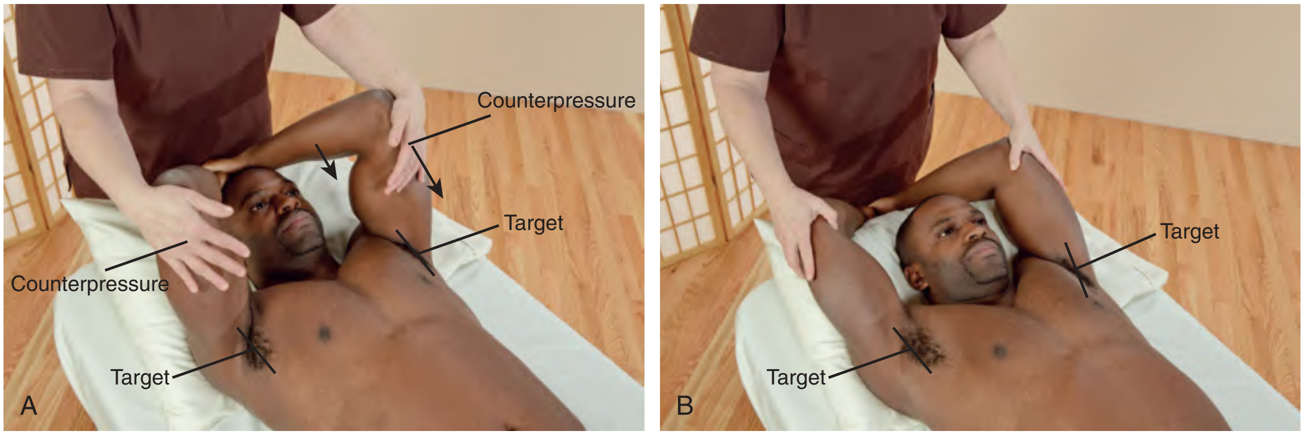


FIGURE 12-3 Contract and stretch sequence. **A,** Isolate target muscles. Apply counterpressure and instruct client to gently push into therapist's hands, contracting target muscles. **B,** Client stops contracting and the therapist stretches tissues into and just through bind to affect tissue length.

4. Repeat steps 1 to 3 until 10% to 25% improvement occurs.

Contract Antagonist and Stretch

The following is the procedure for **contract antagonist and stretch** (Figure 12-4):

1. Lengthen the target tissues to comfort barrier and back off slightly.
2. Contract the antagonist muscle group, or activate eye movement, or do both (the muscle in extension).
3. Stop the contraction and slowly bring the target tissues into a lengthened state, stopping at resistance.

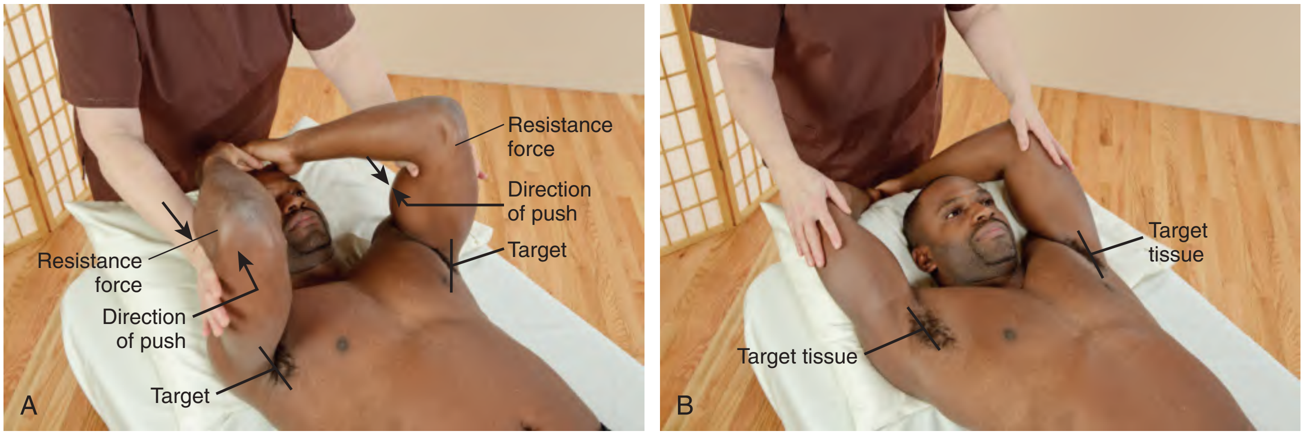


FIGURE 12-4 Example of contract antagonist and stretch sequence. **A,** Place target tissues at comfort barrier. Apply counterforce on antagonist, and instruct client to push gently into the hands. **B,** Client stops contracting, and the therapist stretches tissues into and just through the bind to affect tissue length.

4. Repeat steps 1 through 3 three or four times until 10% to 25% improvement occurs.

These two methods can be combined to enhance lengthening effects. This combined approach can be called **contract-relax-antagonist-contract** (CRAC).

The following is the procedure for contract-relax-antagonist-contract (Figure 12-5):

1. Position the target tissues at the comfort barrier.
2. Back off slightly.
3. Tense the target tissue for 7 to 10 seconds, or have the client roll his or her eyes in a big circle, or do both.
4. Contract the antagonist muscles, or have the client roll his or her eyes in a big circle, or do both.
5. Stop the contraction of the antagonist.
6. Stretch the target tissues to a more normal resting length.

Pulsed Muscle Energy

Pulsed muscle energy procedures involve engaging the comfort barrier and using small, resisted contractions (usually 20 in 10 seconds). This method can be used to increase stretch tolerance in short tissues or to stimulate weak long tissue, to increase tone.

The following is the procedure for pulsed muscle energy (Figure 12-6):

1. Isolate the target tissue by placing attachments as close together as possible.
2. Apply counterpressure for the contraction.
3. Instruct the client to contract the target tissues rapidly in small movements for about 20 repetitions. Go to step 4, or use this variation: maintain the position, but switch the counterpressure location to the opposite side, and have the client contract the antagonist muscles for 20 repetitions. Rapid eye movement can replace the pulses or enhance the action.
4. Slowly lengthen the target tissues.
5. Repeat steps 2 to 4 until a more normal full resting length is obtained (10% to 25% improvement).

Use pulsed muscle energy to stimulate weak inhibited muscles by doing the following (Figure 12-7):

1. Isolate the target tissue by placing attachments as close together as possible.
2. Apply counterpressure for the contraction.
3. Instruct the client to contract the target tissues rapidly in small movements for about 20 repetitions. Rapid eye movement can replace the pulses or enhance the action.
4. Slowly return the area to normal position. Do not stretch.

Note: All contracting and resisting efforts should start and finish gently.

Positional Release/Strain-Counterstrain

According to Dr. Chaitow, during **positional release**, techniques for various proprioceptors are influenced by methods that take them into an "ease" state, and that theoretically allow them an opportunity to "reset," reducing hypertonic status. **Strain-counterstrain** and other positional release methods use the slow, controlled return of distressed tissues to the position of strain as a means of normalizing function.

Positional release is a more generic term used to describe these methods. Positional release methods are used in painful areas, especially areas of recent strain, before, after, or instead of muscle energy methods. The tender points often are located in the antagonist of the tight muscle because of the diagonal balancing process the body uses to maintain an upright posture in gravity.

Repositioning of the body into the original strain (often the position of a prior injury) allows proprioceptors to reset and stop firing protective signals. By moving the body into the **direction of ease** (i.e., the way the body wants to go and out of the position that causes pain), the proprioception is taken into a state of safety. Remaining in this state for a time allows the neuromuscular mechanism to reset itself. The massage practitioner then gently and slowly repositions the area into neutral.

The positioning used during positional release is a full-body process. Remember that an injury or loss of balance is a full-body experience. For this reason, the practitioner

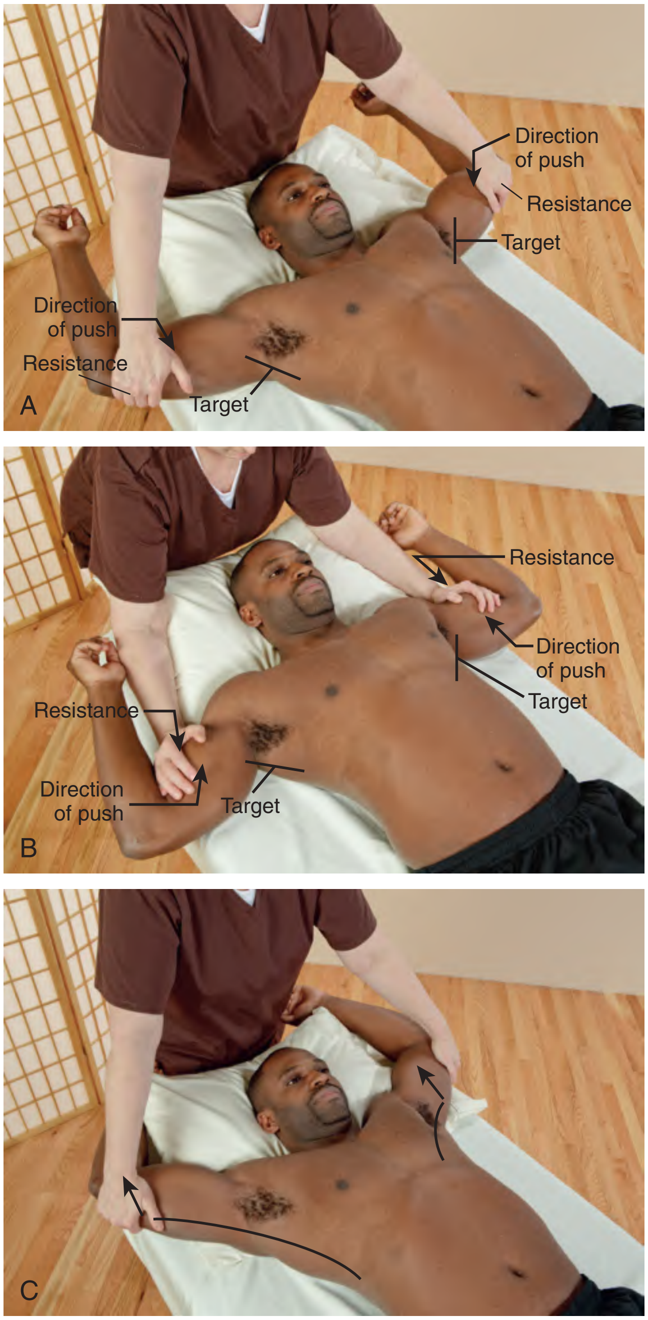


FIGURE 12-5 Contract-relax-antagonist-contract and then stretch shoulder adductors (quadriceps): **A,** Contract target tissue against applied counterforce. **B,** Move hands to antagonist muscles, and instruct client to push into the applied counterforce, contracting the antagonist muscle group. **C,** Instruct the client to stop pushing, and then stretch the target tissues.

FIGURE 12-6 Example of a pulsed muscle energy sequence. **A,** Isolate target muscle and position for counterpressure. Pulse muscle back and forth using controlled tiny movements. **B,** Tell client to stop movement and to stretch the short tissues. Pulsed muscle energy methods can be difficult for the client to perform. The pulsing contractions are small and precise. The eyes can move back and forth to facilitate the pulsing movement.

FIGURE 12-7 Example of pulsed muscle energy to stimulate weak inhibited muscles. Target hip abductors. Isolate target area and instruct client to pulse up into the resistance force 20 times. Do not stretch. Repeat if necessary.

must consider areas distant to the tender point during the positioning process. Very possibly, the position of the feet will have an effect on a tender point in the neck. Eye position is almost always a factor. Often the ease position can be found just with eye movement.

The following is the procedure for positional release (Figure 12-8):

1. Locate the tender point.
2. Gently initiate the pain response with direct pressure. Remember that the sensation of pain is a guide.

FIGURE 12-8 Example of a positional release sequence—pectoralis major: **A,** Locate tender point and apply only enough pressure to activate sensation. **B,** Maintain pressure on point and begin moving body into pain-free ease position. **C,** Continue modifying position as needed until pain-free (or significantly decreased) ease position is found. **D,** When the pain sensation is gone or is significantly decreased, maintain in ease position for approximately 30 seconds. **E,** Slowly move body back to neutral position or until tissues containing the tender point are at bind, and then gently increase bind to the stretch area.

3. Slowly position the body until the pain subsides. Include eye position.
4. Wait at least 30 seconds until the client feels the release, lightly monitoring the tender point.
5. Slowly move the body back to a neutral position, or gently stretch the tissue.
6. Repeat steps 1 to 5 until a more normal resting length is attained.

Positional release techniques are important because they gently allow the body to reposition and restore balance. They are also highly effective ways of dealing with tender areas, regardless of the pathologic cause. Sometimes it is impossible to know why the point is tender to the touch. However, if tenderness is present, a protective muscle spasm surrounds it. Positional release is an excellent way to release these small areas of muscle spasm without inducing additional pain.

Integrated Approach

Muscle energy methods can be used together or in sequence to enhance their effects. Muscle tension in one area of the body often indicates imbalance and compensation patterns in other areas of the body. Tension patterns can be self-perpetuating. Often, using an **integrated approach** introduces the type of information the nervous system needs to self-correct. The procedure outlined next relies on the innate knowledge of the body of what is out of balance and how a more normal functioning pattern can be restored.

The following is the procedure for an integrated approach. (Use the position from Option A, steps 1 and 2, or Option B, steps 1 and 2, as the starting point for the rest of the process that begins at step 3.)

Option A (Figure 12-9)

1. Identify the most obvious of the postural distortion symptoms.
2. Exaggerate the pattern by increasing the distortion, moving the body into ease. This position becomes the pattern of isolation of various muscles and associated tissues to be addressed in the next part of the procedure. Continue with step 3.

Option B

1. Identify a painful point.
2. Use positional release to move the body into ease until the point is substantially less tender to pressure. The position of ease found becomes the pattern of isolation of various muscles to be addressed in the next part of the procedure. Continue with step 3.

After choosing from Option A or Option B, continue the procedure as follows:

3. Stabilize the client in as many different directions as possible.
4. Instruct the client to move out of the pattern. Be as vague as possible and do not guide the client, because it is important for the client to identify the resistance pattern.
5. Provide resistance for the client to push or pull against.
6. Modify the resistance angle as necessary to achieve the most solid resistance pattern for the client.
7. Spend a few moments noticing when the client's breathing changes; then, while still providing modified resistance, allow the client to move through the pattern slowly.
8. When the client has achieved as much extension as he or she can, recognize that what the client has achieved is the lengthening pattern.
9. Gently increase lengthening to perform the stretch.
10. Pay attention to what body areas become involved besides the one addressed. This is your guide to the next position.

Active Assisted Stretching

The following procedure is used for **active assisted stretching** (Figure 12-10):

1. Identify and isolate the muscle, making sure it is not working against gravity in this position. Remind the client to exhale during the stretching phase of this technique.
2. Lengthen the muscle to its pathologic barrier, move slightly beyond this point, and stretch gently for 1 to 2 seconds.
3. Return the muscle to its starting position. Repeat this action in a rhythmic, pulse-like fashion for 5 to 20 repetitions.
4. The client can benefit from contracting the antagonist while the target muscle is lengthened and stretched. As in all proper lengthening and stretching movements, attention must be paid to the stretch reflex; bouncing is never done because it initiates this reflex.

DIRECT TISSUE STRETCHING

Objectives

15. Define direct tissue stretching.
16. Demonstrate longitudinal and cross-directional direct tissue stretching.

Direct tissue stretching targets tissues in a local area that have been assessed as short and binding. If only a small section of muscle needs to be stretched, if the muscle does not lend itself to stretching with joint movement, or if the joints are so flexible that not enough pull is put on the structures to achieve an effective stretch to the tissues, direct tissue stretching is the method of choice (Box 12-2).

This approach to stretching does not involve joint movement as part of the stretch application. Palpation and joint movements are the assessments that identify areas of short tissue; the tissue is directly stretched using the various mechanical forces applied by the massage therapist. **Longitudinal tissue stretching** pulls tissue in the direction of the fiber configuration. **Cross-directional stretching** pulls the tissue against the fiber direction.

Longitudinal tissue stretching uses tension force to separate the ends of the tissue to lengthen it. The procedure for longitudinal tissue stretching is as follows (Figure 12-11):

1. Locate the tissues to be stretched.
2. Place the hands, fingers, or forearms directly over the area to be stretched.

BOX 12-2 Stretching by Joint Movement Versus Direct Localized Tissue Stretching

Some muscle tissues are extremely difficult to stretch by using active or passive joint movement. This is related to the size, shape, and direction of the tissue fibers. Muscle tissues that are small and short, square or rectangular, and/or oriented transversely in the body respond better to direct tissue stretching. Following is a list of some of the muscles that are better addressed by direct methods:

Suboccipitals	Iliocostalis
Supraspinatus	Semispinalis
Pectoralis minor	Multifidus
Serratus posterior superior	Rotatores
Serratus posterior inferior	Quadratus lumborum
Supinator	Quadriceps
Anconeus	Popliteus
Longissimus	Tibialis anterior

FIGURE 12-9 Integrated approach combining MET methods. **A,** Part 1: locate target area. Option A: Identify the pattern of distortion. **B,** Increase distortion in ease position. **C,** Part 1: locate target area. Option B: Use tender point, and then move body into positional release to identify distortion pattern. **D,** Part 2: Treatment. Stabilize client in multiple areas, and instruct client to gently push out (about 10 seconds) while attempting to return to neutral position. **E,** After completely resisting client movement for about 10 seconds, allow the client to move through the resistance. **F,** At the end of the movement range achieved as the client moves against partial counter pressure, the massage therapist moves the area into bind to stretch the short tissues. **G,** If a tender point and positional release were used in part 1, again contact the tender point and refine the stretch position as necessary, so the tissues containing the tender point are stretched.

FIGURE 12-10 Active assisted stretching. **A,** Identify target area. **B,** Lengthen to and just into pathologic barrier with client assistance. **C,** Return to start position with client assistance. **D,** Stretch to and just through the barrier. Repeat multiple times until a more normal ROM is achieved.

FIGURE 12-11 Direct longitudinal tissue stretching.

FIGURE 12-12 Cross-directional tissue stretching.

3. Separate the fingers, hands, or forearms (tension force) or lift the tissue with pressure sufficient to stretch the tissue (bending or torsion force). Take up all slack from lengthening, then increase the intensity for up to 20 seconds.
4. Repeat two or three more times.

Cross-directional tissue stretching uses a pull and twist component, introducing torsion and bend forces. The procedure for cross-directional stretching is as follows (Figure 12-12):

1. Access the area to be stretched by moving against the fiber direction using compression.
2. Lift or deform the area slightly and hold for 30 to 60 seconds until the area gets warm or seems to soften.

Use the following procedure for skin and superficial connective tissue:

FIGURE 12-13 Example: active release method. **A,** Target tissues—pectoralis major and associated fascia. Fix (to hold steady) target tissues. Passively move target tissue into ease. Identify the area of increased tone or bind, and use compression and tension forces to hold in place. **B,** Maintain target tissue in while client moves arm away to stretch the tissue. **C,** Repeat 2 or 3 times, each time taking up any slack in the tissues.

1. Locate the area of restriction.
2. Lift and pull (like taffy), while first moving into the restriction and then pulling and twisting out of it, keeping constant tension on the tissue (remember the plastic wrap exercise). Go slowly. Take up slack until the area warms and softens.

FIGURE 12-14 Example of pin and stretch—target: hamstrings. **A,** Place tissue into passive ease, and pin (fix, hold steady) target tissues with compression and tension. **B,** Maintain target tissues at bind, and move the distal joint (knee) into extension. **C,** Maintain target tissues at bind while stretching the area. Repeat multiple times until a more normal resting length is achieved.

COMBINED STRETCHING—ACTIVE RELEASE AND PIN AND STRETCH

Objectives

17. Combine stretching methods for increased effect.
18. Define and demonstrate active release and pin and stretch.

FIGURE 12-15 Examples of stretching.

1. Position head at end range of movement (bind) and stabilize. This is the point of resistance for MET. Move shoulder down/away toward feet to provide tension force to stretch target tissues.
2. Using hand or forearm, apply compression and tension force to drag tissue into bind. With the other hand, begin to move adjacent joint (shoulder) away (toward head) when resistance (bind) is felt. It is appropriate to introduce MET methods.
3. The side-lying position is the most efficient position for stretching the tissue of the lateral torso.
4. To address reduced external rotation ROM, the shoulder is in abduction 90%, and the arm remains on the table. Stabilize just medial to the glenohumeral joint. Move into external rotation with or without client assistance. Stop at bind.
5. To address shortening tissue involved in supination and pronation, position the elbow just short of full extension, and stabilize. Then turn palm up to bind, and just into bind to stretch. Various applications of MET can be used to increase tolerance to the stretch.
6. The hip flexors are more easily stretched with the client side-lying (see example 3). Stabilize at the gluteus muscles on the top leg while grasping above the knee of the leg on the table, and slide the leg along the table into the stretch position.

FIGURE 12-15, cont'd

7. To stretch hip abductors, cross one leg over the other slightly, and internally rotate and stabilize. Using entire forearm, place hand on lateral side of thigh about midway between hip and knee. The therapist forearm lies firmly along lateral tissues to midcalf and pulls entire limb medially to stretch abductor tissue.
8. To stretch tissue of the anterior knee in the prone position, stabilize mid posterior thigh and flex knee to 90 degrees, and then no more than an additional 45 degrees. Do not attempt to bring heel to gluteal muscles.
9. In the prone or side-lying position, the tissues of the sole of the foot can be stretched by pushing heel down toward table and stabilizing. Use palm of hand to extend toes.
10. In side-lying position with therapist in back of client and with client hip flexed to 45 degrees, push knee down to table, and stabilize lateral side of thigh just above knee. Use forearm to cross the chest just under the clavicle, and roll the client back to stretch the tissues.

Effective stretching methods can combine the approaches described in this chapter. These combined approaches have been called **active release** and **pin and stretch** and involve the application of compression into the short binding tissue to hold it, followed by active or passive movement.

Muscle energy techniques can be implemented into combined methods (active release, Figure 12-13; pin and stretch, Figure 12-14):

1. Locate the area to be stretched.
2. Apply compression to the short tissue and hold it in a fixed position.
3. Instruct the client to tense the tissue identified as short, and then relax.
4. Instruct the client to move adjacent joints and lengthen the tissue, and/or the massage practitioner may use the other hand or forearm to move the tissue or joint into a stretched position.

STRETCHING ATLAS

The sequence of photos in Figure 12-15 provides an example of stretching position and methods by body area. Additional examples are provided on the Evolve website. These methods can be incorporated into the general massage protocol as indicated by assessment. Recall that stretching is considered an intervention. This means that it is applied only when tissue and/or joint movement is hypomobile.

Log on to your Evolve website to view the complete stretching atlas.

SUMMARY

In this chapter, stretching was defined and explained as an intervention that causes short binding tissues to change, by increasing flexibility. Various assessment procedures may be used to determine whether stretching would be beneficial. Stretching methods can be considered active and passive and serve as targets to areas of limited range of motion when a pathologic barrier exists.

Muscle energy techniques complement stretching methods by increasing tolerance to stretch sensation. Use of breath and eye movement during muscle energy techniques also supports stretching outcomes. Direct tissue stretching is an approach that easily blends with massage application. Combined stretching methods, such as *active release*, or pin and stretch, can also increase the response to stretching.

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evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1 Describe how the stretching atlas can be used as an assessment tool.
2 How might you explain proper stretching methods to a client who is overstretching?
3 In what ways can stretching methods be incorporated into the massage session?
4 How could you use the stretching atlas as a self-help tool?

CHAPTER

13 Focused Massage Application

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1 Perform indirect functional techniques.
2 Perform direct functional techniques.
3 Perform circulation support and lymphatic drain massage.
4 Perform connective tissue application.
5 Perform trigger point therapy.
6 Perform joint play.
7 Perform specific releases.

KEY TERMS

Active Release
Anterior Rotation
Anterior Serratus
Bind
Connective Tissue Methods
Deep Lateral Hip Rotators
Diaphragm
Edema
Fluid Dynamics
Groin Area Muscles
Hamstrings
Indirect Functional Techniques
Inflare
Interspinalis
Intertransversarii
Joint Play
Lymph Nodes
Lymphangions
Lymphatic Drain Massage
Mobilization With Movement
Multifidi
Outflare
Pectoralis Minor
Pelvis Alignment
Posterior Rotation
Psoas
Quadratus Lumborum
Rectus Abdominis
Rhomboid
Rotatores
Sacroiliac Joint
Scalenes
Sternocleidomastoid
Subscapularis
Trigger Points

OUTLINE

This chapter discusses various massage methods that target specific tissues or body functions. Subjects discussed include indirect functional techniques, fluid dynamics, connective tissue, trigger points, joint play, and specific releases.

INDIRECT AND DIRECT FUNCTIONAL TECHNIQUES

Objectives

1. Perform indirect functional techniques.
2. Perform direct functional techniques.

Indirect functional techniques are usually referred to as indirect techniques or indirect methods of treatment. These methods are very gentle and safe. Rather than being treated as a specific modality, functional indirect methods need to be incorporated into the massage application, regardless of whether the focus is soft tissue or joint movement. These methods, rather than engaging and attempting (by whatever means) to overcome resistance (**bind**), do the exact opposite. The soft tissue or joint is taken in all directions to the point of maximum ease. The massage practitioner simply maintains the joint or tissue in this ease position. No further treatment is provided at this point, and after a couple of minutes, the position is gently released.

Direct functional techniques are the opposite of indirect methods. These methods begin at the restriction barrier (bind) and move into resistance. Direct methods are more invasive than indirect methods. Because these methods produce changes by increasing the intensity of the mechanical force application to move tissue beyond the point of bind, the potential for adverse effects is increased.

Regardless of how methods are done, the underlying principles are assessment of ease and bind and the natural tendency of the body to seek homeostasis.

Soft tissue or joint mobility is assessed for motion restriction by palpation and/or joint movement, and restricted motion is treated by taking the dysfunctional tissue or joint in the direction of easier movement, which would be away from the restriction or bind, and toward the way the tissue or joint wants to go in all planes of movement (sagittal, frontal, transverse). The soft tissue ease position is maintained until a sense of softening is perceived. If the massage practitioner cannot easily palpate or identify this sensation, the position should be held in this area 30 to 60 seconds. Breathing can enhance the ease position and is assessed by having the client inhale and exhale, typically holding the breath for a few seconds in the direction that further contributes to the ease of tissue tension. Because indirect functional techniques are noninvasive methods, they should be the first approach attempted to normalize tissue and joint movement.

On the other hand, stretching is considered a direct technique because it engages the bind and moves through it. Stretching is more invasive than indirect methods, increasing the potential for adverse reactions.

A modification that incorporates the indirect method and more aggressive direct stretching involves moving back and forth between the ease position and the bind position. This can be described as indirect/direct. First, the ease position is identified and held, as previously described. Then the restrictive barrier of a joint or tissue is engaged in each plane of motion and is held taut at the barrier until softening occurs. The corrective activating force moves slightly through the restrictive barrier and again sustains the area in this position for 30 to 60 seconds, until the tissue softens. Various forms of oscillation can be added. It is effective to alternate 2 or 3 times between direct and indirect application.

Ease/indirect and bind/direct methods can be combined with muscle energy methods. As discussed, during muscle energy application, muscles (contractions) are actively used to support the response. Muscles are placed in a specific direction, which can be ease or bind; the client then pushes slowly in a controlled manner against a counterforce usually supplied by the massage therapist.

A variation is to introduce a mild degree of overpressure at the point of maximum ease, which actually results in taking the soft tissue just into a bit of bind. The result is release of previously restricted tissues. It is essential that all movements are directed and controlled by the practitioner. A refinement of this application involves adding gentle focused oscillation while the tissue or the joint is in the ease position. Vibration, tiny shaking movements, and small focused rocking all are effective. In another variation, the client produces the oscillation with tiny pulsed movements against resistance provided by the massage practitioner (pulsed muscle energy).

Indirect and direct functional methods serve as the basis for **connective tissue methods**, described in greater depth later in the chapter. Connective tissue methods can be indirect (i.e., a restricted area is placed into a position of little resistance until subsequent relaxation occurs) or direct (i.e., the affected area is placed against a restrictive barrier with constant force [stretched] until fascial release occurs).

A sequence of indirect and direct functional techniques is shown in Figure 13-1.

Log on to your Evolve website to view additional examples of direct and indirect application.

FLUID DYNAMICS

Objective

3. Perform circulation support and lymphatic drain massage.

The body is an interconnected network of fluid compartments that contain blood, interstitial fluid, lymph, synovial fluid, and cerebrospinal fluid. Normal flow within the tissue and exchange of fluid between compartments

FIGURE 13-1 Examples of direct and indirect application. **A,** Moving tissues into ease takes less effort. **B,** Moving tissues into bind requires more effort. **C,** The indirect ease position places target tissues on slack. **D,** Moving tissue with direct methods to and through bind makes tissues taut. **E,** Local tissues can be addressed by moving them into ease and holding. **F,** Direct/bind local tissue stretching is effective. **G,** Very specific points can be addressed first by moving the area into ease. **H,** Then, after holding a specific target area in ease, move the area into bind, possibly just into the bind.

are essential for homeostasis. Any impediment to normal flow leads to fluid stagnation, resulting in impaired tissue nutrition and repair. Stagnant tissue fluid becomes toxic, which, as the protein content increases, can lead to fibrotic tissue changes.

Fluid tension in the body is called *hydrostatic pressure*. Body fluid is classified as extracellular (outside the cell) and intercellular (within the cell). About one-third of body fluid is extracellular and is located in two compartments:

1. The blood circulatory system, including arteries and veins
2. The interstitial or anatomic space around cells and lymphatic vessels

Fluids also move across compartments by diffusion from areas of high salt concentration to areas of lower salt concentration. The rate and volume of fluid movement are determined by pumping mechanisms such as the heart, muscle contraction and relaxation, rhythmic compression of fascial structures during movement, and respiration. Other factors influencing fluid movement include the viscosity of the fluid, the permeability of the membranes, and the size of the various vessels through which fluid travels.

Vasodilators and constrictors of the circulatory system therefore influence the movement of body fluid. Massage that addresses the extracellular fluid can mechanically support the movement of fluid within these compartments by stimulating *hydrokinetics* (transport of fluid) along pressure gradients from high pressure to lower pressure. The mechanical pumping and oscillation applications of massage and the reflexive release of vasodilators (primarily histamine) produced during massage, coupled with the vasodilatation or constriction response of hydrotherapy, interplay in various ways to influence the outcome of the application.

INFLAMMATION AND FLUID DYNAMICS

Inflammation results in increased interstitial fluid, which then raises hydrostatic pressure in the area. Tissue swelling produces pain caused by pressure on pain receptors. This increase in tissue pressure can serve a protective function by mechanically limiting movement and producing pain. This is important during the first few days after an acute injury, but the process then needs to begin to reverse itself for normal healing to take place.

The inflammatory process heightens the influence of chemical vasodilators affecting the venules and capillaries. Greater permeability of blood vessels is noted locally, with reduced flow velocity. This leads to the formation of local edema and stasis, with reduced exchange of nutrient and waste products. Pressure on vessels, or reduction of tissue space by changes in muscle tone, fascial pliability and length, and bony impingement, can also impede fluid exchange in the tissue. Carpal tunnel syndrome is an example in which the median nerve is impinged by fascial shortening and edema. Restoration of fascial pliability and reduction of edema support normal function. Massage treatment uses tensile forces to elongate shortened connective tissue, compressive forces to support the pumping action, encouraging the movement of tissue fluid, and neuromuscular applications to reduce and normalize muscle tone.

Edema

Edema, which is the presence of abnormally large amounts of interstitial fluid, can be caused by a variety of factors, some of which are discussed here.

- *Lack of exercise.* Exercise in which muscles alternately contract and relax stimulates lymph circulation and cleans muscle tissue. If muscles stay contracted or flaccid, lymph circulation decreases drastically inside muscles, and edema can result.
- *Overexercise.* During exercise, both blood pressure and capillary permeability increase, allowing more fluid to seep into interstitial spaces. If movement of fluid exceeds the ability of the lymphatic capillaries to drain the areas, fluid accumulates. This seems to be a contributing factor to delayed-onset muscle soreness.
- *Salt.* The body maintains a specific ratio of salt to fluids. The more salt a person consumes, the more water is retained to balance it, which can result in edema.
- *Heart and kidney disease.* These diseases affect blood and lymph circulation. Lymph massage stimulates the circulation of lymph. Caution is indicated because the increase in fluid volume could possibly overload an already weakened heart and kidneys.
- *Menstrual cycle.* Water retention and a swollen abdomen are common before or during the menstrual cycle.
- *Lymphedema.* Lymphedema is a condition of stasis of lymph secondary to obstruction of lymph vessels or disorders of the lymph nodes. Limbs affected by this condition become very swollen and painful, resulting in difficulty moving the affected limb and disfigurement. Lymphedema can be life-threatening. Interstitial fluid is contaminated, and even small wounds can become infected.
- *Inflammation.* Increased blood flow to an injured area and release of vasodilators, which are part of the inflammatory response, can cause edema in localized areas. This is a common response to injury and surgery.
- *Other causes.* Medications, including steroids, hormones, and chemotherapy for cancer, may cause edema as a side effect. Scar tissue and muscle tension can cause obstructive edema by restricting lymph vessels.

THE LYMPHATIC SYSTEM

Massage generally stimulates the circulation and lymph movement. The lymphatic system transports fluid from around the cells through a system of filters. Interstitial fluid becomes lymph fluid once it enters the lymphatic capillaries.

The lymphatic system permeates the entire tissue structure of the body in a one-way drainage network of vessels, ducts, nodes, lacteals, and lymphoid organs. Segments of lymph capillaries are divided by one-way valves and a spiral set of smooth muscles called **lymphangions**. This system moves fluid against gravity in a peristalsis-type undulation.

The lymphatic tubes merge into one another until major channels and vessels are formed. These vessels run from the distal parts of the body toward the neck, usually alongside veins and arteries. Valves in the vessels prevent backflow of lymph.

Lymph nodes are enlarged portions of the lymph vessels that generally cluster at the joints. This arrangement assists movement of lymph through the nodes by means of the pumping action from joint movement.

All of the body's lymph vessels converge into two main channels: the thoracic duct and the right lymphatic duct. Vessels from the entire left side of the body and from the right side of the body below the chest converge in the thoracic duct, which in turn empties into the left subclavian vein, situated beneath the left clavicle. The right lymphatic duct collects lymph from the vessels on the right side of the head, neck, upper chest, and right arm. It empties into the right subclavian vein beneath the right clavicle.

Movement of lymph occurs along a pressure gradient from high-pressure to low-pressure areas. Fluid moves from the interstitial space into the lymph capillaries through a pressure mechanism exerted by respiration, peristalsis of the large intestine, compression of muscles, and pull of the skin and fascia during movement. This action is especially prominent at the soles of the feet and the palms of the hands, where major lymph plexuses exist. It is likely that the rhythmic pumping of walking and grasping facilitates lymphatic flow.

Lymph circulation involves two steps:

1. Interstitial fluid flows into the lymphatic capillaries. Plasma is forced out of blood capillaries into spaces around the cell walls. As fluid pressure between cells increases, cells move apart, pulling on the microfilaments that connect the endothelial cells of the lymph capillaries to tissue cells. This pull on the microfilaments causes the lymph capillaries to open like flaps, allowing tissue fluid to enter the lymph capillaries.
2. Lymph moves through a network of contractile lymphatic vessels. The lymphatic system does not have a central pump, as the heart does. Various factors assist in the transport of lymph through the lymph vessels.

The "lymphatic pump" of the body is the spontaneous contraction of lymphatic vessels that results from increased pressure from lymphatic fluid. These contractions usually start in the lymphangions adjacent to the terminal end of the lymph capillaries and spread progressively from one lymphangion to the next, toward the thoracic duct or the right lymphatic duct. The contractions are similar to abdominal peristalsis and are stimulated by increases in pressure inside lymphatic vessels. Contractions of the lymphatic vessels are not coordinated with the heart or breath rate. If pressure inside the lymphatic vessels exceeds or falls below certain levels, lymphatic contractions cease.

During breath inhalation, the thoracic duct is squeezed, pushing fluid forward and creating a vacuum in the duct. During exhalation, fluid is pulled from the lymphatics into the thoracic duct to fill the partial vacuum.

LYMPHATIC DRAIN MASSAGE

Objective

3. Perform circulation support and lymphatic drain massage.

CONTRAINDICATIONS AND CAUTIONS

Edematous tissues have poor oxygenation and reduced function, and they heal slowly after injury. Chronic edema results in chronic inflammation and fibrosis, making the edematous tissue coarse, thicker, and less flexible.

Lymphatic drain massage may lower blood pressure. If the client has low blood pressure, the danger is that it may fall further, and the client may be dizzy when standing up.

When a person is ill with a viral or bacterial infection and fever, circulation of lymph through the nodes slows, giving the lymphocytes more time to destroy the bacteria or virus. Because massage moves fluid through the lymphatic system more quickly, it can interfere with the body's efforts to defeat attacking cells and can prolong the illness. During fever, white blood cells multiply rapidly, but bacteria and viruses multiply more slowly; fever therefore is part of the body's healing process. Because lymphatic drain massage lowers body temperature, do not give such a massage to a client with a fever.

Lymphatic drain massage affects the circulation of fluid in the body and can overwhelm an already weak heart or kidneys. Do not perform lymphatic drain massage on anyone with congestive heart failure or kidney failure, or undergoing kidney dialysis, unless the massage is specifically ordered by the client's physician.

INDICATIONS

Simple edema, screened for contraindications, responds well to massage focused on the lymphatic system. This approach is helpful for soft tissue injury, which includes surgery (with supervision), because it speeds healing and reduces swelling.

Traveler's edema is the result of enforced inactivity, such as sitting in an airplane or a car for several hours. It can affect anyone who sits for extended periods. Interstitial fluid (tissue fluid) responds to gravity, causing swelling in the feet, hands, and buttocks of a person who has to sit without moving very much for a few hours. Lymph drainage massage can remove the edema and reduce the pain and stiffness caused by the edema. Caution is indicated for the formation of blood clots with prolonged inactivity. Because many professional athletes often travel, this is a concern for massage.

Exercise-induced, delayed-onset muscle soreness is partly the result of increased fluid pressure in the soft tissues. Lymphatic drain massage is effective in reducing pain and stiffness associated with this condition.

Lymphatic drain massage softens scar tissue and stimulates improved circulation.

PRINCIPLES

Pressure provided by massage mimics the drag and compressive forces of movement and respiration and can move the skin to open the lymph capillaries. The pressure gradient from high pressure to low pressure is supported by creating low-pressure areas in the vessels proximal to the area to be drained.

Depth of pressure, speed and frequency, direction, rhythm, duration, and drag are adjusted to support the lymphatic system. Pressure should be just sufficient to move the skin.

Disagreement exists about the intensity of pressure used. Some schools of thought recommend very light pressure. Others use deeper pressure and hold that the stronger the compression used, the larger will be the increase in the flow rate of lymph. This text combines the two approaches.

Lymphatics are located mostly in superficial tissues, in the outer 0.3 mm of the skin; surface edema occurs in these superficial tissues, not in deep tissue. Moving the skin moves the lymphatics. Stretching the lymphatics longitudinally, horizontally, and diagonally stimulates them to contract.

Simple muscle tension puts pressure on the lymph vessels and may block them, interfering with efficient drainage. Massage can normalize this muscle tension. As muscles relax, lymph vessels open, and drainage is more efficient.

TREATMENT

In general, massage first drains the surface area using lighter pressure; then areas of muscle tension are worked on using appropriate massage methods and pressure. Finally, work is finished in the area with another surface lymph drain.

The greater the amount of fluid in the tissue, the slower the massage movements. Massage strokes are repeated slowly, at a rate of approximately 10 per minute; this is approximately the rate at which the peripheral lymphatics contract.

Move lymph fluid toward the closest cluster of lymph nodes, which for the most part are located in the neck, axilla, and groin. Massage near the nodes first, then move fluid toward them, working proximally from the swollen area toward the nodes. Massage the unaffected side first, then the obstructed side. For instance, if the right arm is swollen because of scar tissue from a muscle tear, massage the left arm first.

The approach is a rhythmic, slow repetition of massage movements. Full-body lymph drain massage lasts about 45 minutes. Focus on local areas for about 5 to 15 minutes.

The methods of lymphatic drain massage are fairly simple, but this is a very powerful technique that elicits body-wide responses. Although disagreement about the method has been expressed, all approaches have some validity. Therefore, the technique described in this text combines the various methods used to support lymphatic movement in the body.

The massage session begins with a pumping action on the thorax. Place both hands on the anterior surface of the thoracic cage. While the client exhales completely, passively follow the movements of the thorax with your hands. When the client starts inspiration, resist the movement of the thorax for 5 to 7 seconds. Repeat this procedure 4 or 5 times. Pumping action on the thorax increases lymph drainage through the lymphatic ducts by additionally lowering intrapleural pressure and exaggerating the action of inhalation and exhalation of breath.

The massage application consists of a combination of short, light, pumping, gliding strokes beginning close to the torso at the node cluster and those directed toward the torso; the strokes methodically move distally. The phase of applying pressure and drag must be longer than the phase of release. The releasing phase cannot be too short because the lymph needs to drain from the distal segment. Therefore, the optimal duration of the pressure and drag phase is 6 to 7 seconds; for the release phase, it is about 5 seconds. This pattern is followed by long, surface gliding strokes with a bit more pressure to influence deeper lymph vessels. The direction is toward the drainage points (following the arrows on the diagram in Figure 13-2).

The focus of initial pressure and finishing strokes is on the dermis, just below the surface layer of skin, and on the layer of tissue just beneath the skin and above the muscles. This is the superficial fascial layer, which contains 60% to 70% of the lymphatic circulation in the extremities. It does not take much pressure to contact the area. If too much pressure is applied, the capillaries are pressed closed, which nullifies any effect on the more superficial vessels. Generally, light pressure is indicated initially, and this increases to a moderate level (including kneading and compression, as well as gliding) during repeated application to the area to reach the deep lymphatic vessels; it then returns to lighter pressure over the area.

Drag is necessary to affect the microfilaments and to open the flaps at the ends of the capillary vessels. A pumping, rhythmic compression on the soles of the feet and the palms of the hands supports lymph movement. Rhythmic, gentle passive and active joint movement reproduces the body's normal means of pumping lymph. The client helps the process through deep, slow breathing, which stimulates lymph flow in the deeper vessels.

When possible, position the area being massaged above the heart, so that gravity can assist lymph flow. (See specific protocol, beginning on page 219.)

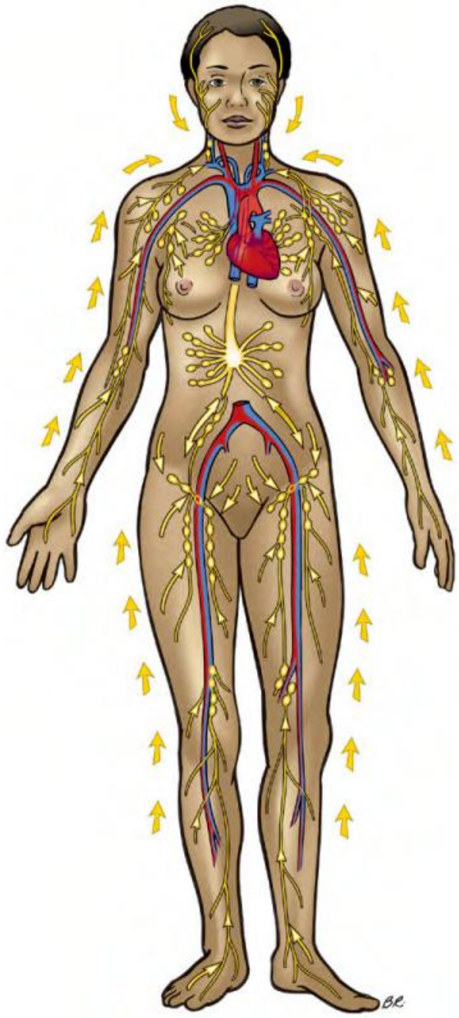

FIGURE 13-2 Direction of strokes for facilitating lymphatic flow. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

THE CIRCULATORY SYSTEM

Objective

3. Perform circulation support and lymphatic drain massage.

The circulatory system is a closed system composed of a series of connected tubes and a pump. The heart pump provides pressure for the blood to move through the body via the arteries and eventually into the small capillaries, where actual blood gas and nutrient exchange occurs. Blood returns to the heart by way of the veins. Venous blood flow is not under pressure from the heart. Rather, it relies on muscle compression against the veins to change interior venous pressure. As in the lymphatic system, backflow of blood is prevented by a valve system.

MASSAGE METHODS

The purpose of circulatory massage is to stimulate efficient flow of blood through the body. Current research seems to indicate that this effect is not as pronounced as was once believed (see Chapter 3). However, because the research findings are somewhat mixed, it is prudent to consider a form of massage application that logically would support this body function by mimicking normal function.

Massage to encourage blood flow to the tissues (arterial circulation) is different from massage performed to encourage blood flow from the tissues back to the heart (venous circulation). Because of the valve system of the veins and lymph vessels, deep, narrow-based stroking over these vessels from proximal to distal (from the heart out) is contraindicated. A small chance exists of breaking down the valves if this is done. However, compression, which does not slide, as does gliding or stripping, is appropriate for stimulating arterial circulation.

TREATMENT

Compression is applied over the main arteries, beginning close to the heart (proximal), and systematically moves distally to the tips of the fingers or toes. Manipulations are applied over the arteries, with a pumping action at a rhythm of approximately 60 beats per minute, or whatever the client's resting heart rate is. Compressive force changes internal pressure in the arteries, stimulates intrinsic contraction of arteries, and encourages movement of blood out to the distal areas of the body. Compression also begins to empty venous vessels and forms an arterial-venous pressure gradient, encouraging arterial blood flow (Figure 13-3).

Rhythmic, gentle contraction and relaxation of the muscles powerfully encourage arterial blood flow. Both active and passive joint movements support the transport of arterial blood.

The next step is to assist venous return flow. This process is similar to lymphatic massage in that a combination of short and long gliding strokes is used in conjunction with movement. The difference is that lymphatic massage is done over the entire body, and movements are usually passive. With venous return flow, gliding strokes move distal to proximal (from fingers and toes to the heart) over the major veins. The gliding stroke is short—about 3 inches. This enables the blood to move from valve to valve. Long gliding strokes carry blood through the entire vein. Both passive and active joint movements encourage venous circulation. Placing the limb or other area above the heart brings gravity into assistance (Figure 13-4).

Athletes experience **fluid dynamics** issues in various ways. Hydration is especially important and is discussed in Unit One. In terms of methodical application, the massage outcome can target each main fluid area: arterial, venous, and lymphatic functions. All of these areas are strained during exercise. Cardiovascular fitness is a major focus of many exercise programs and of sport conditioning and training. Application of massage support to influence fluid dynamics is dependent on whether massage is applied

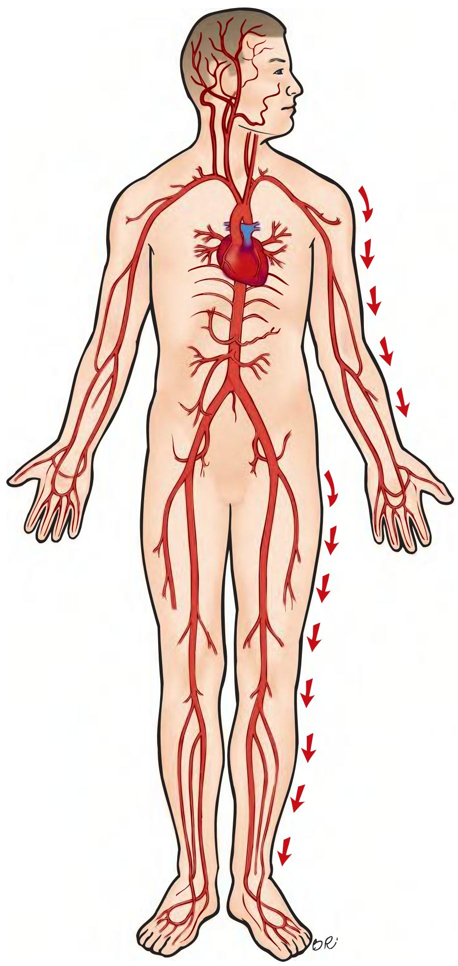

FIGURE 13-3 Direction of compression over arteries to increase arterial flow. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

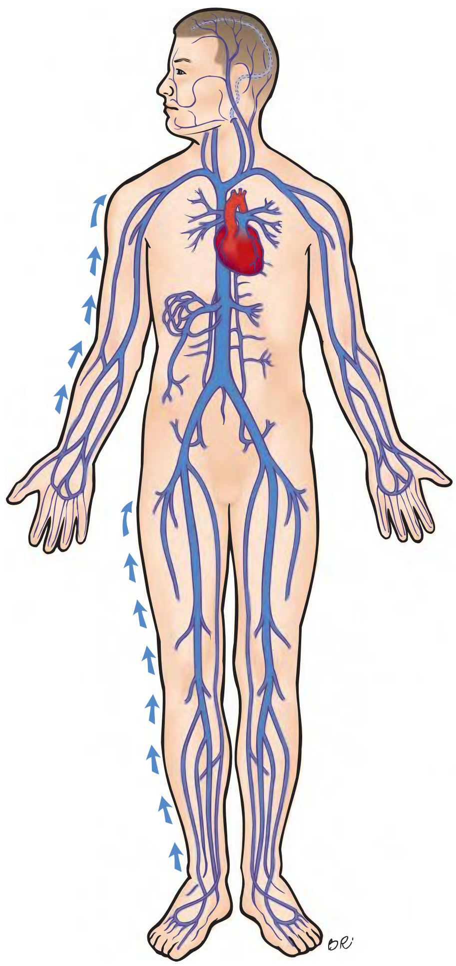

FIGURE 13-4 Direction of gliding strokes to facilitate venous flow. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

as part of the "warm-up–cool-down–recovery," or as part of the rehabilitation process.

In general, massage application targeted to increase arterial flow is part of the warm-up process. Venous congestion can occur post exercise, as does an increase in interstitial fluid. Methods to address venous return can decrease interstitial fluid by moving it into the lymphatic system.

Recovery involves normalizing all fluid movement. Injury rehabilitation involves managing swelling and encouraging effective circulation to the injured area to support healing.

Specific situations involving focused massage applications include injury swelling; sprains, strains, or other contusions; surgery swelling; delayed-onset muscle soreness; and chronic swelling (joint).

Strains, sprains, contusions, and surgery require specific treatment. These local injuries of the first and second degree (mild and moderate) benefit from both local and systemic lymphatic drain massage. It is important to decongest the entire drainage area affecting the injured area, for example, a sprained ankle requires drainage of the entire leg into the trunk.

PRICE (*p*rotection, *r*est, *i*ce, *c*ompression, *e*levation) treatment should be used for the first 24 hours. Movement of fluid from superficial tissues can begin after the acute stage begins to diminish—as always, proper medical care needs to be provided and medical team orders followed.

Treatment of delayed-onset muscle soreness can begin as a preventive measure immediately after activity begins. Part of the process of delayed-onset muscle soreness involves inflammation with increased capillary permeability. Increased influence of the sympathetic autonomic nervous system on blood pressure leads to increased fluid movement from capillary beds into tissues. This increases interstitial fluid and hydrostatic pressure within the tissues. Lymph capillaries are unable to effectively drain the area, and congestion increases, which puts pressure on the pain-sensitive receptors.

Chronic swelling usually occurs around joints, tendons, and bursae. Edema acts as a protective mechanism in attempting to reduce the problem that is causing the inflammation. A portion of the treatment for this condition involves addressing fluid issues of both blood and

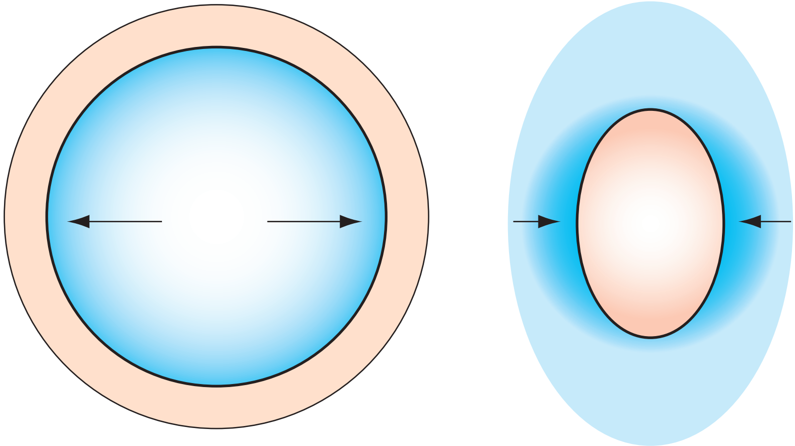

FIGURE 13-5 Effects of hydrostatic pressure.

lymph. When massage is used, the goal is to reduce the fluid enough to increase function–not to interfere with the protective process and increased stability provided by hydrostatic pressure (Figure 13-5).

The entire area around the contusion needs to be drained, but caution is necessary because the capillaries have been damaged, and the massage must not interfere with the healing process. However, blood in the interstitial fluid increases the protein content of the fluid, which increases the potential for formation of fibrotic tissue. This is why it is essential that the lymphatic system remove interstitial fluid containing blood. Appropriate massage application can enhance this process.

Use of massage to increase arterial and venous circulation and lymphatic movement will be recommended throughout the text to serve the athlete and others who are involved in fitness and rehabilitation programs.

The following section provides a precise description of the massage application that affects first arterial flow, and then venous return; both approaches involve addressing capillary beds. Next, lymphatic drain massage for interstitial (extracapsular) tissue fluid and intracapsular fluid (inside the joint capsule) is described. These three approaches are easily and effectively combined.

Methods of mechanical and reflexive fluid movement are primarily focused on mechanical force. To understand them, it is necessary to understand both the structure and the function of vascular and lymphatic systems. It is also necessary to appreciate the properties of a fluid, including properties of water, colloids, and viscosity.

Fluids naturally move from high pressure to low pressure with gravity. The more viscous (thick) the fluid, the slower it moves. Fluid moves against gravity only with a pump. The faster and stronger the pump, the more fluid is moved.

Permeability is the rate at which a fluid (water) moves across a membrane. Fluid moves by *osmosis* and *diffusion.* The application of effective massage is dependent on all of these factors (Figure 13-6).

Increasing Arterial Circulation

Various mechanisms can influence arterial circulation. The massage application needs to address all these areas. However, effects of pressure in the vessels and of stimulation of vasodilatation are especially important. These effects include the following:

- Increased sympathetic arousal, which increases both stroke volume and heart rate
- Increased buildup of pressure within the vessels
- Vasodilatation of the capillaries

The general massage should be brisk, lasting 15 to 30 minutes. Active participation of the client in various forms of range of motion and muscle energy methods is effective in increasing both sympathetic arousal and demand for blood as a result of muscle activity.

Deliberate temporary pressure against the arteries results in a buildup of fluid pressure between the heart and the temporary blockage caused by the therapist's pressure. This leads to an increased flow rate of the blood when the pressure block is released. Compression of the arteries in a rhythmic fashion moves arterial blood faster toward the capillaries to supply the nutritional and oxygen requirements of tissues. Usually, the target areas are limbs, hands, and feet.

To create temporary pressure, do the following:

1. Position the area where increased arterial circulation is desired, below the heart if possible: Seated, standing, and semireclined positions are most desirable.
2. A broad-based compression force is used against the tissue over the arteries. Begin close to the torso. If the

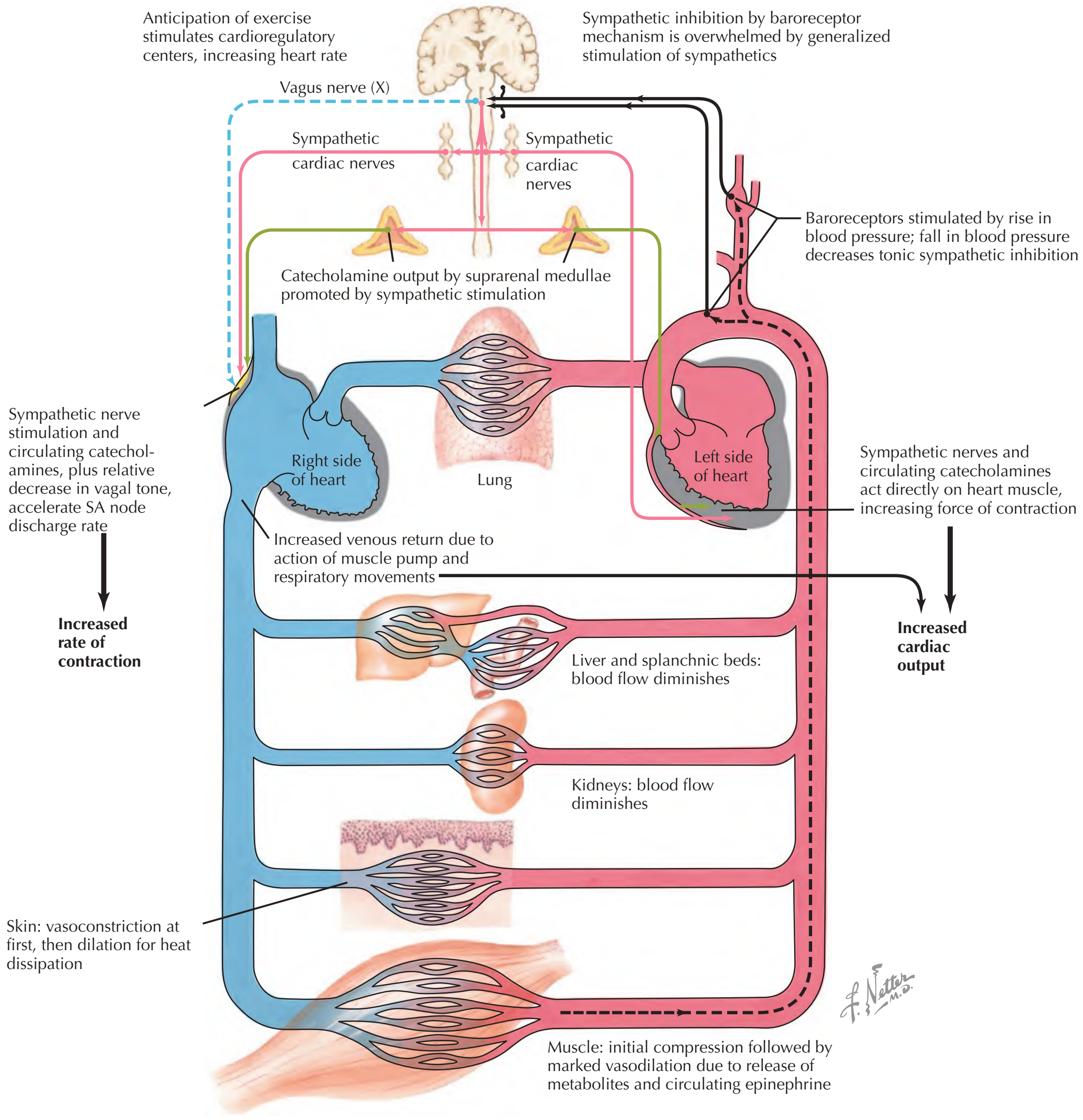

FIGURE 13-6 Effects of exercise on circulation. (*Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

arms are the target, begin where the arms join the torso (same for the legs).

3. Compression must be deep enough to close off the arteries so that pressure builds. The rate of on/off compression of the arteries is timed to the client's heart rate, which is determined by the closest pulse rate in the area. For example, if the pulse rate is 60 beats per minute, the compression rate would be approximately 1 second on/1 second off–it is helpful to count, such as "1–(compress) and (release); 2–(compress) and (release)."
4. Pressure systematically moves distal toward fingers and toes.
5. The athlete can make a fist and can release or curl the toes and release at the same rhythm. Perform three or four repetitions in the area until the distal area is increased in temperature.

Next, rhythmically knead and compress the target area to create hyperemia (histamine response and vasodilatation). Squeeze out the capillary beds to allow movement of blood into the venous system, creating space for the arterial blood. This will facilitate exchange of nutrients and gases, as well as plasma movement into interstitial spaces. Pressure and squeezing techniques have a pumping effect on circulation. Pressure forces blood out of the vessels in one direction only (toward the heart) because of the unidirectional valves. When pressure is released, the vessels are refilled from the arterial supply.

Microcirculation

The walls of the blood vessels need to be soft and pliable so that they can assist the pumping action and allow filtration and absorption through them. Because a massage stroke forces blood through the capillaries and arterioles, it has a stretching effect on the vessel walls, and thus can help increase their size, capacity, and function.

Venous Return

As with all methods, this massage application supports the anatomy and physiology of normal function. To support normal venous circulation, the venous pump is mimicked. A combination of short and long gliding stokes is used over the veins. Depth of pressure is a bit greater than that used with lymphatic drain massage because the intent is to actually pump blood through a tube. Position the area, usually a limb, somewhat above the heart to allow gravity to assist fluid movement:

1. As with lymphatic drain, begin close to the torso and glide no more than 3 to 5 inches with the direction toward the heart to take advantage of the valve system in the veins. Systematically move toward the distal end of the limb.
2. Use kneading to move blood within capillary beds, dispersing it through soft tissue.
3. Have client actively contract and relax muscles and move joints in the area. Think of this action as similar to that of a pump. Passive joint movement can be used if necessary. It is effective to move the joint through its entire range of motion.
4. Repeat the entire sequence, then shift location a bit to address a different vein.
5. Calf muscles act as a secondary heart pump, especially influencing venous returning blood flow. The client can move the ankle in slow circles to activate this pumping action. This can also be taught as a self-help method. It is especially effective if the client lies on a slant board with the head slightly lower than the heart. This method is helpful even if the target area is not placed above the heart.
6. The respiratory pump supports venous return by channeling thoracic pressure during breathing. This is primarily caused by diaphragm action. Therefore it is important for the breathing mechanism to be normal.

Lymphatic Drain Massage

The following protocol is meticulous and detailed. It covers all current applications for lymphatic drainage that are based on physiologic mechanisms. It is presented in the ideal order of application to target lymphatic fluid flow. (*Author's note:* I personally seldom perform the procedures as written here. Instead, I pick, choose, and modify. However, for learning purposes, I strongly suggest that you practice the protocols for both full-body application and local application until you are comfortable with the procedures, concepts, and outcomes.) This protocol addresses increased movement of interstitial fluid into the lymphatic capillaries without fibrosis. Management of fibrotic tissue is discussed on page 227.

Contraindications for lymphatic drain massage include the following:

- Compromised urinary or cardiovascular function, especially congestive heart or kidney failure
- Systemic illness with symptoms such as fever, diarrhea, vomiting, and unexplained edema
- Edema present in the acute phase of an injury (first 24 hours)
- Edema that is contributing to joint stability

Because surgery, abrasions, and puncture wounds break the protective skin barrier, sanitation around the area of the wound is critical. Lymphatic drain massage around surgical areas and injury can be used safely, but not within the first 24 to 48 hours. Extreme care must be taken not to disturb the tissue healing process. Direct work over an area of surgery needs to be delayed until incision sites are healed (5 to 7 days, maybe longer).

Lymphatic drain massage targeted to a specific joint is most effective in the context of a general full-body massage application.

Assessment for Increased Interstitial Fluid Volume

Common history components:

- Increased physical activity such as a competition or a game followed by a 24- to 48-hour period of relative inactivity
- Increased physical activity as above, but with insufficient recovery time (common in training camp schedules)
- Increased salt intake
- Increased water intake without appropriate electrolyte balance
- Decreased fluid intake
- Water weight gain of 3 to 5 pounds

Common complaints:

- Delayed-onset muscle soreness; sore all over, best described as achy
- Stiffness that will not stretch out and is not clearly confined to a particular area
- Sensation of the skin and muscles being "fat or taut"

Visual assessment:

- Loss of muscle and joint definition
- Appearance of being swollen
- Client appears sluggish.

Physical assessment:

- Skin and superficial fascia palpated as taut from increased hydrostatic pressure
- Skin and superficial fascia palpated as boggy, spongy, soggy (increased fluid but not enough to push against skin, as previously described)
- Difficulty palpating muscle fiber structure due to fluid accumulation overlay
- Decreased definition of joints
- Reduced range of motion of joints as a result of edema
- Difficulty in lifting the skin and fascia from the surface layer of muscles
- Deep, broad-based and narrow, superficially based types of compression; both are painful

- Pitting edema and prolonged blanching of skin after compression
- Drag on the skin and superficial fascia can create pockets of fluid that feel like small water balloons.

Other observations:

- Reflexive methods are ineffective in resolving complaints.
- Connective tissue applications may make symptoms worse, at least temporarily.

Supportive measures:

1. Increase fluid intake with proper electrolyte balance (50% water-diluted sport drink or pediatric fluid replacement drink such as Pedialyte).
2. Eat diuretic-type foods such as pineapple, papaya, berries, cucumbers, radishes, and celery.

Full-body lymphatic drain massage takes 45 to 90 minutes depending on the size of the client. Begin working on least affected areas, then progress to the target area.

STEP-BY-STEP PROTOCOL FOR FULL-BODY LYMPHATIC DRAIN MASSAGE

Objective

3. Perform circulation support and lymphatic drain massage.

Log on to your Evolve website to watch Video 13-1: Lymphatic Drain.

PHASE 1—PREPARING THE TORSO

1. Position the client on the back (supine) with arms and legs bolstered above the heart but with no areas of joints in a closed packed position (typically ends of range of motion).
2. Begin on upper thorax and use glide, knead, and compression to prepare the tissue. Goals are to increase skin pliability and connective tissue ground substance pliability, and to reduce any areas of muscle tension so that lymph capillaries and vessels are unobstructed. Continue into the abdomen, paying particular attention to abdominal and diaphragm muscles.
3. Mobilize the ribs by applying gentle but firm, broad-based compression beginning at the sternoclavicular joint, and work down toward the lower ribs. Make two or three passes, working from the sternum out toward the lateral edge. If an area of restriction is found, various methods can be used to increase mobility in the area. Compressing the restricted area while the client coughs is usually effective. Massage the intercostals.
4. Place client in side-lying position, and use glide, knead, and compression to continue to increase tissue pliability and rib mobility. Work from the iliac crests upward toward the axilla. Pay particular attention to the **anterior serratus**. Repeat on the other side.
5. Place client in the prone position (face down). Use glide, knead, and compression to increase tissue pliability and rib mobility. Begin at the iliac crest and systematically work toward the shoulder and neck. Do both left and right sides.

Outcome

Torso soft tissue pliability and rib mobility allow effective deep breathing and movement of lymph into the torso.

PHASE 2—DECONGESTING AND DRAINING THE TORSO (FIGURE 13-7)

1. Reposition client in the supine position with arms and legs bolstered above the heart.
2. Place hand (a flat or loose fist) just below either clavicle, and compress and release. Repeat 3 or 4 times. Repeat method over sternum. Repeat method over the abdomen. Compress with exhale, release with inhale. *Note:* Repeat this procedure approximately every 15 minutes during the session (Figure 13-8).
3. Begin surface draining procedure. This process consists of dragging and sliding the skin to the tissue bind in various directions to pull on the microfilaments, while opening the ends of the lymph capillaries so that interstitial fluid can move from around cells into lower-pressure areas of lymph vessels. This needs to be done in a repetitive, rhythmic, slow manner, as with a pump. Drag skin to bind and let it return, drag skin again, etc. Each skin movement has a slightly different direction vertically, horizontally, diagonally, and circularly. The skin movement phase is a little longer than the release phase. Remember, the massage application is structured to mimic the pull of skin and fascia that would normally affect microfilaments attached to the lymphatic capillaries. Begin skin drag at the closest lymph node area, and work distal. This decongests and lowers pressure, allowing fluid to move from high pressure to low pressure.
4. Begin skin movement at the thorax midline above the diaphragm, and work toward the area under the clavicles. (Do both sides.) When this area is thoroughly addressed, repeat chest compression.
5. Continue with skin movement below the diaphragm, and change direction to drain toward the groin.
6. Have client do deep breathing while you gently but firmly knead the abdomen; then repeat chest compression. Compress on exhale, release on inhale.
7. Position client on side and repeat skin drag method, starting near the axilla, and drain from the waist up toward the axilla; below the waist, drain toward the groin, starting proximal to the region where drainage occurs. Do both sides.
8. While client is in the side-lying position, rhythmically compress the ribs (compress on exhale, release on inhale).
9. Place client in the prone position and drain again: Above the waist toward the axilla, and below the waist toward the groin. Compress the ribs in rhythm with the breathing.

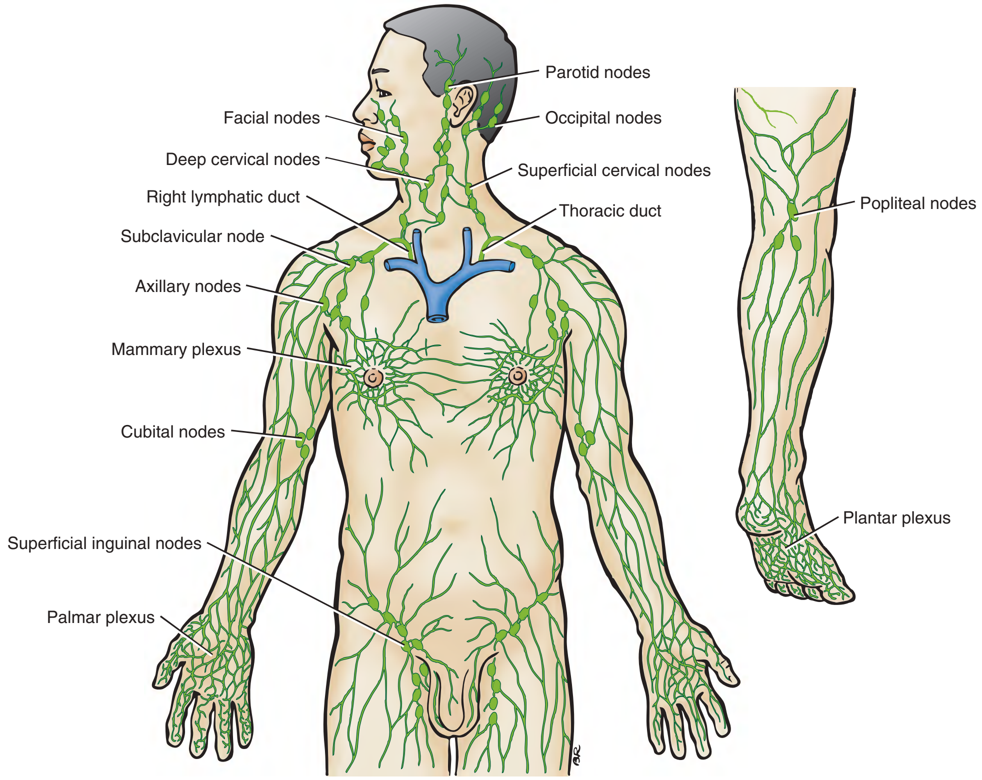

FIGURE 13-7 Principal lymph vessels and nodes. (From Fritz S: *Mosby's fundamentals of therapeutic massage*, ed 5, St Louis, 2013, Mosby.)

FIGURE 13-8 Examples of decongesting the torso. **A,** Rhythmic compression just under the clavicle. **B,** Rhythmic compression over the sternum. **C,** Rhythmic compression over the abdomen.

Outcome

Torso is decongested and is able to receive fluid from limbs.

PHASE 3—LIMBS (FIGURE 13-9)

1. With client in supine, prone, and side-lying positions, begin to systematically address the arms and legs. The procedure for both is the same. Address the least congested area first. For example, if the arms have more fluid, begin with the legs. If the right arm is more congested, work the legs first, then work the left arm, then the right arm.
2. Begin with passive and active joint movement in the following sequence: hip, knee, ankle, foot; shoulder, elbow, wrist, hand.
3. Prepare tissue in the limbs for draining, as for the torso. Use gliding, kneading, and compression, as well as shaking, to increase the pliability of connective tissue and to decrease muscle tension. Restriction in these areas interferes with the ability of fluid to move into the lymphatic capillaries.
4. Repeat passive and active joint movement, as in step 2.
5. Bolster the limb above the heart and begin skin drag application close to the torso, in the groin, gluteal, or axillary area. Systematically, gently, slowly, and rhythmically drag the skin in multiple directions, ending in the direction of the closest set of lymph nodes. Work down toward the elbow or knee.
6. Apply moderately deep gliding from the elbow or knee toward the groin or axilla. The intent is to support movement of the fluid once inside the vessels while activating the lymphangions. Glide with the intent of moving the fluid from valve to valve and increasing intravessel pressure. Long, slow, moderately deep gliding from the knee or elbow to the groin or axilla is also appropriate.
7. Apply active and passive joint movements again. The intent is to pump fluid at the nodes located at the joints.
8. Knead and compress the soft tissue of the elbow, knee, axilla, or groin. The intent is to move the interstitial fluid into deeper tissues to surface lymphatic capillaries.
9. Repeat steps 3, 4, and 5.
10. Apply active and passive joint movement.
11. Begin skin drag application near the knee or elbow, and work down to the ankle and wrist. Move skin in all directions, and end with direction toward the knee or elbow.
12. Apply active and passive joint movement.
13. Re-drain the upper limb as described in steps 3, 4, and 5.
14. Apply active and passive joint movement.
15. Knead and compress the soft tissue of wrist and elbow or ankle and knee.
16. Repeat steps 8, 9, 10, 11, and 12.
17. Apply moderately deep, short and long gliding strokes from the wrist to the axilla, or from the ankle to the groin.
18. Apply active and passive joint movement.
19. Apply broad-based slow, rhythmic, moderately deep compression to the palms of the hands and the soles of the feet. Pump the plexus located in these areas for about 60 seconds.
20. Repeat active and passive joint movement.
21. Place client in side-lying position.
22. Knead and compress neck tissue to prepare for drain.
23. Begin skin drag methods close to the clavicles and work at the skull. The direction of the force is toward the clavicles.
24. Apply active and passive joint movement to the neck.
25. Use short and long gliding and moderately deep pressure to increase fluid movement within the vessels. Work from the skull toward the clavicles.
26. Repeat steps 24 and 25.

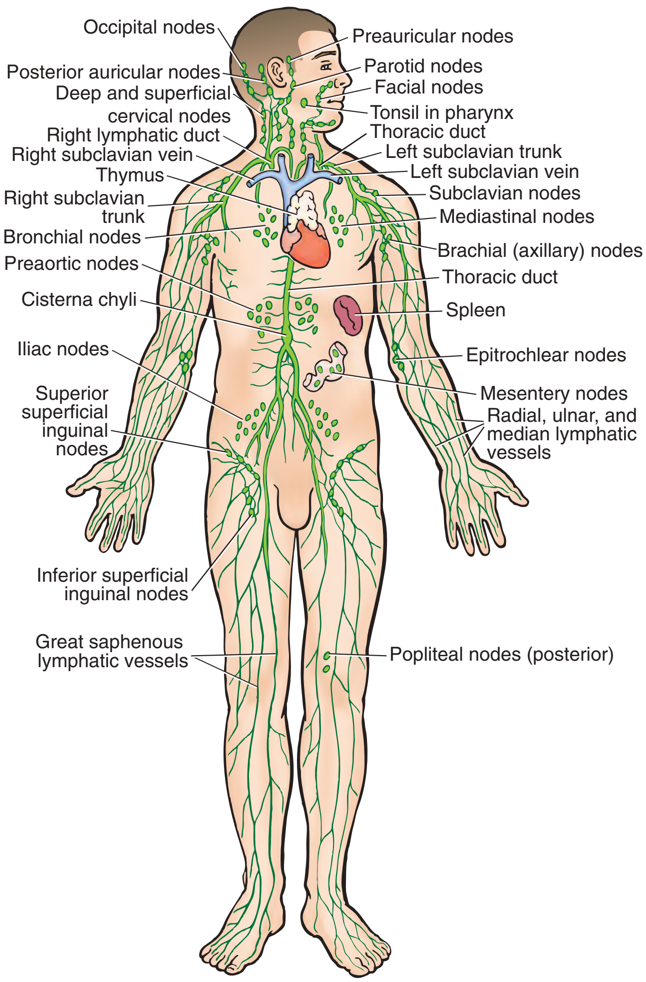

FIGURE 13-9 The lymphatic system and lymphatic drainage pathways throughout the body. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

27. Apply broad-based compression to the thorax in a rhythmic pumping manner synchronized with deep breathing (compress on exhale, release on inhale) to affect duct pressure.
28. Repeat steps 23 through 27.
29. Place client in supine position and bolster limbs above the heart.
30. Repeat steps 2 through 18 on each limb.
31. Repeat rhythmic pumping compression of ribs near the clavicles synchronized with deep breathing. Remember to compress on exhale and release on inhale.

Outcome

Full body addressed using massage to mimic natural lymphatic drain process.

INTEGRATED FLUID MOVEMENT

It is logical to consider blood and lymphatic movement as an integrated process. Because effective fluid movement is essential for the athlete, as well as for all clients, it is recommended that massage application should involve assessment and focus on fluid dynamics in the body. Anatomically, we can be considered bags of fluid. Figure 13-10 presents a sequence for an integrated fluid movement procedure to be incorporated into massage. The lower limb is the target for the example, and the same process is used for the upper limb. Once the entire area is addressed, specific areas such as knee swelling can be performed.

Log on to your Evolve website to view an expanded example of an integrated fluid movement sequence on a lower limb.

FIGURE 13-10 Example of integrated fluid movement sequence—lower limb. An expanded sequence is provided on the Evolve website. **A,** Begin with arterial flow. Position the limb lower than the heart to support movement of blood toward the extremities. Begin compression at the torso over the area of the femoral artery. Compression is deep enough to apply pressure on the artery. **B,** Preparation begins for return fluid flow toward the heart. Increase the bolstering so the leg is now above the heart. Rhythmically move the hip and the knee to begin to address return fluid flow (venous and lymph). **C,** Position the lower limb as shown. Begin near the torso and use the forearm to apply short gliding strokes for groin to knee while periodically actively or passively flexing the knee and/or rolling the ankle in slow circles. Pressure depth extends into the superficial fascia but not into the muscles. **D,** Specifically begin movement of the skin and superficial fascia by dragging rhythmically into bind, then into ease, to effect lymphatic uptake of interstitial fluid. Work slowly and methodically all the way to the ankle.

STEP-BY-STEP PROTOCOL FOR LYMPHATIC DRAIN MASSAGE FOR SWELLING OF AN INDIVIDUAL JOINT AREA OR CONTUSION (FIGURE 13-11)

Swelling at joints occurs for many reasons. Rheumatoid arthritis is one cause of joint swelling that requires caution when massage is applied, and all massage should be closely supervised by the medical team.

Osteoarthritis is another common cause of joint swelling. Fluid buildup is usually protective in nature. Intracapsular fluid inside the joint capsule can serve to keep pain-sensitive bone structures separated and to reduce rubbing and friction in the joint. Fluid around the capsule can provide stability for a joint and can limit painful motion. In these cases, the goal is not to totally eliminate the fluid, but to keep it moving, to reduce the tendency for stagnant edematous tissue to become fibrotic, and to maintain appropriate levels of fluid. As explained, some fluid buildup both within and outside the capsule is beneficial. Too much is detrimental to effective healing. Because it is essential to maintain mobility in arthritic joint maintenance, optimal fluid dynamics in the area is important.

Trauma such as sprains, contusions, breaks, and surgery results in swelling as part of the acute inflammatory response. This tissue fluid must be managed because of its high protein content resulting from tissue debris and blood from the injury. The fluid can quickly become fibrotic during the subacute healing phase. The key is to manage accumulated fluid while keeping it moving, without increasing any inflammatory response or disrupting the healing process. Sometimes the only component of lymphatic drain massage that can be used directly at the site of the trauma is skin drag.

When targeting an isolated area, it may not be necessary to be as meticulous as has been described for full-body lymphatic drain massage. It is helpful to use a shorter, less intense application to the whole body, even when targeting a particular joint or area. Passive and active range of motion and some skin dragging are appropriate as part of the general massage application; increased fluid movement anywhere in the body influences the movement of all lymphatics.

PROCEDURE

1. Identify the main area of the trunk toward which the fluid will move. For arm joints and tissues, this would be the axilla and the area around the clavicles. For joints and tissues in the leg, the destination area would be the groin and lower abdomen.
2. Bolster the entire limb containing the individual target areas to be addressed in a relaxed position above the heart, with joints in the mid-range, open position.
3. Prepare the tissue in the entire limb with gliding, kneading, compression, and shaking to increase pliability of connective tissue structures and to reduce muscle tension on the lymphatic vessels.
4. Begin the skin drag close to the torso, and meticulously drain to the next distal joint (elbow or knee).
5. Apply active and passive joint movement, making sure that the area of the groin or the axilla is effectively compressed in a pumping fashion during joint movement.
6. Knead and compress the soft tissue of the knee and groin or elbow and axilla with the intent of affecting deeper interstitial fluid movement.
7. Repeat active and passive joint movement.
8. Repeat steps 4 and 5.
9. Apply gliding strokes of moderate pressure toward the trunk with the intent to increase fluid movement in the lymphatic vessels.
10. Repeat active and passive joint movement.
11. Prepare the tissue in the lower part of the limb (arm or leg) with gliding, kneading, compression, and shaking.
12. Repeat step 4, this time working all the way from the knee or the elbow distally to the ankle or the wrist.
13. Repeat steps 5 through 10, including the entire limb from the wrist or ankle to the axilla or groin.
14. Using compression, slowly and rhythmically pump the sole of the foot or the palm of the hand; continue for about 60 seconds.
15. Repeat active and passive joint movement.
16. Specifically address the swollen joint–hip, shoulder, knee, elbow, ankle, wrist, foot/hand, toes/fingers–or contusions by meticulously using skin drag in all directions over the area, unless the skin is damaged. If a breach in the skin is noted, work near the area but not on it.
17. Apply active and passive joint movement.
18. Repeat steps 16 and 17.
19. If the target area is a joint, use compressive action to squeeze and release the tissue surrounding the joint. This action should be slow and rhythmic. Smaller joints can be squeezed within the hand; large joints will require use of both hands to surround and squeeze the joint while maintaining the compressive action.
20. Repeat the entire sequence if necessary.

CONNECTIVE TISSUE FOCUS (FIGURE 13-12)

Objective

4. Perform connective tissue application.

The quality of connective tissue can generally be assessed by noting the pliability of the skin and subcutaneous layers. Thickened, adhered fascia is less mobile, and the skin will glide only a short distance before feeling tight (bind). It is amazing how far healthy tissue can comfortably be stretched in all directions. In the treatment of musculoskeletal problems, the connective tissue of primary

FIGURE 13-11 Step-by-step protocol for lymphatic drain massage for swelling of an individual joint area or contusion, using the knee as an example. **A,** Prepare the area by moving the joints by an active and passive pumping action. Use bolsters to lift the target area (knee) above the heart. **B,** Methodically lymph drain the entire area, in this example, from groin to foot. **C,** Rhythmically move the target area (knee) within a pain-free range. **D,** Gently compress into the bolsters to assist fluid flow. Repeat multiple times. **E,** Rhythmically compress the target area, and combine with circular skin drag. **F,** Release compression, and gently massage the node area in back of the knee. Repeat the compress release skin drag and massage at the back of the knee sequence multiple times. **G,** Apply gentle compression to the back of the knee, and rhythmically move the knee back and forth.

FIGURE 13-11, cont'd **H,** Rhythmically skin drag around the target area. **I,** Repeat compression. **J,** Repeat release in a rhythmic pumping manner. On the release phase, use fingers to gently massage nodes at the back of the knee. **K,** Again, lymph drain the entire area. **L,** Repeat joint movements. **M,** With the target area above the heart, rhythmically and repeatedly move the joint through pain-free range of motion. Repeat entire sequence beginning with **A.**

concern is the fascia, which wraps the muscle fibers into bundles and compartments and then wraps all these together to form the whole muscle. The outer layer of fascia makes up the muscle sheath, which maintains the overall shape and is smooth on the outside so that the muscle can move freely and independently of other structures. It is not contractile tissue, but it does have—or it should have—the same elasticity as the muscle.

The fascia is subject to trauma through overstretching or impact, and scar tissue and adhesions can form. The

FIGURE 13-12 Examples of methods that can be used to target connective tissues. Additional examples are found on the Evolve website. **A,** Connective tissue (myofascial) methods involve moving tissues to bind and into bind to increase tension forces that act on the tissues. These methods are considered direct methods. **B,** All forms of stretching and direct methods therefore move to and through bind to affect connective tissues. **C,** Rotational movements create torsion forces that effectively place tissues into and through bind. **D,** Example of positioning of the body so target tissues (anterior thigh) are taut (lengthened), then gliding with drag to stretch the fascia. **E,** Combined loading is effective in addressing various connective tissues. In this example, grasp tissue, then lift and pull. **F,** The taut tissues (area of bind) are usually between the two points of contact with forces moving in opposite directions.

main problem, however, involves chronic changes that result from long-term strain. The fascia thickens and becomes more fibrous, which makes it less mobile and reduces its pliability. This affects the function of underlying muscle and may restrict its free movement. Furthermore, if interstitial fluid cannot pass freely through the fascia, the muscle may not receive an adequate supply of oxygen and nutrients and will be less able to eliminate metabolic waste material.

Along with producing excessive tension or thickening in the fascia, connective tissue forces affect the autonomic nervous system through a neurofascial reflex. This stimulates local blood flow, and the skin appears red and is warm.

Adhesions and fibrous tissue created by scar tissue cause the greatest dysfunction. In early healing stages, scar tissue is sticky, and fibers can adhere to each other. For a muscle to function properly, the fibers must be able to glide smoothly alongside one another; when stuck together, they cannot do this, and the affected area will not function optimally. Over time, a local area of muscle fibers can mat together into a fibrous mass.

Noncontractile soft tissues can be affected by fibrous adhesion, becoming thick and less pliable. Adhesions can also form between different structures, such as between ligaments and tendons, muscles, and bone. This can lead to significant restriction in movement and function.

Transverse strokes into bind using shear and bend forces can break down adhesions by literally tearing adhesive bonds apart. Once the fibers are separated, they are able to functionally slide again. Applied effectively, massage methods targeting connective tissue should create a sensation of burning and localized intense pulling but should not cause any actual damage, because the adhesions themselves contain no blood vessels. Massage done too heavily or on tissue that is in an early stage of repair can cause further damage.

When a large fibrous mat of compacted tissue has formed, little or no circulation may be running through it, and therefore a natural healing process cannot take place. Massage increases tissue pliability and allows blood to flow more easily through the tissue, stimulating healing.

Massage is able to stretch specific localized areas of tissue in a way that may not be possible with other approaches. Longitudinal (tension force) stroking and kneading (bend and torsion force) can stretch the tissues by drawing them apart and in all possible directions.

In most instances, a lubricant is not used with connective tissue approaches because the drag quality that moves tissues into bind is necessary to produce results, and lubricant reduces drag.

Methods that affect primarily the ground substance must exhibit slow, sustained pressure, tension, and agitation. Most massage methods can soften the ground substance as long as the application is not abrupt. Tapotement and abrupt compression are less effective than slow gliding methods that have a drag quality. Kneading and skin rolling that incorporate a slow pulling action are effective as well. Appropriate application introduces one or a combination of mechanical forces of tension, compression, bind, shear, and torsion. The key is to maintain the force applied into the tissue bind/restrictive barrier.

Fiber components are affected by stretching methods (longitudinal or cross-fiber) that elongate fibers past the normal give of the fiber and enter the plastic range past the bind. This may result in freeing and unraveling of fibers or a small therapeutic (beneficial and controlled) inflammatory response that signals changes in the fibers.

e Log on to your Evolve website to view additional examples of methods used to target connective tissues.

TISSUE MOVEMENT METHODS

More subtle connective tissue approaches rely on the skilled development of following tissue movements. The process is as follows:

1. Make firm but gentle contact with the skin. This is best accomplished with the tissue in the ease position.
2. Increase downward, or vertical, pressure slowly until resistance is felt; this barrier is soft and subtle.
3. Maintain downward pressure at this point; now add horizontal drag until the resistance barrier is felt again.
4. Sustain horizontal pressure and wait.
5. The tissue will seem to creep, unravel, melt, slide, quiver, twist, or dip, or some other movement sensation will be apparent.
6. Follow the movement while gently maintaining tension on the tissues and encouraging the pattern as it undulates though various levels of release.
7. Slowly and gently release first the horizontal force, and then the vertical force.

Twist-and-release kneading and compression applied in the direction of the restriction can also release these fascial barriers.

The development of connective tissue patterns is highly individualized; therefore, systems that follow a precise protocol and sequence are often less effective in dealing with complex patterns.

The important consideration in all connective tissue massage methods is that pressure applied vertically and horizontally (compression and drag) actually moves the tissue to create tension, torsion, shear, or bend, long enough to alter pliability.

A good grip with the skin is essential, so no lotion or oil can be present. This grip can be held with the hands or forearms. The technique is even performed sometimes with a towel, to provide stronger contact with the skin.

Tissue can be moved toward ease (the way it wants to move) and is held for a few seconds to allow the tissue to soften. The client can add a neurologic component by contracting or relaxing the muscle as the massage therapist holds the tissue at ease. The entire procedure can be repeated while the tissues are held at bind (the way it does *not* want to move).

Some varieties of this process have been formalized into modality systems such as active release, myofascial release, and deep tissue methods.

ACTIVE RELEASE AND PIN AND STRETCH

In **active release**, the massage therapist applies passive pressure, and movement is provided by the client. This method can be described as *combined loading*. Assessment identifies a local area of fibrotic tissue and/or adhered fibers. Compression is applied to hold the area in a static position just into bind. Then the tissues are stretched away from that point. The points where pressure is applied are often the same as those used as typical **trigger points**.

The basic method is to start with the muscle relaxed and held in a passive shortened position by moving the associated joint. Focused compression is applied directly into adhered fibers to fix them in position. The muscle is then stretched by the client away from this fixed point by moving the joint. Pressure needs to be applied with sufficient force to prevent target tissues from moving as the stretch takes place.

Active and resisted movements, instead of passive ones, can be used to stretch the muscle. In fact, this may be more effective because neuromuscular function is involved and because the focus is on connective tissue. The client contracts the antagonist that reciprocally inhibits the muscle being treated and moves the area, while the massage therapist maintains focused pressure. An easy way to do this is to have the client move associated joint areas in a slow circle, or back and forth if the joint is a hinge joint. Tissues can be stretched away from the pressure point using deep massage strokes made with the other hand or forearm. This approach is useful when it is not convenient to move the joint, for example, when treating the gluteal muscles while the client is in the prone position or when hip flexion to stretch the muscle would be impossible.

BOX 13-1 Theory of Trigger Point Formation

The following progression has been proposed to explain the formation of trigger points:

- Dysfunctional motor endplate activity occurs, commonly associated with strain, overuse, or direct trauma.
- Stored calcium is released at the site as a result of overuse or tearing of the sarcoplasmic reticulum.
- Acetylcholine (Ach) is released excessively at the synapse as the result of calcium-charged gates.
- High calcium levels present at the site keep the calcium-charged gates open, and Ach continues to be released.
- Ischemia develops in the area, creating an oxygen/nutrient deficit.
- A local energy crisis develops.
- The tissue is unable to remove the calcium ions without available adenosine triphosphate (ATP); therefore, Ach continues to flow.
- Removal of the superfluous calcium requires more energy than is required for sustaining a contracture; therefore the contracture remains.
- The contracture is sustained not by action potentials from the spinal cord but by the chemistry at the innervation site.
- The actin/myosin filaments slide to a fully shortened position (a weakened state) in the immediate area around the motor endplate (at the center of the fiber).
- As the sarcomeres shorten, a contracture knot is formed.
- The contracture knot is the "nodule," which is the palpable characteristic of a trigger point.
- Remaining sarcomeres of that fiber are stretched, thereby creating the usually palpable taut band that also is a common trigger point characteristic.
- Attachment trigger points may develop at the attachment sites of these shortened tissues (periosteal, myotendinous) where muscular tension provokes inflammation.

From Chaitow L, Delany J: *Clinical applications of neuromuscular techniques*, vol 1, *The upper body*, London, 2002, Churchill Livingstone.

TRIGGER POINTS*

Objective

5. Perform trigger point therapy.

Some confusion surrounds the synonymous use of the terms *neuromuscular therapy* and *trigger point therapy*. Neuromuscular therapy is an umbrella term that encompasses a variety of treatment approaches, one of which is trigger point therapy. Trigger point therapy is one of many techniques useful in the treatment of neuromuscular and myofascial problems.

A trigger point is an area of local nerve facilitation and chemical imbalance of a muscle that is aggravated by stress of any sort affecting the body or mind of the individual. Trigger points are small areas of hyperirritability within muscles (Box 13-1). If these areas are located near motor nerve points, the person may experience referred pain caused by nerve stimulation. The area of the trigger point is often the motor point where nerve stimulation initiates a contraction in a small, sensitive bundle of muscle fibers, which in turn activate the entire muscle.

A trigger point area is typically located in a tight band of muscle fibers. Palpation across the band may elicit a twitch response, which is seen as a slight jump in the muscle fibers. This is difficult to detect when the trigger point is in deeper muscle layers. Any of the more than 400 muscles in the body can develop trigger points. Trigger points are accompanied by the characteristic referred pain pattern and restriction of motion associated with neuromuscular and myofascial pain.

*Recommended text for trigger point therapy: Chaitow L, Delany J: *Clinical applications of neuromuscular techniques*, vol 1 and 2, *The upper body*, London, 2002, Churchill Livingstone.

With classic trigger points, the referred pain pattern can be traced to its site of origin. The distribution of referred trigger point pain does not usually follow an entire distribution of a peripheral nerve or dermatomal segment.

PERPETUATING FACTORS

Perpetuating factors in the development of trigger points are reflexive, mechanical, and systemic. Reflexive perpetuating factors include the following:

- Skin sensitivity in the area of the trigger point
- Joint dysfunction
- Visceral dysfunction in the viscerally referred pain pattern
- Vasoconstriction

Mechanical perpetuating factors include those listed here:

- Standing postural distortion
- Seated postural distortion
- Gait distortion
- Immobilization
- Vocational stress (this includes sport activity)
- Restrictive or ill-fitting clothing and shoes

Systemic perpetuating factors include the following:

- Enzyme dysfunction
- Metabolic and endocrine dysfunction
- Chronic infection
- Dietary insufficiencies
- Psychological stress

ASSESSMENT

It often is difficult to decide whether a tender spot is really a trigger point, a point of fascia adhesion requiring friction, a motor point, or some other irritable reflex point, including an active acupuncture point. Because stretching of trigger point areas is essential for effective treatment, if doubt exists regarding the nature of the point, it should be treated as a trigger point. Stretching can be longitudinal or direct.

The massage therapist usually finds trigger points during palpation or general massage using both light and deep palpation (Box 13-2).

During the palpation process, if a trigger point is identified, the client becomes aware of the trigger point but does not initiate protective mechanisms such as guarding (tightening up), breath holding, or flinching during assessment or treatment.

The muscle must be relaxed to be assessed effectively. If the pressure is too great, severe local pain may overwhelm the referred pain sensation, making accurate evaluation impossible. Trigger points that are so active that referred pain is already being produced do not require exaggerated pressure during assessment.

Palpation for trigger points can aggravate their referred pain activity. Therefore, only tissues that can actually be treated at the same visit should be examined for trigger points (Figure 13-13).

BOX 13-2 Palpation for Trigger Points

In performing light palpation, the therapist may notice trigger points from the following responses:

Skin changes: The skin may feel tense with resistance to gliding strokes. The skin may be slightly damp as a result of perspiration from sympathetic facilitation, and the therapist's hand will stick or drag on the skin.

Temperature changes: The temperature in a local area increases in acute dysfunction but decreases in ischemia, which indicates fibrotic changes within the tissues.

Edema: Edema is an impression of fullness and congestion within the tissues. In instances of chronic dysfunction, edema is replaced gradually with fibrotic (connective tissue) changes.

Deep palpation: During palpation, the therapist establishes contact with the deeper fibers of the soft tissues and explores them for any of the following:

- Immobility
- Tenderness
- Edema
- Deep muscle tension
- Fibrotic changes
- Interosseous changes

From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.

METHODS OF TREATMENT

Trigger point treatment should not be provided for extended periods. It should be incorporated into a more general approach.

All of the basic neuromuscular techniques, including muscle energy methods, deal effectively with trigger points if the hyperirritable area within a muscle is hyperstimulated and then lengthened, and if connective tissue in the area is softened and stretched. Direct manipulation of proprioceptors by pushing or pulling on a muscle belly or its attachments is also effective. Positional release with appropriate stretching is one of the most effective ways to treat trigger points.

After a trigger point has been identified, the massage therapist uses a pressure technique, muscle energy, or a direct manipulation and stretch method to reduce hyperactivity in the point. Intervention progresses from least invasive to most aggressive. Positional release (1) is used first; (2) consists of identifying the painful point and positioning the body in the easiest position that reduces pain at that point; and (3) is the first step in the integrated muscle energy method, which introduces muscle contraction before lengthening.

Direct manipulation methods consist of pressing the belly of the muscle together to affect spindle cells and pushing the tendons apart to affect tendon receptors

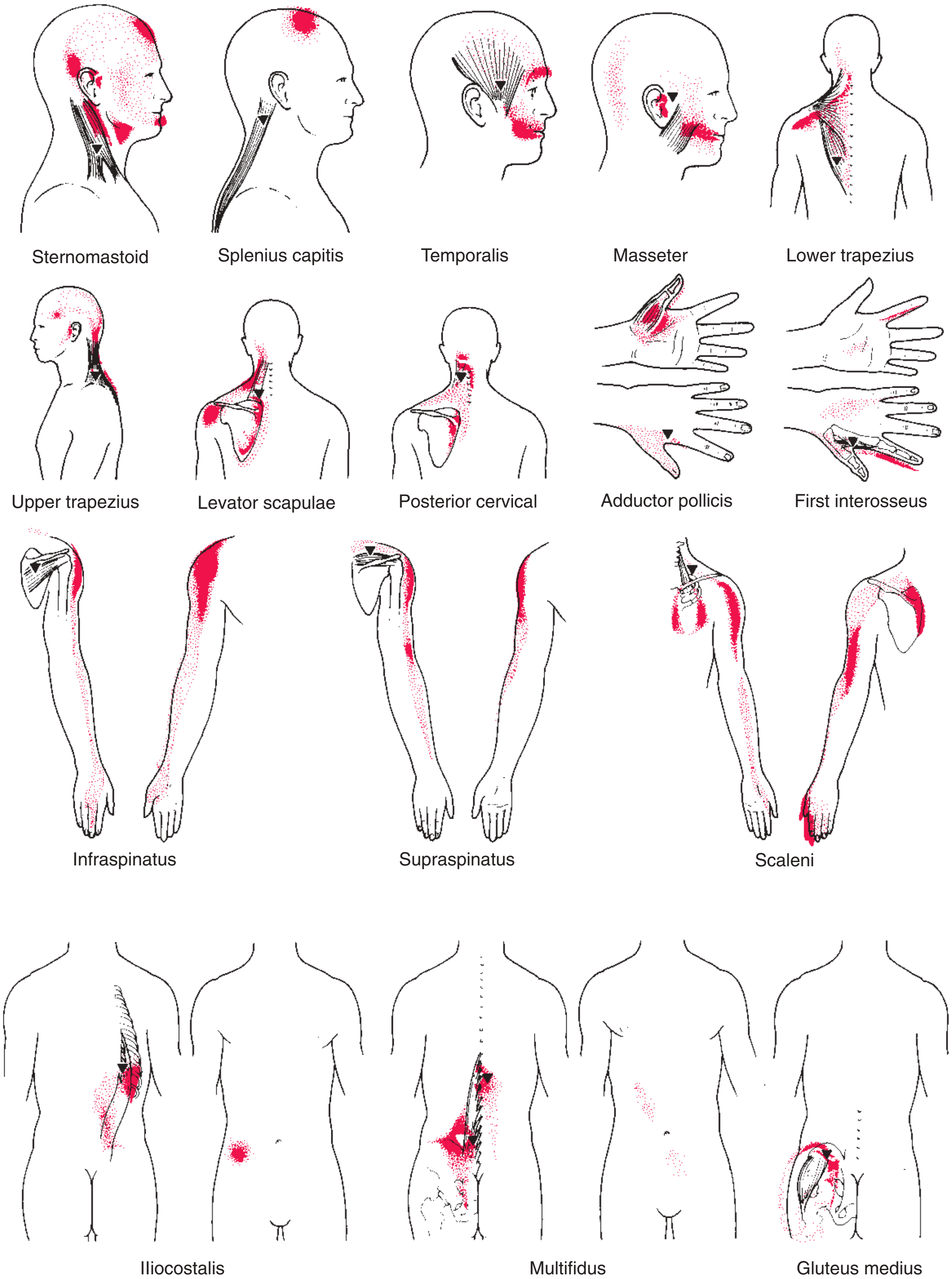

FIGURE 13-13 Common trigger points. (From Chaitow L: *Modern neuromuscular techniques,* ed 2, Edinburgh, 2003, Churchill Livingstone.)

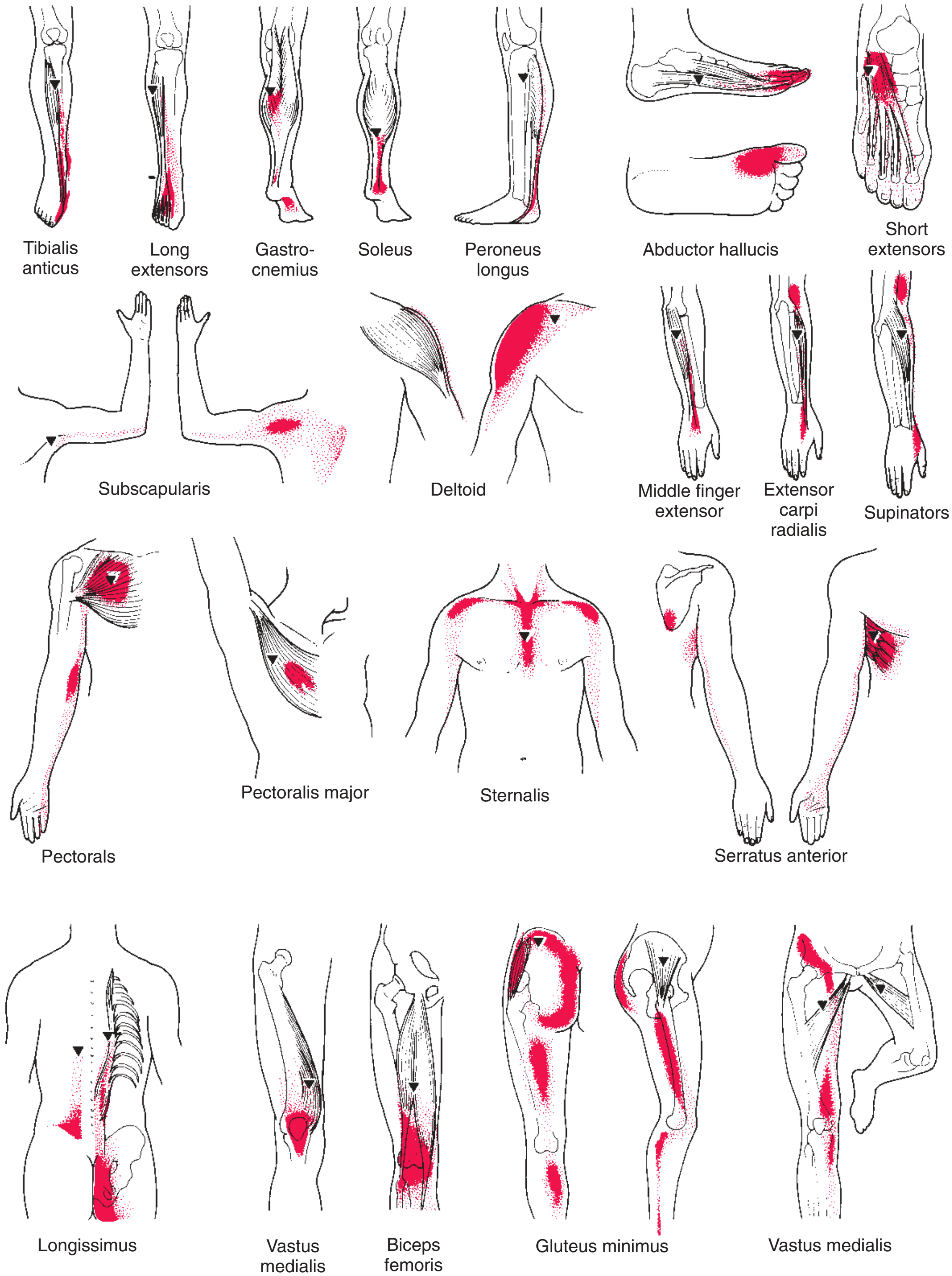

FIGURE 13-13, cont'd

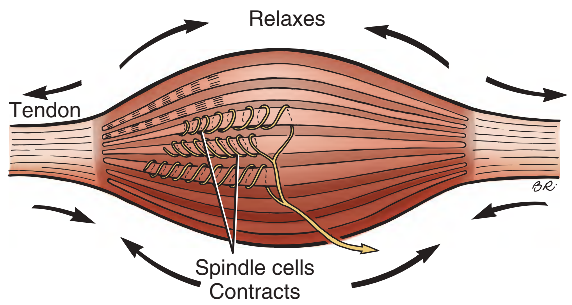

FIGURE 13-14 Direct manipulation of proprioceptors. (From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2013, Mosby.)

(Figure 13-14). If the belly of the muscle is pressed together and the desired effect is not experienced, the next step should be to separate the tissue from the middle of the muscle belly toward the tendons. Lengthening and direct manipulation are the least invasive and gentlest methods and should be used next. The integrated muscle energy method is more aggressive than positional release or direct manipulation but less aggressive than pressure or pinching methods and should be used next. These methods often are effective and are worth trying before more intense pressure or pinching techniques are attempted.

The local area must be lengthened. This lengthening may be performed directly on the tissues or through movement of a joint.

If the trigger point remains after less invasive methods have been attempted, pressure techniques can be tried. Pressure may take the form of direct pressure, in which the trigger point is pressed by the therapist against an underlying hard structure (bone), or pinching pressure, when no bony tissue lies underneath, as with "squeezing" of the **sternocleidomastoid** muscle.

Pressure techniques can end the hyperirritability caused by mechanical disruption of sensory nerve endings mediating trigger point activity. When using the direct pressure technique, the massage therapist must hold the compression long enough to stimulate the spindle cells.

After the trigger has been located, the time of applied pressure will be different from the time used to locate the trigger. Dr. Chaitow recommends gradually intensifying pressure, building up to 8 seconds, and then repeating the process for up to 30 seconds, or as long as 2 minutes. The procedure should end when the client reports that the referred pain has stopped, or when the massage therapist feels a "release" in the trigger point tissue.

Sufficient duration is determined by the fiber construction of the muscle. Muscles are made up of red (slow-twitch) and white (fast-twitch) fibers. The type of fiber is determined by whether the muscle functions as a postural (stabilizer) muscle or as a phasic (mover) muscle, and by the demands exerted by the client's lifestyle. It is easier to fatigue phasic muscle fibers than postural muscle fibers. After the muscle is fatigued, a period of recovery ensues, in which the fibers will not contract and the muscle can be lengthened effectively and stretched if necessary.

Dr. Chaitow also recommends variable pressure, rather than constantly held pressure from beginning to end, to avoid further irritation of the trigger area. This involves a carefully changing pressure for a specific purpose, which reflects the therapist's sensitivity to what is happening as the tissue responds; the therapist applies more pressure as the tissue shows that it is relaxing and accepting more pressure. When the massage therapist senses that the tissues are becoming tense, pressure is decreased.

As an alternative, deep cross-fiber friction over the trigger point can be effective, followed by lengthening and stretching. This method is beneficial if the massage therapist suspects that the connective tissue around the trigger point has become fibrotic.

Localized treatment of the muscle should always end with lengthening and stretching–passive or active–of the affected muscle. Gradual, gentle lengthening to reset the normal resting length of the neuromuscular mechanism of a muscle and stretching to elongate shortened connective tissue of the involved muscle must follow any other interventions. Incomplete restoration of the full length of the muscle means incomplete relief of pain. Failure to lengthen and stretch the area results in eventual return of original symptoms.

Muscle energy approaches are more effective than passive stretching in achieving the proper response. Trigger points located in deep layers of muscle or in a muscle that is difficult to lengthen by moving the body are addressed with local bending, shearing, and torsion to lengthen and stretch the local area. This is often the most effective method with athletes.

Trigger points in the belly of muscles are usually short, concentrically contracted muscles. Trigger points located near the attachments are usually found in eccentric patterns in long inhibited muscles acting as antagonists to concentrically contracted muscles. Muscle shortening may serve as a response for compensation purposes. Do not treat attachment trigger points; only monitor them. It is best to address trigger point activity in the short tissues first and wait to see if the trigger points in the "long muscles" and at the attachments resolve as the posture of muscle interaction normalizes. Treat attachment points only if tissue remains fibrotic.

Do not overtreat trigger points. Address only trigger points that re-create or recognize symptoms that the client is experiencing. Remember, anything can feel like a trigger point if pressed hard enough. Address only the trigger point that is most painful, most medial, and most proximal and that re-creates the client's symptoms. Leave the rest alone. When posture and function normalize with regular massage, trigger points will go away on their own.

To balance long inhibited muscles, the following strengthening procedures can be used.

Isometric Contraction

The muscle is placed in a specific position within its range, and the client contracts against resistance, with no actual movement taking place. This is particularly useful in maintaining strength in a muscle that cannot be exercised normally owing to dysfunction in its associated joint. The strengthening effect is greatest in the middle and inner range of movement.

Concentric Movements

This is the most common type of muscle-strengthening activity; it involves contraction and shortening of a muscle by taking it through its active range of movement with weighted resistance; for example, the biceps muscle concentrically contracts when lifting a weight, by flexing the elbow.

A muscle produces its greatest force in the mid-range. If a muscle is strengthened only in the mid-range, it will function only in that range and may become chronically short. Therefore, it is important to always include exercises with light resistance through the fullest range of both concentric and eccentric function to develop length as well.

Movements should be made slowly to develop control throughout the contraction range. Sudden, quick contractions can lead to injury and are likely to increase muscle tension by overstimulating nerve receptors. Refer back to the chapter for research related to trigger points (Figure 13-15).

FIGURE 13-15 Examples of trigger point treatment methods from least to most invasive. **A,** Hold area of trigger point at ease. **B,** Positional release places trigger point area in ease. **C,** Hold tissues containing trigger point at bind. **D,** Broad-based compression over tissues containing trigger point.

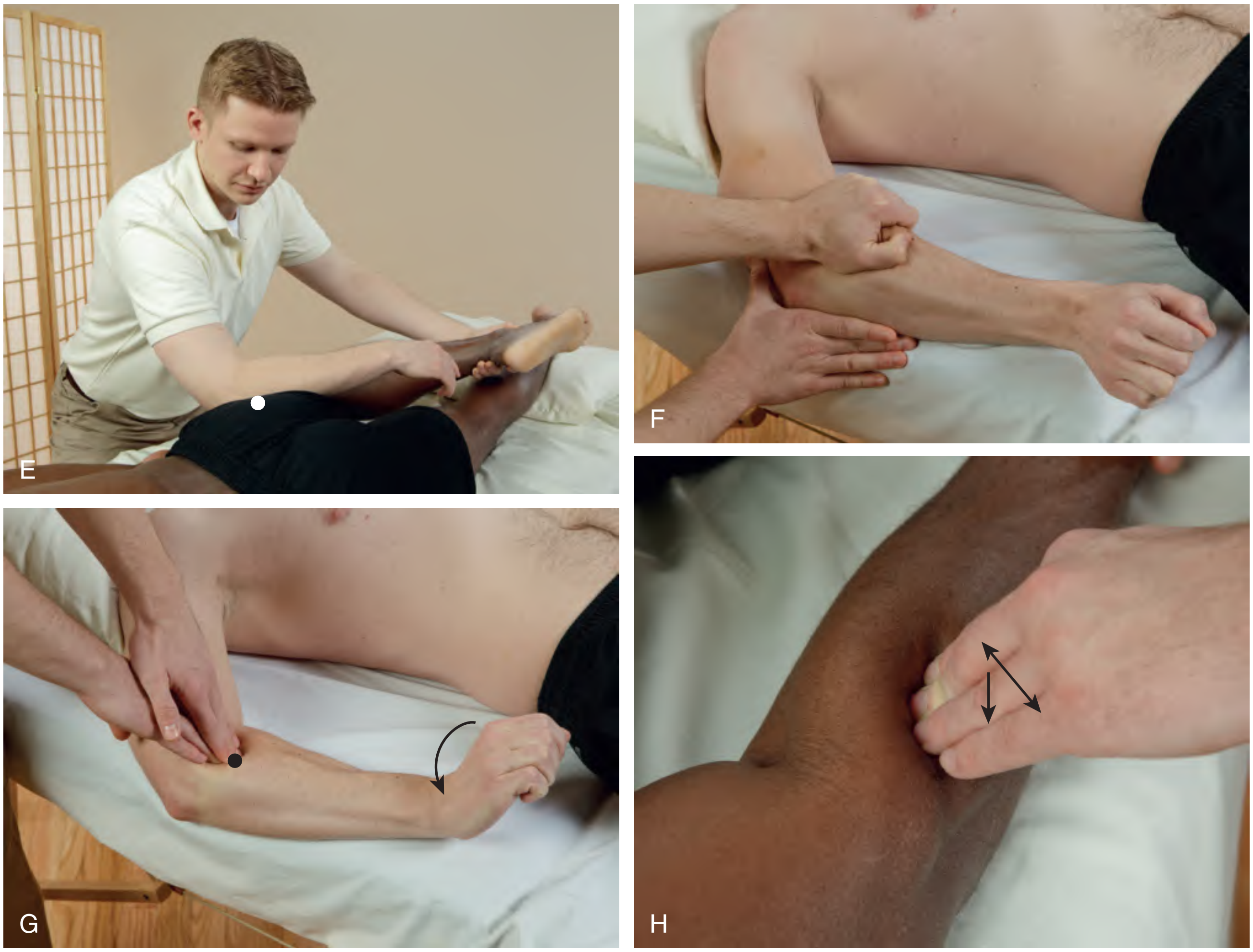

FIGURE 13-15, cont'd **E,** Broad-based compression with movement. **F,** Lift and pinch tissues that contain trigger points with or without movement of the distal joint. **G,** Focus narrow-based compression with active movement. **H,** Direct narrow-based compression with friction (shear force).

JOINT PLAY

Objective

6. Perform joint play.

Synovial joints provide both stability and mobility. Synovial joints are constructed in such a way that inherent movement of bones occurs inside the joint capsule. This is called **joint play**. It is not uncommon for this natural small movement to become reduced.

In general, all synovial joints have one bone end that is concave and one that is convex. The position of the ends of the bones in the joint capsule is a factor in efficiency of joint function. Especially with athletes, optimal joint action is necessary, so if the fit of the bone ends is a bit off, this can influence performance. Also, athletes are more likely to get bangs and bumps that jar and jam the joints.

Working with specific joint function is beyond the scope of practice for therapeutic massage and is best left in the care of medical team personnel, such as the trainer.

One method that can be used as part of massage to influence proper joint play is an indirect functional technique called **mobilization with movement**. This gentle method uses the ease position of a joint combined with active movement by the client to settle the joint into a more functional position.

To use this method, one must have a thorough understanding of individual joint structure, the closed packed and loose-packed positions of each joint, and the normal range of motion of each joint (Table 13-1).

Before this method is used, all soft tissues (muscle, tendons, ligaments) need to be as relaxed and pliable as appropriate to maintain joint stability and produce joint movement.

During assessment, the typical verbiage used by the athletic client is "stuck." The client will usually be able to identify the stuck area and will describe an event such as

TABLE 13-1 Least-Packed Positions of Joints

Joint(s)	Position
Spine	Midway between flexion and extension
Temporomandibular	Mouth slightly open
Glenohumeral	55° abduction, 30° horizontal adduction
Acromioclavicular	Arm resting by side in normal physiologic position
Sternoclavicular	Arm resting by side in normal physiologic position
Elbow	70° flexion, 10° supination
Radiohumeral	Full extension and full supination
Proximal radioulnar	70° flexion, 35° supination
Distal radioulnar	10° supination
Wrist	Neutral with slight ulnar deviation
Carpometacarpal	Midway between abduction/adduction and flexion/extension
Thumb	Slight flexion
Interphalangeal	Slight flexion
Hip	30° flexion, 30° abduction, and slight lateral rotation
Knee	25° flexion
Ankle	10° plantar flexion, midway between maximum inversion and eversion
Subtalar	Midway between extremes of range of motion
Mid-tarsal	Midway between extremes of range of motion
Tarsometatarsal	Midway between extremes of range of motion
Metatarsophalangeal	Neutral
Interphalangeal	Slight flexion

From Magee DJ: *Orthopedic physical assessment,* ed 5, Philadelphia, 2008, Saunders.

jamming fingers while catching a ball, falling, being hit, stepping down hard, stepping in a hole, and so forth, as the cause of the injury.

This method should not cause pain at any time.

PROTOCOL FOR MOBILIZATION WITH MOVEMENT (FIGURE 13-16)

1. Normalize all tissue surrounding the joint.
2. Position the joint in least-packed position (typically the middle range of motion).
3. Stabilize the most proximal end of the joint, and gently pull straight line traction. Remember, no pain.
4. Maintain traction while introducing movement in a different direction–up, down; back, forth; rotation, diagonal. Identify the direction of the greatest ease.
5. Maintain this position, especially traction, and instruct the client to move the joint through the range of motion. The action of the muscles should pull the joint back into a more functional fit.

If the client is unable to move the joint (including when sleeping), modify the technique by creating traction, then passively move the joint through pain-free and normal range of motion.

SPECIFIC RELEASES

Objective

7. Perform specific releases.

Log on to your Evolve website to watch Video 13-2: Specific Releases.

These individual procedures should be done in the context of a general massage session with awareness of whole-body compensation patterns. No single muscle functions independently. All muscles are linked into myotactic functional patterns. To restore optimal function, all muscles in the pattern must be addressed. Typically, when changes in a muscle(s) result in hypertonicity and increased tension, corresponding antagonist patterns will be inhibited, and those muscles will weaken. To compensate, these same antagonist patterns may shorten and become fibrotic. The opposite also may occur. Should a muscle become weakened, antagonist patterns will increase in tension and over time will shorten and become less pliable.

It is more effective to think of muscle groups in terms of functioning patterns than to consider individual muscles (Figure 13-17).

Muscles function as flexors, extensors, abductors, adductors, internal rotators, and external rotators. These actions are mostly concentrated in the extremities, and at occipital, cervical, thoracic, lumbar, and sacral junctions.

Another important consideration in muscle function is stabilization and maintenance of posture. Stabilizer muscles usually fix the joints above and below the joint that is being primarily moved. Muscle groups (prime mover and synergist or helpers) can function as stabilizers when the joint in which they move is not the primary point of action. All of this must be considered when working with isolated and localized procedures, as described in the following section. The question that needs to be addressed is, "What is the reason for this muscle being dysfunctional?" Until the entire pattern is addressed, symptoms will continue to return.

The main method for addressing these areas involves inhibiting pressure just into the bind in the muscle belly or at the attachments to reduce motor tone and deform tissue shape. These specific procedures address muscles that often are short and found in deeper tissue layers, which makes access difficult.

Remember to perform general massage before and after doing muscle releases.

Most inhibiting pressure is applied to the muscle belly unless it is easier to access the attachments. If you release muscle on the left side, be sure to release the same muscle

FIGURE 13-16 Three examples of mobilization with movement/indirect joint method. **A,** Ankle traction. **B,** Maintain traction and move to ease position. **C,** Maintain traction and ease with active assisted movement. Instruct the client to move the ankle in circles. **D,** Wrist traction. **E,** Maintain traction and move to the ease position. **F,** Maintain traction and ease with active assisted movement. Instruct the client to move the wrist in circles. **G,** Finger joint traction.

FIGURE 13-16, cont'd **H,** Maintain traction and move to ease position. **I,** Maintain traction and ease with active assisted movement. Instruct the client to move the finger joint back and forth.

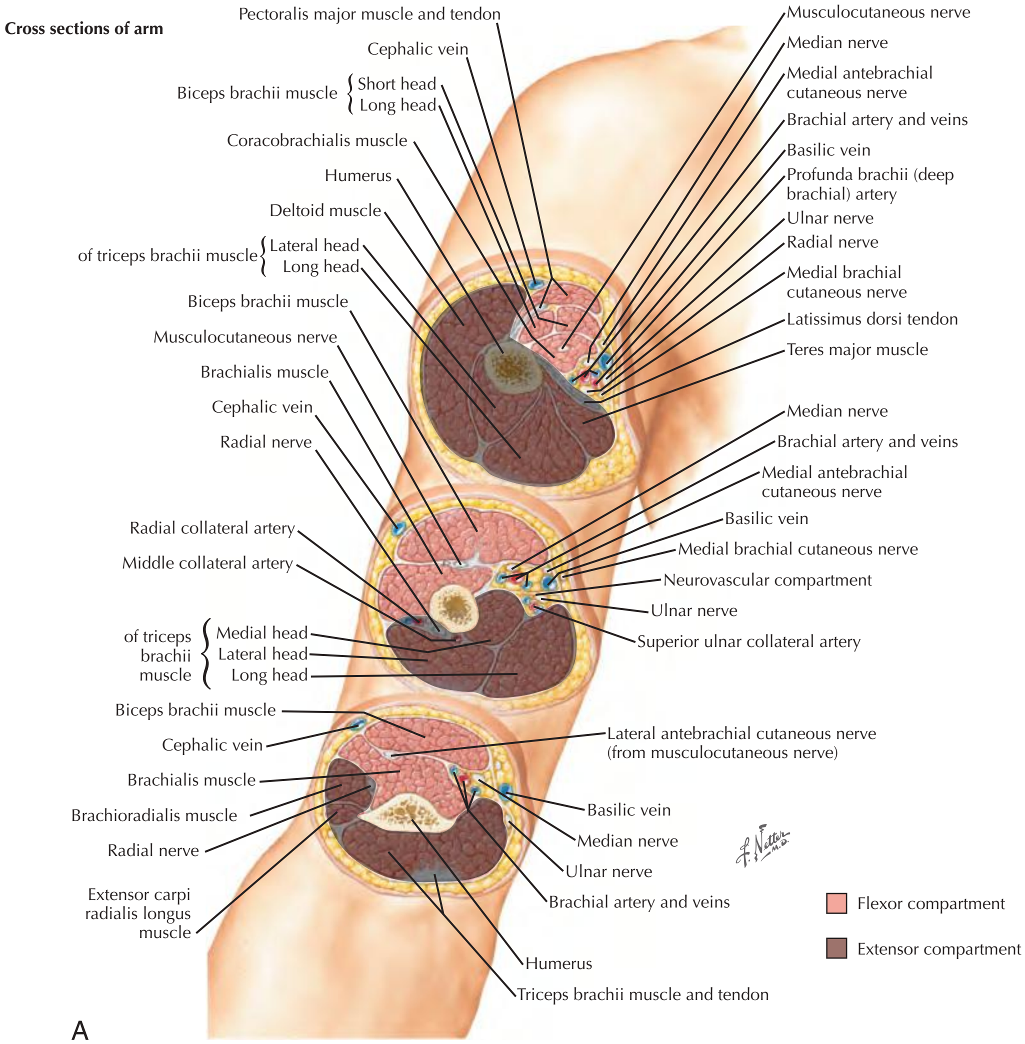

FIGURE 13-17 **A** and **B,** Functional compartments. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

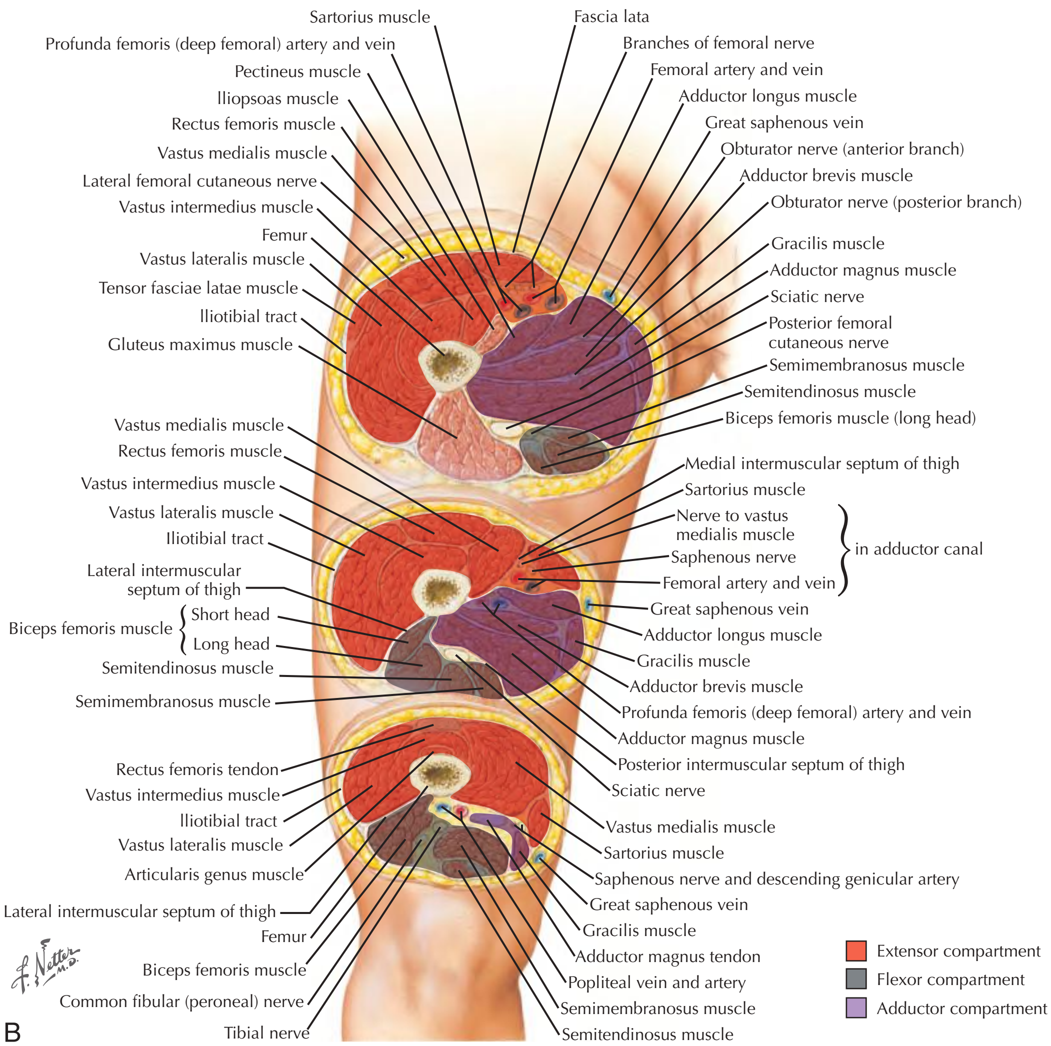

FIGURE 13-17, cont'd

on the right side, even if it tested short only on one side. These methods should be used to achieve outcomes and should not be routinely incorporated into the massage.

SCALENES (FIGURE 13-18)

Symptoms

Most symptoms that involve the scalene relate to brachial or cervical plexus impingement. Symptoms include mid-thoracic pain near the mid-scapula, chest pain, arm pain that is often mistaken for carpal tunnel syndrome, and occasionally pain that radiates into the head behind the eye.

Assessment

The best positions for assessment are side-lying and supine. Palpate to reproduce symptoms. Systematically apply a flat pressure to the area between the upper trapezius and the sternocleidomastoid. Starting at the base of the skull, work down toward the clavicles using sufficient pressure to reproduce referred pain patterns. If the pain pattern can be reproduced, the assessment is positive.

Pain usually is caused by a contracted **scalene** muscle in conjunction with a chain pattern often involving lumbar flexors or lateral flexion. The quadratus or **psoas** is often involved.

Procedure

1. Use positional release if possible, relying on the position of the lower body to achieve the position of ease.
2. Apply compression at a 45-degree angle to re-create the symptom. Have the client activate apposing antagonist patterns, directly (as with the opposite scalene groups) or in the paired pattern (as in the **quadratus lumborum**), to initiate reciprocal inhibition. As the muscle softens, pinpoint the area of tension. This area will appear more tense than surrounding tissue. Then have the client use pulsed muscle energy with both the muscle and the antagonist against the compression being held; this re-creates the symptoms. Let the client rest, and lighten pressure every 15 or so seconds. Resume until tension is reduced, but for no longer than 60 seconds. If the area does not release in 60 seconds, it is held by the kinetic

FIGURE 13-18 Specific release performed on the scalenes. **A,** Front view, side-lying position. Use compression with the forearm to move at a 45-degree angle into the area of the scalenes. Make sure the client's head is pointed down into the pillow. Slightly tip the forearm forward and back to access middle, anterior, and posterior scalenes. **B,** Back view. Use the forearm to compress tissue of the lower cervical area to access scalenes.

FIGURE 13-19 Specific release performed on the occipital base. **A,** Position the client side-lying with his nose pointed toward the table, and use the ulnar edge of the forearm to apply compression into the area just under the occipital ridge. **B,** Alternate position using braced fingers.

chain compensation pattern. Work will need to focus on normalizing this pattern.

3. Once the muscle releases, lengthen it gently if acute, and then stretch it if the condition has been chronic. Stretching will span several sessions.
4. To stretch, keep the palpating hand in place, and slowly move the head and rib cage apart until the palpating hand identifies the longest position of the muscle tissue. The tissue will feel taut in this position. Then stabilize the head, and lengthen and stretch from the thorax.

OCCIPITAL BASE (FIGURE 13-19)

Procedure

1. With the client in side-lying position, use the forearm for broad-based compression at a 45-degree angle.
2. When the client rolls his eyes, you should feel muscles activate; then hold the position for up to a total of 30 seconds.

STERNOCLEIDOMASTOID (FIGURE 13-20)

Note: If doing this release before psoas release, find out whether the client also needs psoas release by using the test described on page 248.

Procedure

1. Place the client in supine position slightly turned; stand above the client's head.
2. Hold the target muscle between thumb and fingertips, and squeeze, starting superior and proceeding to inferior. The client rolls his eyes and lifts and depresses his

FIGURE 13-20 Specific release performed on the sternocleidomastoid. **A,** Locate the muscle by having the client turn his head and lift to contract the muscle. **B,** Grasp the muscle, and tell the client to relax. Lift and squeeze from the base of the skull to the sternoclavicular joint.

chin and legs or bends his knees to engage the psoas during release of sternocleidomastoid.

RECTUS ABDOMINIS (FIGURE 13-21)

Explain the procedure first and get clear consent from the client because of the location of inferior attachments involved. Rule out a hernia before doing this method. If you perform this release, you should also do the **hamstrings**.

Symptoms

Symptoms mimic those of a groin injury. This abdominal muscle tends to facilitate psoas tightening because the other three abdominal muscles are inhibited when the **rectus abdominis** is tight.

Assessment

Palpation of upper and lower attachments re-creates symptoms.

Procedure

1. Start at superior attachments on the lower five ribs, then move to the shear muscle belly location to loosen the middle of the rectus abdominis muscle. Caution is required if a female client has had a C-section or a hysterectomy, because of scar tissue in the muscle.
2. Apply inhibiting pressure on inferior attachments above and below the symphysis pubis for 30 seconds. Work over the client's underwear, and hook your fingers around the symphysis pubis for 30 seconds while the client raises his shoulders as if trying to do a sit-up. If you feel tendons move while the client is doing this, you will know your fingers are in the right place.

HAMSTRINGS (FIGURE 13-22)

Symptoms

Pain is felt at proximal and distal attachments, with a sense of stiffness and aching.

Assessment

Test to see if short: Can the client bend at the waist and touch his toes while keeping his legs straight? Can the client flex his knees to touch toes and straighten legs?

Procedure

1. Use braced hand to apply inhibiting pressure at proximal and distal attachments. Attachments at the knee are most easily accessed when the knee is flexed.
2. Use broad-based compression on the muscle belly while the client flexes the knee. The side-lying position is most effective.

MULTIFIDI, ROTATORS, INTERTRANSVERSARII, AND INTERSPINALES (FIGURE 13-23)

As a combined group, these muscles produce small, refined movements of the vertebral column. They work in coordination, with each group of muscle fibers contributing to the entire action.

Symptoms

The client often wants to have his back "cracked," yet manipulation does not provide relief. Stiffness is noted upon initiation of movement, but once movement begins, stiffness is reduced. The client is unable to stretch effectively to affect muscle groups. Aching, as opposed to a sharp pain, is felt.

Assessment

Palpation is the only effective assessment. These are small, deep muscles located between and along the edges of the vertebrae. A history of being seated or of standing for extended periods is common. Palpation, with the client in both prone and side-lying positions, deep into the spaces between the vertebrae reveals tough tissue bands that will replicate symptoms. Effective palpation must go deep enough to contact the muscle group and get under the erector spine muscles. Caution is necessary when

FIGURE 13-21 Specific release on the rectus abdominis. **A,** Palpate attachments on the ribs, and apply compression and glide. **B,** Use kneading to move tissue into and out of bind. **C,** Locate the belly of the muscle, and grasp and lift and move the tissues back and forth. **D,** Tell the client to put her hand on the pubic bone. Friction tissues of the distal attachment on the pubic bone. Curl fingers around and under the pubic bone and friction attachment tissues.

working on these muscles because nerves exit the spine in these areas.

Procedure

Meticulous frictioning of short muscle bands combined with tissue stretching using compression is required. Softening and lengthening of the erector spine and associated fascia is necessary before this procedure is performed.

1. Position the client in the side-lying position with the affected side up and with a small amount of passive extension. It may be necessary to get on the table or use a stool to achieve an effective mechanical advantage.
2. Angle in at 45 degrees against the groove next to the spinal column between the transverse and spinous processes, using braced double hands. Sink in until you can feel the spinous processes.
3. Hold compression firmly against affected tissue, and have the client slowly move the area back and forth from extension to flexion. Then have the client remain in slight extension while you move down in a deep scooping action and then out. After the tissue has softened further, firmly hold the compression, and have the client move into spinal flexion very slowly until you feel the tissue become taut, to stretch the area. Hold this position until the tissue softens.

SUBSCAPULARIS AND LATISSIMUS DORSI (FIGURE 13-24)

Symptoms

The client complains of aching or throbbing in the shoulder and upper arm. The wrist may also ache. The client may have been told that he has a frozen shoulder. Symptoms include pain or restriction of activities that require any form of external rotation, as well as shortening of the latissimus dorsi with restricted shoulder movement, especially flexion and abduction past 90 degrees. The latissimus dorsi often shortens to increase tautness of the lumbar dorsal fascia if low back/core structures exhibit instability.

Assessment

Visual assessment indicates an internally or medially rotated humerus. When the humerus is placed in external

FIGURE 13-22 Specific release performed on the hamstrings. **A,** Hamstring attachments at the knee. Compress into the medial and lateral condyles of the tibia and into the lateral fibular head. With the knee slightly flexed, use the other hand to move the tibia into internal and external rotation. **B,** Flex the knee while maintaining compression at the hamstring attachments and slowly with small movement of flex, and extend the knee. **C,** The side-lying position is effective for applying inhibitory pressure on the proximal hamstring attachments. **D,** The forearm can be used to compress the adductors and bend the hamstrings, but the leg is very efficient. Use the leg to apply pressure from the groin to the knee, all in one move. To position correctly, place the tibial bone along the location of where the inseam of the pants would lie. Move the knee to facilitate the release.

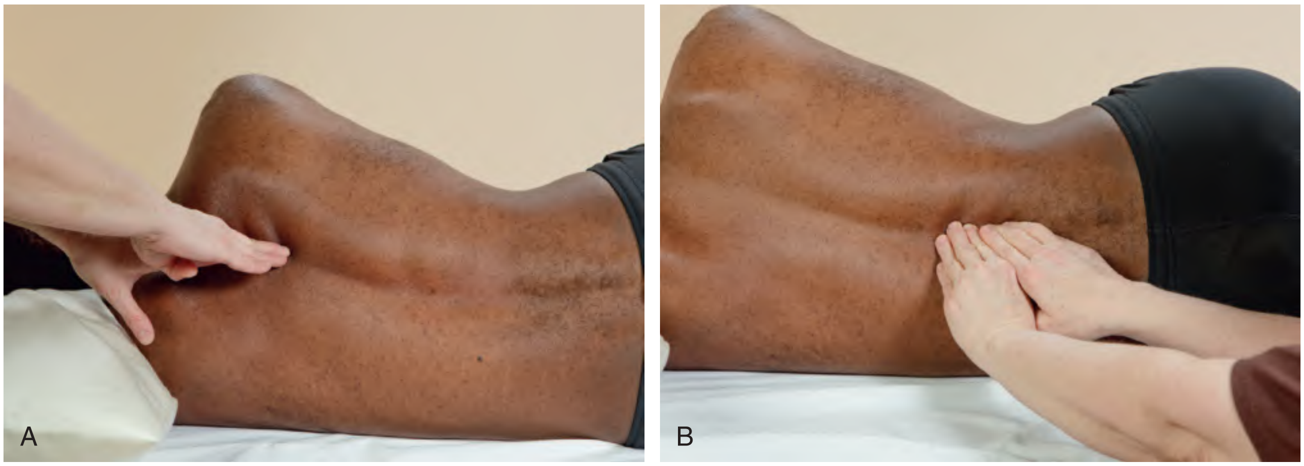

FIGURE 13-23 Specific release performed on multifidi, rotators, **intertransversarii**, and **interspinalis**. **A,** Place braced fingers between transverse and spinous processes, and apply compression and friction. **B,** Move meticulously along the entire vertebral column.

FIGURE 13-24 Specific release performed on the subscapularis and the latissimus dorsi. **A,** Place braced fingers into the space between the pectoralis major and the latissimus dorsi at the axilla. Slide in on top of the subscapularis. **B,** Move the arm across the body and over the fingers to bring the belly of the subscapularis onto the therapist's hand and to apply inhibiting pressure. **C,** To access the latissimus dorsi, place a loose fist on the muscle as it flares out into the axilla. **D,** Compress the latissimus dorsi into the table while the client or the therapist slides an arm along the table away from the body. **E,** Alternate positions for the latissimus dorsi in the side-lying position. The client is slightly rolled forward, and the tissues are compressed with the forearm. **F,** Maintain compression and glide toward attachments on the arm.

rotation and the client is instructed to move it into internal rotation, pain is usually experienced, but not always. These muscles are usually hypertonic if problems exist. This is part of the whole pattern of the body moving into a forward flexed protective and striking position. A history of overhead throwing, such as in baseball or basketball, or working in horizontal abduction and flexion or over the head with back and forth movements, such as during painting, is common. This pattern of movement is stressed in activities such as driving, swimming, and raking or shoveling for long periods, especially if the person is not used to the activity.

The latissimus dorsi creates the bulk of tissues that border the posterior aspect of the axilla. The subscapularis is medial to the latissimus on the anterior side of the scapula with attachments into the joint capsule near the bicipital groove. Tenderness at this attachment is often mistaken for bursitis.

Palpation of the muscles will reproduce symptoms. To palpate subscapularis, the client can be in the prone, supine, or side-lying position, and the arm is horizontally abducted and externally rotated. Deep palpation in the groove between the latissimus to the back and the pectoralis to the front is required. While taking care to avoid the vessels in this area, weave the supported four fingers in and down at a 45-degree angle until the scapula is felt. Probe in different areas by changing the angle of the hand until symptoms are reproduced.

Procedure

1. Once the area of tissue that reproduces the symptoms is located, continue to apply compression while the client moves the arm back and forth from internal to external rotation.
2. Change the position of the humerus from 90 degrees to 130 degrees to access different aspects of the movement pattern as the client moves the humerus into internal and external rotation. This movement can be active, active resisted, or passive, whichever is most effective, to access the narrow band of distal attachment of the **subscapularis**.
3. Keep pressure on the area and increase movement at the end of each range to apply the stretch.

Because this is a painful procedure, give the client breaks, but do not loosen the position of the fingers. Avoid the brachial plexus.

RHOMBOID, PECTORALIS MAJOR AND MINOR, ANTERIOR SERRATUS (FIGURES 13-25, 13-26, AND 13-27)

Symptoms

The client generally complains of pain between the scapulae, and that the back feels tight and fatigued. Sometimes a specific tender point or aching in the upper **rhomboid** area may be mentioned. Often a client will say that he is stretching the back, but actually the chest area is being stretched. Breathing is often of the upper chest pattern and/or restricted.

Assessment

The most common problem is increased tension in the pectoralis major and minor and **anterior serratus**. Palpate these muscle areas for tender points. Usually the client is unaware that these points exist. The scapulae will be difficult to wing, and there will be a forward roll to the shoulders. The client often presents with a history of static position of the arms forward and use of small muscle action, as in computer work. Any activity that requires pushing forward or pulling down will set up or aggravate symptoms.

Procedure

Reducing tension and restoring length in the pectoralis and the anterior serratus muscles will relieve tension on the rhomboids. Pressure held on the tender points in the chest is often effective. If the pattern has become habitual or chronic, the fascia of the chest will need to be stretched.

1. If possible, palpate for tender points with the client side-lying or supine. Place one hand in the rhomboid region to feel for the interplay of pressure applied to the chest involving the pectoralis muscles and the anterior serratus. These muscles pull the scapula forward. Compress or squeeze into the area to identify the tender points.
2. Once the tender points are located, apply pressure using various angles against the area to see if a position of release can be found. If not, have the client move around slowly, and repeat application of pressure. Once the position of release is located, follow the positional release or integrate the muscle energy procedure.
3. It is important to stretch the area. This is accomplished by manually moving the scapula toward the spine while the client is in the side-lying position. This is facilitated by having the client pull the scapula together or by using a firm tapotement to the rhomboid, reflexively creating a contraction reflex while pushing the scapula toward the spine.

DIAPHRAGM (FIGURE 13-28)

Symptoms

The client complains of neck and shoulder tension and aching or pulling at the area of the thoracolumbar junction. Symptoms get worse if anything restricts the abdomen, such as tight clothing or pulling in the stomach. Symptoms may indicate a breathing pattern disorder.

Assessment

Perform assessment for a breathing pattern disorder. In addition, palpate the area of the **diaphragm** along the edge of the rib cage for tenderness or rigidity.

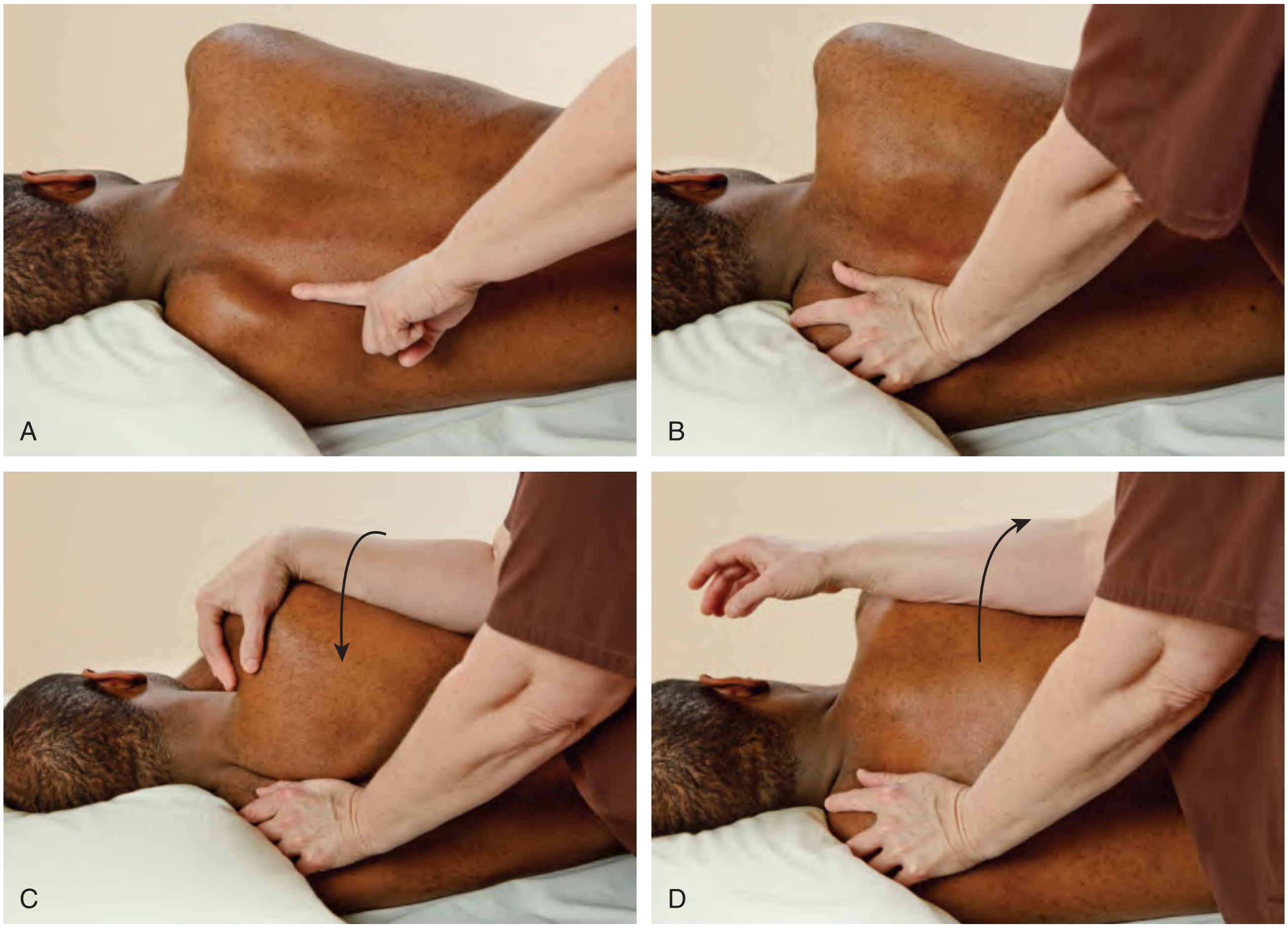

FIGURE 13-25 Specific release performed on the rhomboids. **A,** Rhomboids: Position the client side-lying with one shoulder on the table. **B,** Use the palm to compress tissue against the medial border of the scapula. **C,** Maintain compression and place the other arm on the client; roll the client back so the medial borders of the scapula come together, placing tissue at ease. **D,** Maintain compression on the medial border of the scapula, and roll the client forward, placing tissue into bind.

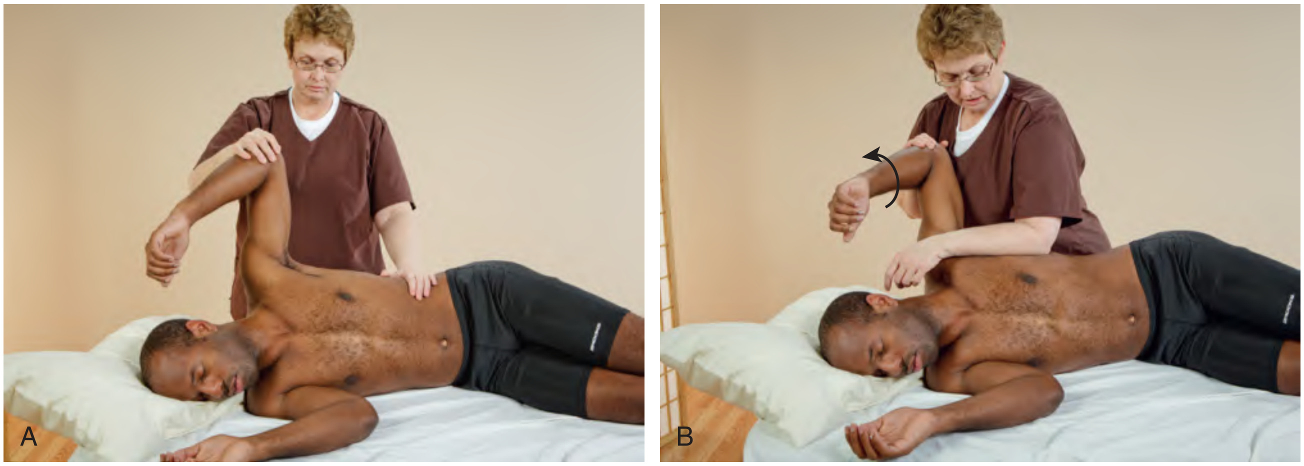

FIGURE 13-26 Specific release performed on the anterior serratus. **A,** Position the client on his side with his shoulder abducted to 90 degrees. **B,** Roll the client's arm back toward the therapist, and place the forearm anterior to the axilla on the ribs to apply compression to the muscle. Instruct the client to inhale and exhale slowly.

FIGURE 13-27 Specific release performed on the **pectoralis minor**. **A,** Muscle is located deep to the pectoralis major. **B,** Use flat, braced fingers to compress through the pectoralis major into the pectoralis minor.

Procedure

Release of the diaphragm should be done in conjunction with breathing pattern disorder, psoas, and quadratus lumborum procedures.

1. The client is supine with knees bent. Locate the edge of the rib cage, and access with an overlapping double hand with braced finger contact, or with the ulnar side of the hand braced by the opposite hand.
2. While the client exhales, slowly let the hand sink under the ribs. Use caution in the area of the liver. When resistance is felt, have the client raise the arm up and over the head, inhale, and then exhale deeply and slowly.
3. Follow the exhale, taking up any slack. The direction of the compressive force should be at an angle of about 25 degrees along and under the rib cage. Do not press directly down toward the spine. It may be helpful if the client holds his breath to the end of the exhale and, while holding his breath, attempts to push your hand out using the muscles. Be aware of extended breath holding by anyone with high blood pressure.
4. Apply a broad-based alternating rhythmic compression to the lower rib attachments, gently but firmly pushing the rib cage in and out. Do not apply pressure on the xiphoid process. Then hook fingers under the ribs and gently stretch up and out.

PSOAS (FIGURE 13-29)

Symptoms

The client complains of generalized lumbar aching, aching into the tops of the thighs, low back pain when coughing or sneezing, and pain when lying on the stomach or flat on the back. Pain increases after sitting and then during standing.

> **IN MY EXPERIENCE**
>
> Nightmares
>
> I was about 3 years into working with an NFL team. Typically about the second week into training camp, and again about November during the season, there seemed to be an epidemic of low back pain. I think that general fatigue interferes with core stability, resulting in a short psoas. Although not a cure, a psoas release can relieve the symptoms, at least temporarily. So it was November, and it felt like I had done 50 psoas releases that day. The actual count was around 25, but it sure felt like more. Even the best body mechanics won't prevent getting tired after working with that many muscular guys in one day.
>
> That night, I had a dream that I was in the massage area at the training facility, and I had a player on the massage table. In my dream, I looked down the hall and saw all these guys in different colored helmets. I asked someone who all the guys were. He replied, "It's the entire NFL; they're all here for a psoas release."
>
> Now that was a nightmare!

Assessment

Gait stride is shortened, more so on the short side. An externally rotated leg is on the short side. The client braces himself with his hands when sitting down or standing up. The leg is unable to fall into full extension, as in the supine "edge of table" test described later. The pelvis is anteriorly rotated on the short side.

Note: A tight and/or shortened quadratus group and tensor fasciae latae are often found with psoas dysfunction and should be addressed before the psoas muscles are addressed. The sternocleidomastoid is also involved.

FIGURE 13-28 Specific release performed on the diaphragm. **A,** Use the ulnar (little finger) side of the hand to gently compress along the edge of the rib cage. Use caution over the liver area. **B,** Sequentially move along the rib cage. **C,** Use both hands to compress tissues at the edge of the ribs. Instruct the client to breathe slowly and deeply. **D,** With the pads of braced fingers, compress into the linea alba. **E,** Gently lift the edges of the ribs.

1. *Edge of table test:* The client places the ischial tuberosity on the edge of the table, bringing one leg to the chest and rolling back to lie on the table. When the leg is held tightly to the chest, the other leg should lie horizontal with the table. If it is above the table, the psoas is short.
2. Direct access to the psoas using hand and/or fist:
   a. The client is supine or side-lying, with knees flexed to at least 110 degrees if supine. Both feet are flat on the table. The practitioner stands on the side to be addressed. A flat stabilized hand or a loose fist can be used. The decision is based on the size and comfort of the client. For the practitioner, the fist position will withstand a longer duration of treatment.
   b. With the client side-lying with knees flexed, the practitioner kneels in front of the client and leans in, using a stabilized hand or a loose fist. The leg

FIGURE 13-29 Specific release performed on the psoas. **A,** Place braced but flat fingers on the lateral edge of the rectus abdominis. **B,** Alternate methods using the fist. Knuckles are at the lateral edge of the rectus abdominis. **C,** Knees are bent to place tissue on the ease. Use pads (not tips) of fingers into the abdomen. **D,** Alternate methods using a soft fist. **E,** When at a depth level that allows access the psoas, have the client flex his thigh against resistance to activate the psoas to confirm location. The muscle should push up against the hand. **F,** Maintain compression on the belly of the muscle, and instruct the client to flex and extend his hip by sliding the heel down the table and then sliding the heel up the table surface.

G

H

I

FIGURE 13-29, cont'd **G,** The psoas can be addressed in a similar manner with the client side-lying and the therapist kneeling or seated. **H,** The thigh can be moved up and then pulled toward the therapist as a counterpressure method to facilitate release. **I,** Alternate method. Direct pressure at the pubis. If it is difficult or contraindicated to apply pressure into the abdomen directly, the psoas can be addressed at the junction of the thigh and the torso. Bend the knee, and slightly externally rotate the hip. Then apply direct pressure.

top can be used to pull the client toward the pressure.

c. The muscle location is best accessed midline between the iliac crest and the navel and can usually be found by placing the metacarpophalangeal joint on the iliac crest. The fingers remain straight, and the tips of the fingers identify the location of the muscle. This muscle is located deep against the anterior aspect of the lumbar and lower thoracic spine. Slow, deliberate compression into the lower abdomen is required. The abdominal aorta can be palpated as pulsation and must not be compressed. The small and large intestines will slide out of the way as downward force is exerted. Identification of the proper location can be confirmed by having the client flex the leg against resistance.

3. A flat sustained compression is applied while the client slowly moves his head in large, slow circles. These actions assist the psoas and act as a contract/then relax of the muscle.
   a. The psoas can be inhibited by having the client activate the neck extensor by slightly tipping the chin toward the ceiling and pushing the back of the head against the table. Alternating flexion and extension of the neck is valuable while maintaining compression against the psoas. These neck actions can be supplemented with eye movement: Eyes look downward during forward flexion, sideways during lateral flexion, and upward during extension.
   b. Additionally, the client can slowly slide the heel of the foot out so that the leg straightens. When the leg is straight, if the client contracts the buttocks, the psoas is further inhibited. The client then relaxes the gluteal muscles and slides the heel as close to the buttocks as possible to contract the psoas. This action is repeated while compression is maintained.
4. Release at the distal attachment: If it is difficult to access the psoas through the abdomen, inhibiting pressure near the distal attachment where the muscle crosses over the pubic bone is possible. Usually the leg is moved into an ease or bind position while the inhibiting pressure is held.

After the release, compression of the psoas acts to lengthen and stretch this muscle. Make sure that the client first rolls to the side and then rolls up before getting off the table. Assist the client if necessary. Do not let the client sit straight up. It is best to perform the following sequence after direct pressure on the psoas.

5. Have the client lie prone as a gentle lengthening position for this muscle. Then have the client assume a four-point position by getting on hands and knees.
   a. Have the client assume the cat or sway-back position and the camel or hunchback position.
   b. The client slides his arms in front and brings his buttocks back against the hamstrings. If the pain in the psoas is not acute, have the client drop gently into the cobra position by lifting the head and chest, straightening the arms, and placing the pelvis flat against the table.
   c. The client assumes the hands and knees position to get off the table.

QUADRATUS LUMBORUM (FIGURE 13-30)

Symptoms

Symptoms include deep local low back pain, which may be more intense on one side, and pain radiating into the buttocks and down the side of the leg to the knee (nerve entrapment). The client tends to wiggle or attempts to stretch with lateral trunk flexion. The client may have restricted breathing. The leg may be shorter on the affected side (may be functional or physical). The client may report pain and stiffness in the area when rolling over in bed.

Assessment

1. Place the client in side-lying position. Palpate with forearms or hands in the space between the ribs and the iliac crest. A connective tissue raphe in this area will need to soften before compressive force is allowed to affect the quadratus lumborum. Have the client straighten and then lift the top leg. The area being palpated should not be activated until the leg is raised more than 20 degrees. If this is the case, the quadratus lumborum is tense and short.
2. Have the client lie prone with legs straight, and assess leg length. The short leg may indicate a tight quadratus lumborum. If lateral flexion of the torso is restricted or asymmetric, the greatest restriction will be noted on the short/tense side.

Procedure

1. Position the client on his or her side with bottom leg bent slightly and top leg straight and in slight hip extension.
2. While standing behind the client, apply compression into the space between the last rib and the top of the iliac crest. The angle of force is about 90 degrees (heading toward the navel). When resistance is felt in the muscle, have the client lift the top leg up and down. Make sure the hip stays in extension.

FIGURE 13-30 Specific release performed on the quadratus lumborum. **A,** Place the client on her side with her top leg straight and behind the leg that is on the table. Use the forearm (braced fingers if space is narrow) to compress tissues between the lower ribs and the iliac crest. A connective tissue raphe in this area will need to soften first, before compressive force is allowed to affect the quadratus lumborum. **B,** Protect the lower ribs, and maintain contact with the iliac crest. Counterpressure may be necessary to maintain stable pressure.

3. Alternatively, have the client move his neck and head back and forth in lateral flexion and extension. Both of these moves facilitate or inhibit the quadratus lumborum muscles. These neck movements can be supplemented with side-to-side eye movements.
4. After the muscle releases, it will need to be lengthened and stretched. Use a manual stretch by exerting force into the low back toward the navel and by side-bending the client in extension with both the torso and the leg.
5. Self-help may include the following exercise: Fingers are interlaced, palms are turned up, and arms are extended over the head. The pelvis is held stable and is rolled

forward while the client is standing or on his knees. Side-bend and twist into slight flexion.

DEEP LATERAL HIP ROTATORS (FIGURE 13-31)

Symptoms

The foot is externally rotated. The client complains of pain deep in the gluteals, which may be associated with sciatic nerve impingement.

Assessment

Perform physical assessment tests for an externally rotated foot. Palpate into the belly of the muscle to identify tender points that re-create symptoms.

Procedure

1. Compression with internal and external rotation of deep lateral rotators. Use forearms to apply compression while moving the hip into internal and external rotation. Incorporate muscle energy methods to facilitate release.
2. Stretching while client is in supine position. Owing to placement of the attachments, when the client is in the supine position with the hip flexed to 90 degrees, the leg is externally rotated and is pulled toward the chest.

GROIN AREA MUSCLES (FIGURE 13-32)

Note: Specific consent is required because of the locations of muscle attachments. Perform over clothing or draping.

Symptoms

The client has a sensation of high groin pull, but the practitioner is not able to palpate tenderness in the adductor region. Symptoms include restricted breathing, shortened stride, and contralateral shoulder pain.

Assessment

1. Assess by palpation. Have the client lie on his side with his top leg bent and pulled up. Using the supported hand position with flat fingers, contact the ischial tuberosity from an inferior approach on the bottom, then slide over it until your fingers feel a spoon-shaped depression. Then apply a downward pressure at a 45-degree angle to access the target tissues.
2. Shift the direction of force to identify tender areas that re-create symptoms. Tell the client to lift his bottom leg: If you feel the muscle move, you are on the right spot.

Procedure

1. Maintain contact with the tender points that create symptoms, increase compressive force, and have the client slightly extend and gently adduct his bottom leg.
2. Continue pressure until you feel the muscle give way and let you in deeper. Be sure to perform this procedure on both right and left sides, or the client will feel unbalanced afterward when walking.

FIGURE 13-31 Specific release performed on the **deep lateral hip rotators**. **A,** Compress through surface tissue to access the target area. The forearm is placed between the **sacroiliac (SI) joint** and the hip joint. **B,** Maintain compression while moving the hip into external rotation. **C,** Maintain compression while moving the hip into internal rotation.

FIGURE 13-32 Specific release performed on **groin area muscle** attachments. **A,** Position the client side-lying with the top leg forward and the hip and knee flexed. Use braced fingers to apply direct pressure against the ischial tuberosity. **B,** Then slide over it until fingers feel a spoon-shaped depression and apply a downward pressure at a 45-degree angle to access the target tissues. Change the angle of the hands to access symptom-producing tissue.

SACROILIAC JOINT AND PELVIS ALIGNMENT (FIGURES 13-33 AND 13-34)

Symptoms

Client reports pain over the SI joint, which increases when standing on one leg or while sleeping at night.

Assessment

Apply direct compression over the SI joint to determine whether symptoms increase.

Procedure

1. Stabilize the sacrum with the hand, foot, or leg.
2. Have the client, while in the prone position, extend his hips, alternating as if walking backward.
3. With the client in side-lying position, move the joint by applying compression alternately at the iliac crest and at the ischial tuberosity to rock the joint back and forth.
4. While the client is in side-lying position, compress the sacrum up and down and back and forth.

PELVIS ROTATION (INDIRECT FUNCTIONAL TECHNIQUE) (FIGURES 13-35 AND 13-36)

Symptoms

The client indicates a twisted sensation and may experience pain in the lower back, groin, or hip.

Assessment

First assess for asymmetry by comparing both anterior superior iliac spines (ASIS) while the client is in the supine position. Signs of dysfunction include the following:

- Bilateral anterior rotation: ASIS palpates as forward and low
- Bilateral posterior rotation: ASIS palpates as backward and high
- Right or left anterior rotation: ASIS palpates as one low and one high
- Right or left posterior rotation: ASIS palpates as one low and one high
- Inflare is left, right, or bilateral: ASIS points toward midline
- Outflare is left, right, or bilateral: ASIS palpates away from midline

Procedure

1. **Anterior rotation**: Use the leg to rotate the pelvis into increased anterior rotation by bringing the leg over the edge of the table. Have the client pull his leg toward his shoulder. Apply moderate resistance, and repeat 3 or 4 times. On final move, stretch soft tissue while increasing posterior rotation.
2. **Posterior rotation**: Begin with the leg bent toward the shoulder, increasing posterior rotation. Have the client push his leg out and down over the table. Apply moderate resistance, and repeat 3 or 4 times. On final move, stretch the soft tissue while increasing anterior rotation.
3. **Inflare**: Position the hip in flexion and internal rotation, increasing inflare. Have the client push out against moderate resistance. The result is external rotation of the hip. Repeat 3 or 4 times. On final move, stretch the soft tissue while increasing outflare.
4. **Outflare**: Position the hip in flexion and external rotation, increasing outflare. Have the client move his full leg toward midline against resistance. On final move, stretch the soft tissue while increasing inflare.
5. Regardless of the corrective procedure, reset the symphysis pubis stability. Place the client in supine position, with knees and hips flexed. Have the client firmly push his knees together against resistance applied by the massage therapist.

Log on to your Evolve website for additional figures illustrating findings in the assessment of pelvis rotations.

Text continued on p. 258

FIGURE 13-33 Assessment performed on the sacroiliac (SI) joint. **A,** With the client prone, use the forearm to compress the sacrum. **B,** Alternate method for sacrum compression using the hands. If there is pain during compression, or when the compression is released, the test is positive. **C,** Apply compression to the SI joint. If pain occurs during compression, or when compression is released, the test is positive. **D,** Compress the ilia together. If pain during compression is noted, or when compression is released, the test is positive. **E,** Palpate by placing braced fingers in the space between the posterior superior iliac spine and sacrum. **F,** Move the hip into 45 degrees of internal rotation. Palpating fingers should not move. **G,** Move the hip into 45 degrees of external rotation. Palpating fingers should not move. In this figure, the fingers move, indicating a positive test.

FIGURE 13-34 Correction for sacroiliac (SI) joint using indirect methods. **A,** Compress the sacrum down. **B,** Hold the sacrum down while the client lifts her leg to move the ilium over the sacrum. **C,** Alternate the legs back and forth while maintaining compression on the sacrum. **D,** Activate the force couple across the SI joint by having the client lift her leg and opposite arm against resistance. Switch arm and leg, and repeat. **E,** With the client on her side, compress and release on the iliac crest near the anterior superior spine. **F,** Repeat and mobilize the SI joint on the opposite side.

FIGURE 13-34, cont'd **G,** Mobilize the SI joint, compressing over the joints while the client rocks her pelvis up and down. Compress against the sacrum and repeat, with the client rocking her pelvis up and down. **H,** In supine position, compress the ilia down toward the table and apart while client rocks her pelvis. **I,** In supine position, compress the ilia together while the client rocks her pelvis.

FIGURE 13-35 Assessment of pelvic rotations. **A,** Begin with the client supine, and palpate the anterior superior iliac spine bilaterally. **B,** Place thumbs on the anterior superior iliac spines. Findings include anterior rotations, posterior rotations, inflares and outflares, and any combination. **See the Evolve website for figures illustrating each of these findings.**

FIGURE 13-36 Corrective methods for pelvic rotations. **A,** Correction for anterior rotation. Passively position the leg to increase anterior rotation. **B,** Instruct the client to move her knee toward the same side shoulder. **C,** Apply overpressure to move the joint into posterior rotation to correct. **D,** Correction for posterior rotation. Position the thigh into hip flexion on the affected side, passively increasing posterior rotation. **E,** Instruct the client to actively extend her hip against resistance. **F,** At end range, apply overpressure to move the joint anteriorly to correct.

FIGURE 13-36, cont'd **G,** Correction for outflare. Passively move the hip into external rotation to increase outflare. **H,** Instruct the client to move in the opposite direction against resistance. **I,** Apply overpressure for increased inflare to correct. **J,** Correct for inflare. Passively move the thigh to increase inflare. **K,** Have the client push against resistance in the opposite direction. **L,** Stabilize while applying overpressure to move the joint into outflare position to provide correction.

SUMMARY

The applications discussed in this chapter are usually incorporated into the general massage protocol. Examples of general massage are provided on the Evolve website. These methods are intervention approaches used to shift the client's structure or function. Therefore, they can strain adaptive capacity and should be used only as needed. Do not overuse any of the methods. Think of each of these applications as the seasoning in the main massage soup.

In general, the biggest mistake made with massage application involves too much or too little seasoning. A massage that is too straining or one that is too bland will not please the client, nor will it be as therapeutic as it should be. The skilled practitioner strives to get the flavor just right.

Log on to your Evolve website to find an extensive series of illustrations that demonstrate the general protocol for massage.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

For each method described, list at least three situations in which you would use the method.

1. Indirect function technique

   Example: Tissue binds in the lumbar fascia
2. Arterial circulation focus

   Example: Pre-event massage
3. Venous return focus

   Example: Long plane ride
4. General systemic lymphatic drain

   Example: Delayed-onset muscle soreness
5. Localized lymphatic drain

   Example: Ankle sprain
6. Deep transverse friction
7. Connective tissue mechanics
8. Trigger points
9. Joint play
10. Reflexology
11. Acupressure
12. Scalene/occipital/sternocleidomastoid release
13. Psoas release
14. Quadratus lumborum release
15. Subscapular release
16. Rectus abdominis release
17. Hamstring release
18. Groin attachments of hamstring and adductors
19. Multifidi, rotators, etc.
20. Deep lateral rotators
21. SI joint

CHAPTER

14

Unique Circumstances and Adjunct Therapies

OUTLINE

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1. Alter massage application to work effectively with a sleeping client
2. Alter massage application to adjust to unique draping concerns, hairstyles, and clothing
3. Provide massage in various environments and in the context of typical sports schedules
4. Adjust massage to respect habitual behavior
5. Use simple and safe application of adjunct therapies to support the massage outcome

KEY TERMS

Arnica montana	Hot and Cold Contrast Hydrotherapy	Pine
Aromatherapy	Hydrotherapy	Rescue Remedy
Balsam Fir	Juniper Berry	Rosemary
Black Pepper	Lavender	*Ruta graveolens*
Chamomile, German	Lemongrass	South Pole
Eucalyptus	Magnets	Tea Tree
Gauss	North Pole	Therapeutic Taping
Geranium	Peppermint	Thyme
Helichrysum		

This final chapter of Unit Two discusses some of the specific circumstances often encountered while working with the sport population. The information is based on years of professional experience. I hope the suggestions will help you understand athletes a little better, and that they provide ideas to address these issues.

This population can present unique situations that require ingenuity, flexibility, creativity, and a sense of humor. As mentioned at the beginning of this textbook, many different situations arise that can stretch one's ability to carry out an effective massage. The main challenges are the sleeping client, draping considerations, clothing and hair, distractions, restroom needs, body size, the massage location, scheduling, and habitual behavior.

The sport and fitness community is open to using essential oils, homeopathy, and **magnets**. The massage therapist needs to be ethical and informed about these approaches. Many of these products are expensive and may have little value beyond placebo effect. The methods provide possibilities for self-help treatment or to support or extend the effects of massage.

This chapter provides information on adjunct therapy such as **aromatherapy**, **hydrotherapy**, and magnet therapy. Hydrotherapy is well researched and is used extensively by those involved in sport fitness and rehabilitation. Aromatherapy (essential oils) is also a useful method; more valid research is providing insight into its mechanism and effects. This chapter describes the oils that I have found most useful and that are generally safe.

Magnet therapy and other energetic methods such as homeopathy are less solid in their research base, but many athletes use magnets, so it is important to understand current theories. My own personal experience indicates that several homeopathic remedies are helpful, especially *arnica*. **Rescue Remedy** is a Bach flower remedy that seems to help with the ongoing trauma and shock that these clients experience.

THE SLEEPING CLIENT

Objective

1. Alter massage application to work effectively with a sleeping client.

Athletes commonly fall asleep during the massage. Because restorative sleep is so important, the ability to adapt massage application to accommodate sleep while continuing to achieve outcomes is important. The most obvious challenges are active assessment and use of methods that require active participation. Altering the flow of massage application so that these methods are used at the beginning of the massage and after massage usually will solve the problem.

Extra blankets and pillows and bolsters usually are required. Clients' circulation alters during sleep and massage, and they become cool. The position of the client needs to be changed gently and smoothly so that he or she is disturbed as little as possible. Instruct the client to keep the eyes closed while changing position. Use rhythmic rocking to settle the athlete if he or she is aroused a bit from sleep. This usually will allow the client to go back to sleep. This can occur during position change, with passive range of motion, and during stretching methods, or if the method applied is unexpectedly painful.

Attempt to do most of the massage with the client in the side-lying and supine position. The prone position can cause sinuses to clog up and strains the lower back. Use it when the client is most wakeful, and bolster the lower legs and under the abdomen to reduce lumbar strain.

The massage needs to be given in a confident rhythmic manner. All movement should be secure and stabilized appropriately. The massage professional must be focused, observant of client responses, and quiet. Passive methods, such as lymphatic drain and other fluid dynamic methods, are easy to apply during sleep.

Some of the more active applications and assessment procedures can be altered and applied passively by the skilled massage therapist.

In general, assessment consists primarily of observation and palpation. For more active assessment methods, such as assessing firing patterns, alter the process and perform these assessments at the beginning of the massage. During the massage, when you sense heat and muscle tension, note the synergistic dominance pattern. If in doubt, assume that the firing pattern is synergistic dominant. Methods applied can be focused to reduce tone in the misfiring muscles while more stimulating methods are applied to the inhibited muscles.

To address gait patterns with the passive or sleeping client, work opposite arms and legs in sequence as follows:

1. Left biceps with left quadriceps and right hamstring
2. Left triceps with left hamstring and right quadriceps
3. Right biceps with right quadriceps and left hamstring
4. Right triceps with right hamstring and left quadriceps
5. Left wrist and finger flexors with left foot dorsiflexors and evertors and right plantar flexors and invertors
6. Left wrist and finger extensors with left foot plantar flexors and invertors and right foot dorsiflexors and evertors
7. Right wrist and finger flexors with right foot dorsiflexors and evertors and left plantar flexors and invertors
8. Right wrist and finger extensors with right foot plantar flexors and invertors and left foot dorsiflexors and evertors
9. Left hand with right foot
10. Right hand with left foot

Joint play is restored by applying traction to the joint and moving it passively within the normal range of motion.

Passive application is usually less effective than active participation of the client, but benefits still are achieved when sleep is also an important goal. Indirect functional techniques become a primary treatment method. Passive application of the ease/bind tissue movement method replaces more invasive connective tissue methods and trigger point application. Pay attention to the sleep cycle, which naturally fluctuates about every 45 minutes, and time the massage to end about when the client would begin to wake up.

DRAPING, CLOTHING, HAIR, AND ENVIRONMENT CONSIDERATIONS

Objective

2. Alter massage application to adjust to unique draping concerns, hairstyles, and clothing.

Ideal draping procedures are presented thoroughly in *Mosby's Fundamentals of Therapeutic Massage,* and certainly the skilled massage practitioner has been able to incorporate effective modifications based on need. The athlete does present some draping challenges that can go a bit contrary to typical draping recommendations.

The reasons for draping are to respect the boundaries and modesty of the client, and to provide warmth. Many athletes are hypersensitive to skin stimulation and find the drape irritating. They can wear loose shorts and/or a tee shirt instead. Other athletes cannot stand to feel wrapped up, so a very loose draping style is necessary. Athlete clients seem to be hot or cold and usually end up cold before the massage is over. It is common for athletes to not want a drape to start and to prefer to wear some sort of loose shorts, and by the end of the massage to be buried in sheets and blankets. Make sure you have extra draping materials and blankets available. Continually monitor skin temperature and add draping as needed to keep the client warm. This is especially important if the client is fatigued and tends to fall asleep during the massage.

Typically, each area to be massaged is undraped, worked with, and then re-draped. However, with a cold client, it may become necessary to work under the drapes. Pay attention to where your hands and forearms are, and if by mistake you touch the genital or breast area, acknowledge it and apologize.

Athletes commonly are very modest and not only want precise draping but also wear restrictive undergarments. Most common are sports bras, compression shorts, and athletic supporters. Many athletes leave their socks on because they have athlete's foot, their feet get cold, or they think they have weird feet. Some athletes wear elastic-type hats that protect or control their hair, and others just want to leave their hats on. Massage needs to be altered to work through these garments, and the massage therapist needs to understand that the client derives some sort of benefit from wearing these clothing items.

Just as common are athletes who are not modest because of ongoing focus on their body or even the type of sport (e.g., bodybuilding) for which they regularly display their body. This usually manifests as disrobing while the massage practitioner is in the area, or showing the massage therapist the location of some area that the athlete wants addressed during the massage. The massage therapist should not interpret this as sexual and should maintain a matter-of-fact, anatomy-is-just-anatomy approach. Because groin injury is common, the massage professional needs to become comfortable with working in this area.

During work with male clients, the genitals can get in the way of accessing the area that needs treatment. Use the drape to move tissue around, or ask the client to reposition the genitals. Male clients often get partial erections while receiving massage because of the increase in circulation and the parasympathetic response. Young athletes are more susceptible and are more embarrassed by this physiologic response. The drape moving in the area can stimulate the erection response, as can working in the groin, buttock, and low back area. Athletes often sleep during massage, and it is common for an erection to occur. Do not use a draping method that would increase awareness of this response and increase the embarrassment of the athlete. This is one of the reasons why male athletes wear athletic supporters and compression shorts during massage.

Keep the drapes loose in the genital area, and use an extra towel over the groin if necessary. Be prepared to discuss this issue in a matter-of-fact and physiologic way. If the massage therapist is embarrassed as well, the situation is even more difficult for the client. One of the reasons that young male athletes prefer middle-aged (40 years and older) female massage therapists is that they are most comfortable with these types of physiologic responses with the "mother-aged" person. The author's experience is that young male athletes tend to avoid younger female and male massage practitioners because of concerns about and misinterpretation of this natural body function.

The buttock area needs effective massage for all clients, but anyone who runs or jumps will especially require effective work in this area. Being comfortable working in this area is absolutely necessary for the massage therapist.

During work with female athletes, the breasts are literally in the way of accessing the anterior thorax. Because this is such an important area, especially for supporting effective breathing, the massage therapist needs to be comfortable working in this area, both with positioning the client and with moving the breast tissue so that it is out of the way. Do not use the hands to move breast tissue. Use the sheet or forearm. No therapeutic reason exists to massage the actual breast tissue if it is normal.

Because athletes drink a lot of fluid, they may have to urinate frequently. They may be embarrassed to ask to use the restroom. The massage therapist should ask whether the client needs to use the restroom at least halfway through the massage. A good time is when changing positions. It is impossible to relax with a full bladder.

Athletes also consume food and supplements that produce intestinal gas. The sports massage professional cannot react adversely if the client passes gas during the massage. High-protein and soy-based sport drinks can make the gas particularly odoriferous (smell strong), so if a person finds intestinal gas especially disgusting, he or she may have difficulty with this population.

IN MY EXPERIENCE

I cannot resist telling the following story. One of the athletic clients with whom I work has a precocious young daughter. At the time this event occurred, she was about 6 years old. She was in the massage area with me, helping me set up. She asked me if her daddy passed gas when he got a massage (her term was "make fluffies"). I asked her why she thought this might be so, and she said, "My daddy passes gas when he is asleep. He sleeps when he gets a massage, so he must pass gas when he gets a massage." How can you argue with this logic? Every time I think of this conversation, I smile. I could not resist disclosing this conversation to my client. We both got a good laugh. A while later, he asked me if he did indeed pass gas when he got a massage. My answer was, "Who doesn't? I am gas tolerant."

Athletes sweat, and although the author's personal experience is that most athletes are meticulous about hygiene, the massage therapist at times may have to work with perspiring clients. Keep a towel available to dry the skin.

Perspiration may create a body odor. This is just part of the process, and the massage therapist cannot be disturbed by these types of normal body odors.

Athletes shower and bathe a lot. In addition, they often soak in hot and/or cold tubs and use saunas. Constant exposure to soap, water, and chlorine dries the skin, and more lubricant may be needed during the massage than with the general population. Use only hypoallergenic lubricants. An athlete who has to compete with a skin rash from a reaction to lubricant will not be pleased.

Many athletes shave their heads, keep their hair short, or braid it. The various braid designs can be intricate and expensive, so it is not appropriate to mess them up during massage. Use compression instead of kneading, and remove lubricant from your hands before working in the hair. Shaved heads present unique challenges. Massage only with the grain of the hair. Do not go in a direction where you feel stubble because this will irritate the area. This recommendation also applies to shaved bodies.

Most athletes are of normal size, but some are large and do not fit on standard massage tables comfortably. They usually are most comfortable on a mat. I have used duct tape to connect two massage tables together to make the surface wide enough. If tall (e.g., basketball players), the athletes hang off the ends of the massage table. They often need some sort of support for their arms, and although some massage tables are equipped with armrests, unless the armrests are adjustable, they are not in the right position. Large, round exercise balls work well when placed at the end of the table. A short stool, chair, or ottoman can work. Usually, large and tall athletes will not fit comfortably in massage chairs.

Large athletes need large bolsters. The bolsters that come with most massage tables are too small. Some creative solutions are rolled exercise mats, two king-size pillows taped together, rolled blankets, and sofa cushions.

Various environmental distractions can occur: massage in a public environment, the client talking on the phone, text messaging, listening to music with or without headphones, fellow athletes, or family members in the area. The massage therapist needs to remain focused and flexible.

Many athletes watch television or movies while getting a massage. The massage therapist can adapt to allow them to be able to see the screen. Position the massage table or mat on a diagonal, where the television screen is visible. When prone, the client should be able to turn his or her head to see the television. Then turn the lies on the side so the client is facing the screen. When it is time to massage the other side completely, have the client switch ends of the table, so his or her head is where the feet were. When the client lies on the other side to be massaged, the client still will be facing the television. When in the supine position, the client again can turn the head slightly to see the screen.

When one is working with athletes, massage commonly is provided in locations other than the typical private massage office. Instead, massage may be given in the locker room, the playing field, or whatever corner is available. If athletes can afford it, they often want massage in their home, which presents all the challenges of an on-site massage, that is, privacy; distractions; attention to confidentiality; discretion; arriving, setting up, and leaving efficiently; and many other situations. Hotel rooms are cramped, so if the athlete is traveling, it may be difficult to find enough room for the massage table. In these situations, you just have to do the best you can and have a sense of humor.

SCHEDULING

Objective

3. Provide massage in various environments and in the context of typical sports schedules.

The athlete's schedule can present unique challenges. Often massage appointments are early in the morning or late at night. Depending on the type of sport, scheduling of massage sessions at the same time consistently may not be possible. On occasion, the massage therapist may have to travel with the athlete. If this population is the massage therapist's main focus, specific scheduling times will be difficult, for example, most of the football players with whom I have worked want a massage on Tuesday night at 8 PM or 9 PM in their home. Tuesday is the typical day off, and they want to get the children in bed before the massage. Other popular times are Friday night after 9 PM to be ready before the final game practice, or on Saturday or Monday morning early before practice. Football players will settle for late evening appointments on the other nights, but this is not their preference. Given this information, it is impossible for one massage therapist to see more than six to eight football players as clients during the season.

Basketball, baseball, soccer, and hockey are even worse for scheduling because the game schedule changes days, times, and frequency. For example, basketball players and baseball players can play two games in a row, have 3 days off, play an afternoon game, and 2 days later play a night game. They will schedule a massage when they can, which is often at the last minute.

Individual athletes such as tennis players, golfers, and bowlers may have a bit more control of their schedules, but availability is dictated by when events occur. Even if the massage professional is employed by an athletic organization, meetings and practice schedules make scheduling difficult.

Because of these scheduling issues, working with a large population of athletic clients on a schedule of 9 to 5, 5 days a week, is difficult. The most difficult scheduling demands are with the professional athlete, and the least with the client pursuing fitness or involved in physical rehabilitation. The massage therapist needs to consider these issues carefully when targeting this population. A life with a standard routine usually is not possible. Difficult scheduling issues may prohibit a massage therapist from working with professional athletes. They cannot easily alter their schedule and often request on-site massage at odd hours. Working for a fitness or rehabilitation center provides the most stable scheduling options. If your career goals target professional athletes, be prepared for an erratic schedule.

HABITUAL BEHAVIOR

Objective

4. Adjust massage to respect habitual behavior.

Many athletes are highly disciplined and have habitual behaviors. Keeping the internal and external daily sequence of events predictable is important, even with the erratic schedules previously described. The athlete responds best to familiarity. This manifests as the same general massage sequence, the same location if possible, the same draping materials and blankets, the same uniform worn by the massage therapist, and the same lubricant. The massage therapist must honor this.

Because of this habitual/ritual behavior, referring the athletic client to a different massage therapist is difficult. If athletes are happy with a massage therapist's work, they commonly will be unwilling for anyone else to work with them. This can place demands on the massage therapist.

IN MY EXPERIENCE

While working with a professional athlete during the playoffs toward a world championship, my life revolved around his schedule until the team finally won. He was just not in a position at this critical juncture to adapt to another massage therapist's style. Remember that even though this particular athlete is considered a world-class champion, the person recovering from a hip replacement is no less stressed and vulnerable, and needs to be supported by familiarity.

HYDROTHERAPY

5. Use simple and safe application of adjunct therapies to support the massage outcome.

Hydrotherapy is a separate and distinct form of therapy that combines well with massage. Water is a near-perfect natural body balancer and is necessary for life. It accounts for the largest percentage of our body weight.

The effects of water are primarily reflexive and are focused on the autonomic nervous system. The addition of heat energy or dissipation of heat energy from tissues can be classified as a mechanical effect. In general, cold stimulates sympathetic responses, and warmth activates parasympathetic responses. Short- and long-term applications of hot or cold differ in effect. For the most part, short cold applications stimulate and vasoconstrict, with a secondary effect of increased circulation as blood is channeled to the area to warm it. Long cold applications depress and decrease circulation. Short applications of heat vasodilate vessels and depress and deplete tone, whereas long heat applications result in a combined depressant and stimulant reaction.

Different water pressures can exert powerful mechanical effects on the nerve and blood supply of the skin. Techniques that are used include a friction rub with a sponge or wet mitten and pressurized streams of hot and cold water directed at various parts of the body (Box 14-1).

In organized sports and physical therapy, the athletic trainer or physical therapist applies hydrotherapy (usually ice). To support hydrotherapy treatment, do not massage an area that has been iced. Let the body restore circulation to the area to warm it.

Hot and cold contrast hydrotherapy is effective in supporting fluid movement. Cold is most effective for just about everything, and ice application is part of acute care in the PRICE system (protection, relative rest, ice, compression, elevation). When in doubt, put ice on it. Real ice is safer than chemical ice packs. Immersion of an area in ice water is especially effective for injuries such as sprains and strains. Heat is better for palliative effect and as a surface relaxer. If injury is not present, a general rule can be to ice joints and heat muscles. Heat may be best before competition and ice afterward. Warm applications, such as rice or seed bags, which go in the microwave, are pleasant during the massage, especially on the feet.

ESSENTIAL OILS

5. Use simple and safe application of adjunct therapies to support the massage outcome.

Essential oils are the highly concentrated oils of aromatic plants.

Aromatherapy is the art of using these oils to promote healing of the body and the mind and combines well with massage. Log on to the Evolve website that accompanies this book to learn more about the essential oils used in massage.

The oils are found in different parts of the plant such as the flowers, twigs, leaves, and bark, or in the rind of fruit. Because of the large quantity of plant material required, pure essential oils are expensive, but they are also highly effective—only a few drops at a time is required to achieve the desired effect. Essential oils are chemicals that interact with the body physiology. Although in general their influences are subtle, the massage therapist needs to take care when using them. Specific therapeutic treatment should be provided only by a qualified aromatherapist.

Most essential oils are volatile (they quickly evaporate), and the molecules are passed readily into the bloodstream.

Essential oils have an immediate impact on the sense of smell. When essential oils are inhaled, olfactory receptor cells are stimulated; then the hypothalamus is stimulated, and the impulse is transmitted to the emotional center of the brain, or limbic system. Recent research has determined that the hypothalamus has neurotransmitter and neuroendocrine activity. The hormones found there are being traced to find out where they go in the body and what effects they have.

The limbic system is connected to areas of the brain linked to memory, breathing, and blood circulation, as well as to the endocrine glands, which regulate hormone levels in the body. The properties of each oil—its fragrance and its effects—determine stimulation of these systems.

BOX 14-1 Effects of Hydrotherapy Using Heat, Cold, and Ice Applications

EFFECTS OF HEAT
- Increases circulation
- Increases metabolism
- Increases inflammation
- Increases respiration
- Increases perspiration
- Decreases pain
- Decreases muscle spasm
- Decreases tissue stiffness
- Decreases white blood cell production

APPLICATIONS OF HEAT HYDROTHERAPY
As a Sedative:
Water is a very efficient, nontoxic, calming substance. It soothes the body and promotes sleep.

Techniques: Use hot and warm baths to quiet and relax the entire body. Salt baths, neutral showers, or damp sheet packs can be used to relax certain areas.

For Elimination:
The skin is the largest organ of the body, and simple immersion in a long, hot bath or a session in a sauna or steam room can stimulate excretion of toxins through the skin. Inducing perspiration is useful for treating acute diseases and many chronic health problems.

Techniques: Use hot baths, Epsom salt or common salt baths, hot packs, dry blanket packs, and hot herbal drinks.

As an Antispasmodic:
Water effectively reduces cramps and muscle spasm.

Techniques: Use hot compresses (depending on the problem), herbal teas, and abdominal compresses.

EFFECTS OF COLD AND ICE
Cold
- Increases stimulation
- Increases muscle tone
- Increases tissue stiffness
- Increases white blood cell production
- Increases red blood cell production
- Decreases circulation (primary effect); increases circulation (secondary effect)
- Decreases inflammation
- Decreases pain
- Decreases respiration
- Decreases digestive processes

Ice
- Increases tissue stiffness
- Decreases circulation
- Decreases metabolism
- Decreases inflammation
- Decreases pain
- Decreases muscle spasm

Types of Applications
- Ice packs
- Ice immersion (ice water)
- Ice massage
- Cold whirlpool
- Chemical cold packs
- Cold gel packs (use with caution)

CONTRAINDICATIONS TO USE OF ICE
- Vasospastic disease (spasm of blood vessels)
- Cold hypersensitivity; signs include:
  - Skin: Itching, sweating
  - Respiratory: Hoarseness, sneezing, chest pain
  - Gastrointestinal: Abdominal pain, diarrhea, vomiting
  - Eyes: Puffy eyelids
  - General: Headache, discomfort, uneasiness
- Cardiac disorder
- Compromised local circulation

PRECAUTIONS FOR USE OF ICE
- Do not use frozen gel packs directly on the skin.
- Do not use ice applications (cryotherapy) for longer than 30 minutes continuously.
- Do not do exercises that cause pain after cold application.
- Do not use cryotherapy on individuals with certain rheumatoid conditions or on those who are paralyzed or have coronary artery disease.

APPLICATIONS OF COLD HYDROTHERAPY
Ice is a primary therapy for strains, sprains, contusions, hematomas, and fractures. It has a numbing, anesthetic effect and helps control internal hemorrhaging by reducing circulation to and metabolic processes within the area.

For Restoring and Increasing Muscle Strength and Increasing the Body's Resistance to Disease:
Cold water boosts vigor, adds energy and tone, and aids in digestion.

Techniques: Use cold water treading (standing or walking in cold water), whirlpool baths, cold sprays, alternate hot and cold contrast baths, showers and compresses, salt rubs, apple cider vinegar baths, and partial packs.

For Injuries:
The application of an ice pack controls the flow of blood and reduces tissue swelling.

Technique: Use an ice bag or pack in addition to compression and elevation.

As an Anesthetic:
Water can dull the sense of pain or sensation.

Technique: Use ice to chill the tissue.

For Minor Burns:
Water, particularly cold and ice water, has been rediscovered as a primary healing agent.

Technique: Use ice water immersion or saline water immersion.

To Reduce Fever:
Water is nature's best cooling agent. Unlike medications, which usually only diminish internal heat, water both lowers temperature and removes heat by conduction.

Technique: Use ice bags at the base of the neck and on the forehead and feet; cold water sponge baths; and drinking of cold water.

From Fritz S: *Mosby's fundamentals of therapeutic massage*, ed 4, St Louis, 2013, Mosby.

IN MY EXPERIENCE

Essential Oils

People in general seem to enjoy pure essential oils as part of the massage. I typically carry around a mood mix, "happy oil," a sleepy mix (sedative), an antiinflammatory analgesic mix (ouchy oil), an upper respiratory mix (snotty nose oil), and energizing stimulatory (energizer oil). These various mixes basically are made using the suggestions provided in this chapter. The funny names are easy to remember. These oil mixes are like the "big squash" massage for general all-over recovery, and like the "squeeze the sponge" massage for fluid retention. Anyway, because I work with a lot of football players, I am careful to make sure that essential oil mix does not smell like grandma's perfume. I usually do this by adding some sort of fir (pine, cypress, or juniper) to the mix. One of my favorite happy oil mixes consists of lavender, orange, and rose. This mix is calming and mood regulating.

It was on Monday after a particularly bad performance in the football game on Sunday. Needless to say, the coaches were not pleased. The players were scheduled for massage Monday morning, and then after lunch, there was going to be an important team meeting. When the players asked for essential oil, I pulled out the lavender, orange, and rose mix, and just about every player wanted some on him. After a while, I realized that I had not softened the flowering scent. I had left out the fir. Off went most of the football team to this big meeting, smelling like grandma's perfume. From what I heard later, the meeting did not go as anticipated. The coaches for some reason could not seem to maintain a stern demeanor. I later confessed to the essential oil intervention, and the coach looked at me and said, "So that is what I was smelling." We had a good laugh about it. As I remember this event, I now wonder if I forgot the fir on purpose. Oh well, it all worked out fine.

Active chemicals in the oil also are absorbed directly by the mucous membranes in the nose.

When used in massage, essential oils not only are inhaled but also are absorbed through the skin. They penetrate the skin and find their way into the bloodstream, where they are transported to the organs and systems of the body.

Essential oils have differing rates of absorption—generally between 20 minutes and 2 hours—so it is probably best not to bathe or shower directly after essential oil use to ensure maximum effectiveness.

Simply think of these properties of the oils: antibacterial, antiviral or antifungal, antiinflammatory, effect on body fluids, analgesic (reduce pain), and stimulant or sedative.

For example:

- If a client has just increased training intensity and has delayed-onset muscle soreness, which represents a combination of inflammation and fluid retention, use German chamomile and juniper berry.
- If a client has a bruise, use helichrysum.
- If a client is fatigued but is having trouble sleeping, use balsam fir and lavender.
- If a client is getting a cold, use eucalyptus, tea tree, and thyme.
- If a client feels achy and stiff, use black pepper and lemongrass.
- If a client has a mild ankle sprain, use helichrysum, German chamomile, and rosemary. If a client has joint aching such as arthritis, use eucalyptus, lemongrass, and peppermint.
- If a client has a headache, use peppermint and lavender.

The list goes on and on. If you do not know what to use, have the client smell the oils, pick two or three that he or she really likes, and mix them together. The massage therapist will find it interesting to do this and then compare the properties of the chosen oils with the client's symptoms and outcome goals.

The following list of essential oils has focused benefits for the athlete. They are reasonably safe when used in small quantities and mixed in carrier oil. Good carrier oils for athletes include high-quality olive oil and almond oil.

The essential oil also can be mixed into melted food-grade coconut oil. When the coconut oil resolidifies, the result is like an ointment. Typically, 10 drops of essential oil in an ounce of carrier oil is all that is necessary. It is best to blend no more than three essential oils together. Do not have a total of more than 15 drops of essential oil per ounce of carrier oil. Target the essential oil to the goals of the massage. The client can use the mixed oil as a self-help measure. When in doubt about skin sensitivity, use the oil mixture on the bottoms of the feet.

An ounce of mixed oil will last a while because only a small amount is used at a time. When purchasing essential oils, buy only pure, high-quality, therapeutic-grade essential oils, and only from well-known suppliers.

Essential oils recommended include the following:

- **Balsam fir**: It has a fresh balsamic odor.
  Uses: To relieve muscle aches and pains; relieve anxiety and stress-related conditions; fight colds, flu, and infection; and relieve bronchitis and coughs.
- **Black pepper**: It has a warm, peppery aroma.
  Uses: To energize; increase circulation; warm and relieve muscle aches and stiffness; and fight colds, flu, and infections. Use with care. Only a small amount, 3 to 5 drops, in an ounce of carrier oil is required.
- **Chamomile, German**: It has a strong, sweet, and warm herbaceous aroma and is blue. German chamomile has many of the same properties as Roman chamomile, with much higher azulene content, so its antiinflammatory actions are greater.
  Uses: To relieve muscular pain; for healing of skin inflammation, acne, and wounds; as a sedative, to ease anxiety and nervous tension and help with sleeplessness. German chamomile should be avoided during early pregnancy and may cause skin reactions

in some persons. Before using, do a small test on a small area of skin, such as the medial ankle.

- **Eucalyptus**: It has a strong camphorous odor.
  Uses: For colds; as a decongestant, to relieve asthma and fevers; for its bactericidal and antiviral actions; and to ease aching joints. Avoid if you or your client has high blood pressure or epilepsy.
- **Geranium**: It has a leafy rose scent.
  Uses: To reduce stress and tension; ease pain; balance emotions and hormones; relieve premenstrual syndrome; relieve fatigue and nervous exhaustion; lift depression; and lessen fluid retention.
- **Helichrysum**: It has an intense, honey, tea-like aroma.
  Uses: To heal bruises (internal and external), wounds, and scars; detoxify the body, cleanse the blood, and increase lymphatic drainage; heal colds, flu, sinusitis, and bronchitis; and relieve melancholy, migraines, stress, and tension.
- **Juniper berry**: It has a fresh pine needle aroma.
  Uses: To energize and relieve exhaustion; ease inflammation and spasms; improve mental clarity and memory; purify the body; lessen fluid retention; and disinfect. Juniper berry should be avoided during pregnancy, or if the client has kidney disease.
- **Lavender**: It has a sweet, fresh scent.
  Uses: To balance emotions; relieve stress, tension, and headache; promote restful sleep; heal the skin; lower high blood pressure; help breathing; and disinfect.
- **Lemongrass**: It has a powerful, lemon-grass aroma.
  Uses: To relieve athlete's foot; tone tissue; relieve muscular pain (sports-muscle pain); increase circulation; and relieve headaches, nervous exhaustion, and other stress-related problems. Use with care, using only a small amount if necessary: 3 to 5 drops per ounce of carrier oil. Avoid in pregnancy.
- **Peppermint**: It has a sweet, mint aroma.
  Uses: To boost energy; brighten mood; reduce pain; help breathing; and improve mental clarity and memory. Peppermint may irritate sensitive skin, so do a skin test. Avoid during pregnancy.
- **Pine**: It has a strong, coniferous, woody aroma.
  Uses: To ease breathing, as an immune system stimulant, to increase energy, and for relieving muscle and joint ache.
- **Rosemary**: It has a camphor-like aroma.
  Uses: To energize; relieve muscle pains, cramps, or sprains; brighten mood and improve mental clarity and memory; ease pain; relieve headaches; and disinfect. Avoid during pregnancy, if the athlete is epileptic, or if the client or massage therapist has high blood pressure.
- **Tea tree**: It has a spicy, medicinal aroma. Tea tree oil is one of the most scientifically researched oils.
  Uses: An immunostimulant, particularly against bacteria, viruses, and fungi; relieves inflammation; and disinfects.
- **Thyme**: It has a sweet, intense herb-medicinal odor.
  Uses: To inhibit infectious diseases; treat colds and bronchitis; relieve muscle aches and pains; aid concentration and memory; and relieve fatigue.

Caution: Not all essential oils are safe:

- Oils that *are not suitable for use* include, but are not restricted to, cinnamon, clove, hyssop, and sage.
- Oils that *should not be used during pregnancy* include, but are not restricted to, basil, clove, cinnamon, fennel, hyssop, juniper, lemongrass, marjoram, myrrh, peppermint, rosemary, sage, and white thyme.
- Oils that *should not be used with steam* include, but are not restricted to, bay, clary sage, ginger, juniper, pine, and tea tree.
- Oils that are *photosynthesizing* include, but are not restricted to, lemon, bergamot, lime, and orange. Do not go out into the sun for at least 2 hours after applying these oils to your skin.

The cautions listed pertain to client and therapist because oils are absorbed not only through the skin but also through the olfactory bulb and hypothalamus. If you are using multiple oils during massage work, it is advisable to ground and center yourself before using the oils and afterward. Otherwise, aromatic effects can distort your thinking, judgment, and sensations as a therapist.

VIBRATION METHODS

5. Use simple and safe application of adjunct therapies to support the massage outcome.

Vibration methods are based on the frequency of the vibration on the body. Many therapeutic methods are included in this aspect of treatment, including sound, color, and light. Two safe and appropriate methods are a Bach flower remedy and homeopathy.

RESCUE REMEDY

Rescue Remedy is a Bach flower remedy that is specific for trauma. Why this remedy is appropriate for athletes is obvious. Rescue Remedy consists of a premixed flower essence combination that can be applied as a first aid measure in emergencies of all kinds. The solution consists of the following flower essences:

- Star of Bethlehem for shock
- Rock rose for acute fear and panic
- Impatiens for inner tension and stress
- Cherry plum for fear of breaking down and despair
- Clematis for the feeling of being "not completely here"

Rescue remedy is appropriate when a situation appears threatening to the individual or indeed might be life-threatening. The theory is that a state of shock paralyzes the energetic system; the conscious mind has the tendency to withdraw itself from the body or, in extreme cases, even to leave it. In such cases, the body is left completely on its own and therefore is unable to activate self-healing energy. Rescue remedy is said to remove the energetic block quickly, enabling the regulatory system of the body to initiate the measures necessary for emergencies.

Because rescue remedy is an energetic interaction that is being held in the water molecules, it is safe. One to 4 drops in a glass of water or water bottle cannot hurt and may help. If the person does not want to take the remedy internally, the remedy can be rubbed on the skin.

HOMEOPATHIC REMEDIES

Homeopathic remedies are usually obtained in the form of small pellets (which are sweet-tasting and dissolve easily), liquids, or tablets. They are prepared from pure, natural substances (animal, vegetable, or mineral) that are listed in the *Homeopathic Pharmacopeia of the United States.*

Homeopathic remedies are prepared by obtaining the source in its most concentrated form and then, through a long process of dilution, preparing a remedy with potency sufficient to effect a physiologic change through vibrational or energetic means. Potency describes the measure of the dilution of the remedy and is denoted by the number that follows the name of the medicine itself. The higher the number, the greater the dilution (up to 1 part remedy to 1 trillion parts diluent) and the stronger the effect.

Because of the minute doses used in homeopathic remedies, they are safe and nonaddictive and have no unwanted side effects.

These remedies cannot harm the client and may have the potential for benefit. The remedy may do nothing, but it also may help. These remedies are especially useful in acute stages of injury and before and after surgery. Combined homeopathic remedies also are available for specific sport-related conditions and can be helpful. They can be found at health food stores for about $5 to $10 a bottle. Homeopathy for specific conditions is a complex discipline, and referral to a qualified professional is necessary.

Arnica Montana

Arnica montana is a natural homeopathic remedy that athletes frequently take in oral pellet form to help reduce bruising and swelling. Grown in mountain regions, this homeopathic herb is said to help reduce bruising and swelling, promote healing, and lessen postoperative pain and discomfort.

Arnica montana also may aid in the prevention of bruising and muscular fatigue.

Ruta graveolens is a homeopathic remedy for trauma to the ligaments and for stiffness and bruising to the limbs and joints.

MAGNETS

In general, magnets seem to help manage pain, especially acute pain. Magnets also may support tissue healing. The effects may just be placebo effects. If appropriate cautions are followed, magnets are safe and noninvasive. The following information is presented to help the massage therapist educate the client.

No research indicates that expensive specialty magnets work any better than inexpensive ones. Just do not drop magnets; this can demagnetize them. The application is similar to ice or heat: about 20 minutes 2 or 3 times a day, or the magnets can be strapped, taped, or wrapped on the body for extended use.

Magnet power is measured in terms of **gauss**, the line of force per unit area of the pole. The gauss rating of a magnet determines the speed with which it works, and the thickness determines the depth of penetration. The surface of the earth is approximately 0.5 gauss. Many manufacturers rate their products using internal gauss and external gauss to indicate strength. The following list shows typical magnetic strength classifications:

Low gauss = 300 to 700 gauss
Medium gauss = 1000 to 2500 gauss
High gauss = 3000 to 6000 gauss
Super gauss = 7000 to 12,000 gauss

Surface gauss rating also refers to the external strength of the magnet.

Gauss depends on the size, shape, polarity, and grade of the magnetic material. Some experts in magnet therapy begin treatment at low gauss and gradually increase strength as necessary. Some companies list their products by internal gauss, and others use the external gauss rating. A quick rule of thumb in determining proper gauss strength is to take the external gauss rating, with 800 gauss being appropriate. To get the internal gauss, multiply this number by 3.9 (approximate). Magnets at 800 gauss external strength can be considered to have 3120 gauss internal rating (approximate). Do not be misled into believing you are getting a higher-strength product; both are correct ratings for the same magnet.

About as many types of magnets are available as there are body parts. Magnetic mattresses and pads are designed to be slept on; magnetic insoles fit inside shoes; block magnets can be placed under mattresses, pillows, or seat cushions; and back supports are available with slots for magnet insertion.

Other magnets are made as body wraps with Velcro closures, jewelry, and magnetic foil.

Most magnets are made of ferrites, which are iron oxides combined with cobalt, nickel, barium, and other metals to make a ceramic-like material. The flexible types of magnets are combined with plastic, rubber, or other pliable materials. The strongest magnets are those made from neodymium (a rare earth element).

Claims of therapeutic effects of magnets still should be regarded with considerable skepticism. Most of the testimonials to the effectiveness of magnetic therapy devices can be attributed to placebo effects and to other effects accompanying their use. For example, magnetic back braces may help ease back pain by providing mechanical support, through warming, and by issuing a constant reminder to not overexert the muscles. All these effects are helpful with or without magnets.

Most valid research does not support benefits from magnet use. One highly publicized exception is a double-blind study done at Baylor College of Medicine, which compared the effects of magnets and sham magnets on the knee pain of 50 postpolio patients. The experimental group reported a significantly greater reduction in pain than was seen in the control group. No replication of the study has been done. However, the results of the Baylor study raise the possibility that at least in some cases, topical application of magnets may be useful in pain relief.

Although controversial and not scientifically proven, theories suggest that magnets do not heal but rather stimulate the body to heal naturally.

An important aspect of magnet use is magnet polarity. This relates to the direction in which the magnet is placed. The **north pole** corresponds to yin, or negative polarity. The **south pole** corresponds to yang, or positive polarity. Box 14-2 shows the magnetic influences of the south and north poles by example.

If the body appears to lack positive and negative energies to heal, two magnets can be used to apply the north and south poles (known as bipolar) simultaneously. Bipolar magnet therapy may be used to heal fractures or to treat chronic pain. Unipolar magnets are available on the market, and which pole is used is not a factor. These magnets tend to be more expensive. When in doubt, use the north pole of the magnet.

As with any treatment, there are cautionary measures to follow. Magnets should not be used during pregnancy, in patients with a history of epilepsy, in those taking blood-thinning medications, on bleeding wounds, or when internal bleeding is occurring. Magnets should never be used on a client with a pacemaker or who has metal implants that could be dislodged by magnet use. Many athletes have had broken bones that are pinned or screwed together. Do not use the magnet on these areas.

From an ethical standpoint, it is probably not the best professional practice to sell these products to clients. Too much potential exists for conflict and dual roles. The products are obtained easily, and the client can find and purchase them easily on his or her own.

Essential oils can be mixed and given to the client as self-help. I strongly suggest that the oils not be "sold" to the client but instead be included as part of therapeutic massage applications.

BOX 14-2 Magnetic Influences of the South and North Poles

North Pole	South Pole
Characteristics: sedation, cooling	Characteristics: stimulation, heating
Negative: yin	Positive: yang
Acute headaches	Fibrosis
Arthritis	Numbness
Bursitis	Paralysis
Fractures	Scars
Inflammation	Tingling
Low back pain	Weak muscles
Sharp pain	
Tendonitis	

FIGURE 14-1 Taping procedures: arch taping. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

THERAPEUTIC TAPING

5. Use simple and safe application of adjunct therapies to support the massage outcome.

Therapeutic taping is the use of adhesive products to protect and rehabilitate. Similar methods are bandaging, strapping, and bracing. Two basic types of tape and taping methods may be used:
- Rigid tape and taping methods
- Elastic tape and taping methods

Rigid tape does not stretch. White athletic tape is an example of rigid tape. It is used to stabilize and protect injured areas, provide stability for unstable joints, and provide protection to prevent injury. The main function is to limit motion. Various taping patterns are used during application of the tape. Typically, an athletic trainer applies rigid tape. The effects can be summarized as a bracing technique that can also be used for neuromuscular reeducation.

Elastic tape can stretch, and this mobility is thought to be responsible for its therapeutic value. Movement of the tape affects activation of the neurologic system, the circulatory system, and the lymphatic system. Chapter 3 presented research on elastic taping procedures, commonly called *kinesiology taping*. Various types and styles of tape share common characteristics, which involve placing the tape on the skin in a variety of patterns, and cutting and shaping the tape to wrap and form around the target area. Principles of direct and indirect tissue movement can be used during taping (see Chapter 13). Tissue can be moved into the ease position or the bind position during taping. The elastic component allows tissue movement but supports a drag on the skin. Various training programs are available to teach methods of using elastic tape. DVDs and books also can explain how to apply the tape and various patterns of application.

Elastic taping methods present low risk for adverse effects, mostly related to skin reaction to the product. These products are relatively inexpensive and can be purchased from multiple locations. The massage therapist who plans to include this adjunct method into the massage practice should obtain appropriate certification from an approved provider (Figure 14-1).

SUMMARY

A conditioned response occurs with repetitive behavior and familiarity. The response is comfortable, safe, and reassuring. All the unique circumstances that arise when the massage therapist is working with the sport population cannot be described. I personally could tell stories for a long time and still laugh, cry, and marvel over the process. If you are reading this text, at some level you are considering working with this population. As was previously discussed, your massage therapy skills, professional behavior, and internal and external coping skills need to be excellent.

I hope this chapter, combined with Chapter 1, reinforces realistic expectations for a career path in this area.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1 Develop a strategy for addressing each of the following:
   a. A large client who wants to watch television during the massage. The client typically falls asleep.
   b. A client who wants the massage therapist to work with her while training at the gym.
   c. The client is a race horse.
   d. The client has a headache, has an expensive hair design with braids, and is cold; no massage table is available.
   e. The only time the client has available is 10 PM at her home, with no babysitter, and she is breastfeeding.
   f. The client follows a strict training schedule and wants massage to fit into the schedule.

2 Develop an appropriate essential oil treatment for each of the following:
   a. Fatigue
   b. Anxiety over competition
   c. Inability to concentrate on paperwork
   d. Headache and upset stomach
   e. Grade 1 ankle sprain

3 Describe a situation in which you might use or recommend each of the following:
   a. Cold hydrotherapy
   b. Warm hydrotherapy
   c. Hot and cold contrast hydrotherapy
   d. Epsom salt soak
   e. Aromatherapy
   f. Rescue Remedy
   g. *Arnica*
   h. *Ruta graveolens*
   i. North pole magnet
   j. South pole magnet
   k. Elastic tape

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UNIT THREE

Sport Injury

CHAPTER

15 Injury in General

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1. List the common causes of physical activity injuries.
2. List injury prevention strategies.
3. Define trauma.
4. List the three healing phases.
5. Describe acute and chronic inflammation and relate the inflammation process to the three stages of healing.
6. Define illness.
7. Estimate general healing time for various injuries and illnesses.
8. Perform PRICE application.
9. Create effective strategies for massage application for acute, subacute, and remodeling phases of healing to support the recovery process.

KEY TERMS

Acute Reinjury of a Chronic Condition
Aging
Backward-Tilting (Posterior) Pelvis
Breathing
Cardiorespiratory Fitness
Cervical Lordosis
Chronic Inflammation
Chronic or Overuse Trauma
Comparative Weakness
Complete Rupture
Compression
Cool-down
Direct Trauma
Elevation
Fatigue
Forward-Tilting (Anterior) Pelvis
Ice
Illness
Inappropriate Training
Indirect Trauma
Joint Pain
Kyphosis
Lifestyle
Linear Region
Lumbar Lordosis
Major Failure Region
Microfailure
Muscle Weakness
Neuromuscular Control/Proprioception/Kinesthesis
Numbness and Tingling
Pathomechanics
Postural Deviations
PRICE Therapy
Progressive Failure Region
Progressive Relaxation
Protection
Reduced Range of Motion
Regeneration and Repair
Remodeling
Rest
Rotated (Left or Right)
Speed
Sport-Specific Demands
Strength
Swayback (Hyperextended) Knees
Swelling
Tenderness at a Specific Point
Toe Region
Trauma
Vascular Inflammation
Visualization
Warm-up

OUTLINE

The focus of the first unit of this book was on sport function and fitness, including an anatomy and physiology review and research relevant to sports and fitness massage. Unit Two covered the benefits of massage for recovery, performance enhancement, and injury prevention, and provided a detailed series of massage applications. This third unit describes the application of massage therapy for sport injury recovery, including rehabilitation protocols featuring massage. All methods that will be used to address the injuries in this unit were presented in Unit Two, and specific sequences for applying these methods are found in this unit.

Unfortunately, athlete injury is common. Various injuries are the major reason why persons participate in physical rehabilitation programs. Those who are deconditioned; who overtrain, especially when fatigued; or who practice and play fatigued are more prone to injury and **illness**.

The usual experience in conventional treatment is to restore normal function when someone is injured. But in sport, there is no acceptance of "normal" function in terms of **strength**, **speed**, or movement. Most athletes continually try to push themselves to new limits, and no matter how carefully they train, they inevitably will be injured from time to time.

Actual treatment of an injury may be the same for athlete and nonathlete if the pathologic condition is the same, but the thinking behind treatment of a sports injury is different. If someone sustains an injury falling downstairs, the event probably will not happen again. Once healing occurs, the injury event can be forgotten. However, if an overuse injury is caused by some component in a sports activity, or if a traumatic injury such as an ankle sprain occurs, effective treatment alone will not necessarily prevent it from recurring. Identification and changing of any component of training that may be causing the overuse or injury potential is vital to prevent recurrence of the injury. In many ways, this is the most challenging part of the massage therapist's assessment process, because it requires careful questioning and a detailed understanding of the training methods used.

Most athletes hope to reach a level of performance slightly beyond that which they will ever actually achieve. They want to be "better," not "normal," and the massage therapist must be aware of this goal of the athlete. The overall aim of treatment therefore must always be to strive to enhance performance, regardless of the current status of the athlete. A major risk in the quest for enhanced performance is injury.

The primary therapeutic massage outcome is prevention of injury, as described in Unit Two. Sports massage has great potential in this area. This is why many top competitors use it as an integral part of their training regimen. With regular massage treatment, the athlete is more able to sustain high levels of performance without getting injured. The massage therapist should measure success not by how well he or she treats an injury, but by how few actual injuries the therapist treats. The great preventative benefits of massage are not yet widely exploited by the recreational athlete. This is something that needs to be promoted through education and greater public exposure.

COMMON CAUSES OF PHYSICAL ACTIVITY–RELATED INJURIES

Objective

1. List the common causes of physical activity injuries.

If a massage therapist is going to be working with injured athletes or those in physical rehabilitation, the therapist first needs to understand the different factors that contribute to creating injury potential.

FATIGUE

Doing too much of a particular exercise fatigues the tissues and can cause damage. This should never occur in training (even though it often does), but it can happen easily during competition, when the athlete pushes to the limit and overexerts. Similarly, problems can arise if training sessions are too frequent and time is insufficient for the tissues to recover fully between practice sessions.

INAPPROPRIATE TRAINING

Inappropriate training occurs when a particular aspect of training leads to injury. The best training for a particular sport is to actually do that sport, because the musculoskeletal system naturally develops in a balanced way in relation to the demands placed on it. Weight training or other gym work that adds to the particular strengths and skills needed for that sport is also recommended. Problems occur if the main power muscles have been strengthened, but the smaller muscles, which have a synergistic or stabilizing function in the activity, have not also been strengthened. Injury occurs because the increased demands cause **fatigue**, and natural movement patterns are affected, leading to other problems. Many of these problems are due to compensatory patterns that develop.

Injury potential increases when athletes mix their training styles. Endurance athletes, for example, often do some anaerobic training to improve their speed, or sprint athletes may do some endurance training to improve their stamina. However, if this is overdone, damage may result from using different energy systems and working the muscles in a way that might not be best suited to them.

Doing different types of exercise is certainly not a bad thing and is a vital part of many athletes' training schedules, but they need to be incorporated appropriately. This situation also is seen when a person participates in two or more different sport activities—for example, basketball and golf, or soccer and bowling.

WARM-UP AND COOL-DOWN

Warm-up and **cool-down** are other areas that are commonly neglected, and this can result in injury. The particular tissues involved in the activity, as well as the general systems of the body, must be prepared for the stresses of athletic activity.

A proper cool-down, which again is sport-specific, is also important. It helps the recovery process to begin properly after hard exercise. After anaerobic activities, for example, maintaining activity at about 50% intensity for a short period is believed to be the best way of facilitating the breakdown of accumulated lactic acid. Stretching is also an important part of a cool-down because it helps realign muscle fibers and prevents the natural tightness and stiffness that often follow hard exercise.

AGE

The **aging** process alters metabolic processes involved in recovery after activity. Tendons become less well lubricated and so are more prone to damage. Repetitive training over time can cause wear and tear on the joints. The older athlete basically needs to put more effort into helping natural recovery processes work effectively. This usually means longer recovery periods between training sessions, more stretching, and proper warming up and cooling down. Massage is especially beneficial for the older athlete.

POSTURAL DEVIATIONS

Postural deviations are often a major underlying cause of sports injuries. Postural misalignment may be the result of unilateral (one side of the body) muscle and soft tissue asymmetries or bony asymmetries. As a result, the athlete engages in poor mechanics of movement **(pathomechanics)**.

Common postural imbalances include the following:

- **Cervical lordosis**: short upper erector spinae. This usually occurs as a postural compensation for a thoracic curvature. The sternocleidomastoid muscles may not be weak, although they may shorten and become tense.
- Thoracic **kyphosis**: weak erector spinae; short abdominal and sternocleidomastoid
- **Lumbar lordosis**: short lower erector spinae; weak abdominal muscles
- **Forward-tilting (anterior) pelvis**: short gluteus maximus and rectus femoris; weak abdominal muscles, hamstrings, and iliopsoas
- **Backward-tilting (posterior) pelvis**: short hip extensors, abdominal muscles, iliopsoas, and hamstrings; weak rectus femoris
- **Rotated (left or right)**: short and tight structures in concave areas; long, taut, and inhibited muscles and structures in convex areas
- **Swayback (hyperextended) knees**: short calf muscles and rectus femoris; weak hamstrings

Distortions can occur as well in many lateral and rotational directions. These distortions involve imbalances between postural muscles on either side of the body, as well as reciprocal imbalances in muscles of the torso. None of these postural imbalances occurs in isolation. An imbalance in one area generally leads to development of imbalances in adjacent areas as they compensate. Combined positional distortion patterns include upper crossed, lower crossed, and pronation distortion syndrome. These patterns can occur singularly or in combination with each other (see Chapter 10).

Muscle imbalance can lead to problems in bone structure. Structural bone problems lead to muscle imbalance. Both problems need to be addressed, and although the massage therapist cannot treat bone structures directly, working with soft tissue can be beneficial.

No single answer has been found for these postural problems. Significant improvements usually require a variety of specialized skills to achieve muscle balance, structural alignment, and joint function.

MUSCLE WEAKNESS

Muscles may become weak because of a combination of injury, lack of use, and nerve inhibition. Once the root cause of the **muscle weakness** has been resolved, normal use, or exercise, should be able to restore muscle strength. However, the body learns to adapt and compensate for small areas of weakness. Because of the complexity of the muscular system, altered movement patterns avoid use of weak muscles but still allow performance of daily activities. The weak muscle does not get the exercise it needs and does not improve.

Whether nerve stimulation is the cause or the consequence, nerve stimulation to a weak muscle is reduced, and eventually nerve function becomes poor. Nerve conductivity improves quickly when the muscle is stimulated. This is why great improvement in apparent strength occurs at first when one starts a new sport or activity. Increased nerve stimulation, rather than true strength, is responsible. When the specific muscle that is weak is isolated and is made to work, the nerves are stimulated, and this rapidly improves its function. In fact, real improvement usually can be felt after only four or five contractions, and the functional effect sometimes can be remarkable. The client immediately feels better movement and therefore uses the muscle(s) more normally. Correcting gait reflexes and firing patterns as described in Unit Two is an example of neural stimulation.

In the long-term situation, nerve conductivity may have become so poor that the client has real difficulty in creating any movement and feels that he or she does not even know how to move the area. It becomes necessary to address the situation with passive movements, with the client feeling and experiencing the movements. The massage therapist moves the area with the client assisting and watching the movement before progressing to the full active method.

LIFESTYLE

The general environment in which the athlete lives, practices, and plays can involve unduly high levels of stress, and this can have a direct effect on the structure of the body and can contribute to injury. Increased mental demand and worry can drain energy, leading to muscular fatigue and tension. A poor practice or a competitive environment that is cold, damp, or noisy can add to the physical stress. Inadequate or ill-fitting equipment also can be a factor. A history of previous injury creates the potential for future reinjury. Lack of sleep, distraction and unrealistic performance expectations, poor nutrition, and use of dangerous substances such as ephedra can increase the potential for injury. Any and all aspects of life may contribute to an injury situation.

Psychological/Emotional Factors

Psychology and emotion play a part in all aspects of life, and injury is no exception. In some clinical situations, despite good and apparently effective treatment, the client continues to suffer painful symptoms. Some persons seem to suffer continually from one injury or another. A person may hold onto an injury because it satisfies other needs (secondary gain). The injury may provide the client with support and sympathy from persons around him or her. Injury also may provide an excuse to avoid activities or to avoid failure. It makes a good excuse for poor performance as well. Continuing in the sport or activity despite the pain makes the athlete appear to be a martyr. Therefore, these clients will have had the problem for a long time and will have already seen other therapists. Massage treatment alone may lead to slightly improved symptoms for a few sessions, but then the client usually moves on to another therapist and starts again.

Although there may be physical or medical reasons for the client's symptoms, underlying psychological factors also may be influencing the situation. This is not an area in which the massage therapist should attempt to work; however, it is important to be aware of the possible effects of these emotional influences. The massage therapist must accept that the pain the client feels is usually real, and to say that there is not a problem would be wrong. The massage therapist should not attempt to deal with the psychological aspect of the injury and should refer the client to the appropriate specialist. However, having an empathetic listener sometimes can help the client see the problem for himself or herself.

INJURY PREVENTION

Objective

2. List injury prevention strategies.

Injury prevention is possible if the athlete is prepared physically and mentally for activity. The athlete should not overtrain and do more than the trainer allows. Balancing training with **rest** is important to avoid overuse injury. The following tips can help the athlete avoid sports injuries:

- Wear and use proper gear for the sport, including helmets, pads, shoes, sunglasses, gloves, and layered clothing where appropriate.
- Warm up slowly before activity. This is especially important in sports that require quick, dynamic movements, such as basketball and soccer.
- Always use proper body mechanics and skill training in sports involving repetitive stress to the upper extremities (e.g., tennis, baseball, golf).
- The athlete should use specific skills to train to prepare for the sport.
- Moderate cross-training for overall conditioning allows specific muscles to rest. Cross-training also alleviates training boredom.
- The athlete should listen to the body. Pain is a warning sign of injury. The athlete should not work through pain but should stop or slow activity until the pain subsides.
- Anyone who is not fit is more likely to sustain an injury. Being fit really means choosing a healthful **lifestyle** in which one is able to express emotions effectively; have good relations with others; and live in keeping with decision-making abilities, ethics, values, and spirituality. Paying attention to aspects of a healthful lifestyle such as physical fitness, adequate nutrition, stress management, control of alcohol consumption and avoidance of drug abuse, smoking cessation, and weight control management can contribute to injury prevention.

Coaches and athletic trainers recognize that improper conditioning is one of the major causes of sports injuries. Coaches and athletic trainers work cooperatively to supervise training and conditioning programs that minimize the possibility of injury and maximize performance. It takes time and careful preparation to bring an athlete into competition at a level of fitness that will reduce injury potential. Therapeutic massage can be a valuable part of an injury prevention program.

TRAUMA

Objectives

3. Define trauma.
4. List the three healing phases.
5. Describe acute and chronic inflammation and relate the inflammation process to the three stages of healing.

Many factors produce mechanical injury or **trauma** in sports and exercise. *Trauma* is defined as a physical injury or wound sustained in sport and produced by an external or internal force. Trauma triggers the healing mechanism. Healing mechanisms work through triggering of the inflammatory response and resolution of the inflammatory response. Different tissues heal at different rates. Skin heals quickly, whereas ligaments heal slowly. Stress can influence healing by slowing the repair process. Sleep and proper nutrition are necessary for proper healing. Use of medication, particularly analgesics for pain and antiinflammatory drugs, is common, and their effects need to be considered by the massage practitioner. Pain medication reduces pain perception, so the athlete can continue to perform before healing is completed. This interferes with successful healing. Antiinflammatory drugs may slow the healing process, particularly in connective tissue healing, by interfering with the normal healing process, which involves acute inflammation.

Understanding sports injuries and appropriate massage application requires knowledge of tissue susceptibility to trauma and the mechanical forces involved.

Tissues have relative abilities to resist a particular load. A load can be singular or can involve a group of outside or internal forces acting on the body. *Force* can be defined as push or pull, resistance to a load is called *mechanical stress*, and the internal response is a *deformation*, or change in dimensions. *Deformation* also is defined as a mechanical strain. The stronger the tissue, the greater the magnitude of the load it can withstand. All human tissues have viscous and elastic properties, allowing for deformation.

Tissue such as bone is brittle and has fewer viscoelastic properties compared with soft tissue such as muscle. The loads (forces) applied to bone and soft tissues that can cause injury include tension, compression, bending, shearing, and torsion. It is interesting to note that these same forces are created by massage application. When tissue is deformed to the extent that its elasticity is almost fully exceeded, a yield point has been reached. When the yield point has been exceeded, mechanical failure occurs, resulting in tissue damage.

Because these same forces are applied therapeutically during massage to encourage tissue repair, the massage therapist needs to take care during massage to avoid superimposing extensive force that may worsen the injury. Identifying which type of force offers the greatest therapeutic value also is important. In general, during acute and subacute phases, do not use the same force as the one that loaded the tissue and produced the injury. For example, if a sprain occurs from a torsion load, kneading that applies torsion force may not be the best choice of treatment until healing is progressing and stability is restored to the area. To achieve results in chronic injury, it may be necessary during massage to introduce the same force that caused the injury. Thus, if an ankle sprain caused by a torsion force healed badly, massage reintroduces torsion force (kneading) to restore normal tissue function.

Injury to soft tissue can be described by a stress/strain arc. *Stress* is defined as the force per area applied to the tissue, and *strain* as the percent change in length. The degree of damage to the soft tissues is affected by more than the type and intensity of the force. The higher the acceleration, the greater the damage. This explains the whiplash phenomenon, in which low speed but high acceleration can cause damage to soft tissues.

FIVE DEGREES OF SOFT TISSUE FAILURE

The five degrees of soft tissue failure are as follows (Figure 15-1):

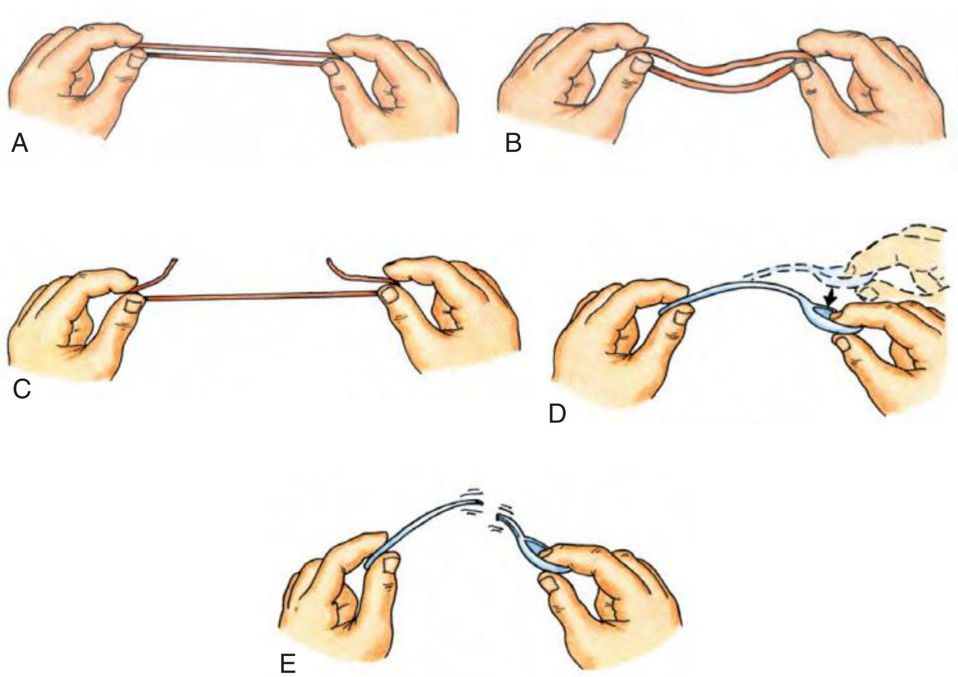


FIGURE 15-1 Properties of connective tissue. **A** through **C,** Elastic deformation. Stress applied to a rubber band. When stress is removed, the rubber band returns to its original length. If stress exceeds the strain capabilities of the band, it can break. **D** and **E,** Plastic deformation. A low degree of stress is applied to a plastic spoon. The spoon will deform slowly and accommodate to a new shape. If stress is applied suddenly and with great force, the spoon will break. (From Shankman GA: *Fundamental orthopedic management for the physical therapist assistant,* ed 2, St Louis, 2004, Mosby.)

- **Toe region**: If the stress is small, the tissue returns to its normal length. This is represented by the toe region of the curve. Tissue may be loaded with a 1.5% to 2.5% strain and may return to normal. This ability decreases with age because the amount of connective tissue crimp decreases with age. Athletes often describe this as "tweaked."
- **Linear region**: If the strain is between 2.5% and 4%, all of the fibers have straightened out, and the collagen tears at its outermost fibers first. This is called **microfailure**. This degree of injury is represented by the linear area of the curve. Tearing of collagen is like a rope that frays from its outer fibers to its center. The client complains of stiffness when using the injured area. Microfailure can occur within the normal physiologic range if repetitive stress is placed on an already damaged structure. This is a grade 1 injury.
- **Progressive failure region**: A strain between 4% and 6% is called the *yield point*, at which major tearing occurs. This is a grade 2 injury.
- **Major failure region**: A strain of more than 6% involves many points of rupture. This is a grade 3 injury.
- **Complete rupture**: An 8% strain causes the collagen fibers to tear completely apart. This can be classified as a grade 3, 4, or 5 injury.

Even with microfailure, the cells, fibers, and ground substance matrix are now damaged, and an inflammatory response is initiated. Injury also affects the sensory nerves in the connective tissue, causing pain. Repair and regeneration of the tissue are carried out through the processes of inflammation and repair.

INJURY CLASSIFICATION

Injury can be classified simply as traumatic or repetitive strain. A sprained ankle is an example of a traumatic injury. Typically, a causative event is identifiable. Repetitive injury results from an accumulation of minor trauma and overuse. Symptoms occur when adaptive processes are no longer effective. Bursitis and plantar fasciitis are examples. Traumatic injury is easier to treat than repetitive injury. Traumatic injury generally is classified as mild, grade 1; moderate, grade 2; or severe, grade 3. The most common injuries are contusions, sprains, muscle pulls and tears, strains, dislocations, fractures, and nerve impingements.

Four types of trauma have been identified:

- **Direct trauma**: blunt trauma such as from contact sports and car accidents
- **Indirect trauma**: trauma that occurs with sudden force overloading
- **Chronic or overuse trauma**: trauma that results from repeated overload, frictional resistance, or both
- **Acute reinjury of a chronic condition**: trauma that results from a sudden tear of a persistent lesion

ASSESSMENT OF INJURY

Some sports injuries are immediately evident; others can creep up slowly and progressively get worse. The massage therapist needs to recognize possible injury and should refer the athlete for diagnosis and treatment.

Signs of injury include the following:

- **Joint pain**: Joint pain, particularly in the joints of the knee, ankle, elbow, and wrist, should never be ignored. Because these joints are not covered by muscle, acute joint pain is rarely primarily of muscular origin. Joint pain requires evaluation by a trainer or physician.
- **Tenderness at a specific point**: If the pain can be re-created at a specific point in a bone, muscle, or joint, major injury may be present. Compare the painful area with the same spot on the other side of the body. If pain sensations are different, refer the athlete for diagnosis.
- **Swelling**: Swelling is a sign of injury. Swelling will cause pain and stiffness or may produce a clicking sound as the tendons snap over one another because they have been pushed into a new position as a result of the swelling. Refer the athlete to a physician to determine the cause.
- **Reduced range of motion**: If pain occurs with passive or active motion, refer the athlete to a physician. Again, compare one side of the body with the other to identify major differences. If any are noted, make a referral.
- **Comparative weakness**: Comparing one side with the other for muscle weakness can reveal significant injury. If this situation occurs, make a referral.
- **Numbness and tingling**: Often related to nerve compression, numbness or tingling may indicate serious injury and should always be evaluated by a trainer or physician.

The massage therapist should always refer to a physician if the athlete has the following:

- An injury that does not heal in 3 weeks
- An infection with pus, red streaks, a fever, or swollen lymph nodes
- Severe pain or pain in a joint or bone that persists for longer than 2 weeks
- Pain that radiates to another area of the body

STAGES OF INFLAMMATION AND REPAIR

Inflammation protects the body from infection and repairs damaged tissue by stimulating new cell growth, which then synthesizes new fibers for repair.

The inflammatory process can be described in the following three phases.

Vascular Inflammation—Acute

Acute **vascular inflammation** typically lasts 24 to 48 hours. In some cases, however, it may last up to a week. Dilatation of arteries, veins, and capillaries occurs, producing redness, heat, and escape of blood plasma, leading to edema. The numbers of fibroblasts and macrophages increase. Fibroblasts increase in size and synthesize ground substance and collagen. This process begins within 4 hours of injury and can last 4 to 6 days. Collagen initially forms a weak, random mesh of fibers. Pain is produced by pressure from the swelling and by the chemical irritation that stimulates pain receptors.

Regeneration and Repair—Subacute

The process of **regeneration and repair** usually begins 2 to 6 days after injury and lasts 3 or 4 weeks.

New capillaries are formed and are laid down in a random orientation unless the area is mobilized. Fibroblastic activity and collagen formation are increased. Scar tissue at this stage is highly cellular and fragile.

In acute and subacute stages, collagen is laid down in a random, disorganized pattern, usually in a plane perpendicular to the long axis; therefore, it has little strength. The collagen develops abnormal cross-links, leaving the tissue with less flexibility. Immature connective tissue is less dense and therefore is injured more easily. The massage therapist must take care to apply the proper amount of pressure during a massage.

Remodeling

In early stages of **remodeling**, the collagen matures into a lattice that is completely disorganized within a gel structure. The collagen can be palpated as thickened or fibrous tissue. A relative decrease in cellularity and vascularity occurs as collagen density increases.

After about 2 months, fibroblastic activity decreases, and less collagen synthesis occurs. Random orientation of collagen provides little support for tensile loads unless appropriate rehabilitation is provided.

Two months to 2 years later, collagen may develop a functional linear alignment in response to stimuli provided by movement and use patterns.

Ineffective rehabilitation and immobilization during all inflammatory healing phases will lead to significant adhesion formation; osteoporosis or loss of bone density; and atrophy of muscle, joint capsules, and ligaments.

CHRONIC INFLAMMATION

Chronic inflammation can result from repeated episodes of microtrama or chronic irritation to the tissue. The process involves an inflammation that is no longer productive.

Chronic inflammation leads to stimulation of pain receptors that cause compensatory adaptations, which assist muscles, causing hypertonicity, or inhibit muscles, causing weakness. Typically, with joint inflammation, the flexors of the joint become hypertonic, and the extensors become inhibited. The innate subconscious logic of the body is apparent: the flexed position affords more joint capsule space for the increased fluid present and avoids the greater pressure and pain that would occur if the joint were in an extended position. Extended positions are often, but not always, associated with increased force because of weight bearing, so flexion occurs subconsciously as a form of guarding.

Chronic inflammation can cause sensitization of the mechanoreceptors, and normal mechanical stimuli can cause the mechanoreceptor to be a pain producer.

Repetitive strain injuries frequently result in limitation or curtailment of sports performance. Most of these injuries in athletes are related directly to the dynamics of running, throwing, or jumping. These injuries may result from constant and repetitive stresses placed on bones, joints, or soft tissues; from forcing a joint into an extreme range of motion; or from prolonged strenuous activity. Overuse and repetitive stress injuries may be relatively minor, but they can be disabling. General massage is used to manage pain and edema and to restore mobility. Rest is important in treatment of microtrauma and overuse conditions with chronic inflammation. Massage used to create parasympathetic dominance helps to support restorative sleep.

Careful and targeted use of methods that superimpose acute inflammation can help resolve chronic inflammation. The key is to create just enough acute reinjury to jump-start resolution of the inflammatory process. This can be considered therapeutic inflammation. Friction is the most common massage method used to create these areas of controlled acute inflammation.

Chronic inflammation with repetitive injury is difficult to treat. Onset is gradual, and acute, subacute, and remodeling healing stages are not defined clearly. Both types of injury–traumatic and repetitive–can become chronic if the healing process is not completed successfully. Common reasons for this include impaired injury repair processes, return to activity too soon after rehabilitation, and inappropriate rehabilitation.

Among traumatic injuries, those to the ligaments and the cartilage are most difficult to treat successfully. If treated properly, bone fractures heal the best. Mild and moderate injury is most suitable for inclusion of massage as part of the active treatment process. Severe injury requires medical intervention and possibly surgery. Massage is a valuable aspect of the rehabilitation process (see Table 9-1, p. 121).

ILLNESS

Objective

6. Define illness.

Illness involves some sort of pathogenic invasion that causes infection (bacteria, fungi, or viruses), immune system dysfunction (hyperactivity or hypoactivity), or organ and system failure. Examples of illnesses include colds, sinus infection, digestive upset, cardiovascular disease, Epstein-Barr virus, diabetes, multiple sclerosis, and fibromyalgia. Illnesses can be acute, subacute, or chronic.

Massage is appropriate during illness if applied correctly. The typical treatment plan consists of a general nonspecific full-body massage that supports sleep and restorative mechanisms, particularly parasympathetic dominance. Energy-based modalities can be used during infection in an adult who is generally healthy. A temperature up to 102°F might not be treated with medicine but

BOX 15-1 Antiinflammatory Diet

- EAT fruits, vegetables, whole grains, omega-3 eggs, fish, chicken, yogurt (unsweetened) with live cultures, extra virgin olive oil, and flaxseed oil.
- AVOID dairy (except yogurt), pork, beef, processed meat, refined grains and sugars, artificial foods, and most fats and oils, especially hydrogenated oils.
- FOODS AND HERBS that are especially valuable in controlling inflammation include ginger, turmeric, cumin, pineapple, and papaya.

instead might be supported with increased fluid intake and rest. Artificially reducing productive fever (fever that results from an unimpeded healing process, also referred to as *low-grade inflammatory response*) can prolong infection. A temperature higher than 103°F needs to be evaluated by a doctor.

Autoimmune disease often involves an increased, sustained, and/or inappropriate inflammatory response. Antiinflammatory support includes an antiinflammatory diet (Box 15-1), possible use of antiinflammatory medications, and other antiinflammatory treatment strategies, such as cold hydrotherapy.

Massage is appropriate for autoimmune disease as long as the application does not generate inflammation and does not strain adaptive capacity. The general massage protocol described in Unit Two of this text is appropriate with caution for overuse of mechanical force targeting connective tissue. Be especially cautious with shearing forces (friction) and with compressive force application that could cause tissue damage such as bruising.

REALISTIC EXPECTATIONS FOR RECOVERY

Objectives

7. Estimate general healing time for various injuries and illnesses.
8. Perform PRICE application.

The idea of "good as new" after injury recovery is misleading. Even the best healing outcome results in some sort of compensation adaptation. Injured areas are prone to tissue changes, such as decreased connective tissue pliability in the area; altered firing patterns with tendency toward synergistic dominance; reflexive activity to other aspects of the kinetic chain function; susceptibility to subclinical (chronic) inflammation and swelling; tendency to develop traumatic arthritis/arthrosis; and changes in muscle size and strength patterns.

Massage is effective as part of a treatment plan for all of these issues. If an athlete has experienced only a few minor injuries, performance is likely not to be affected. However, recovery from repeated injury eventually takes its toll. Adaptive mechanisms become strained, and performance is affected. Massage therapy that supports appropriate training, rehabilitation, and ongoing maintenance can reduce the adaptive strain of cumulative compensation on the body. For example, if a client has had three or four ankle sprains in the mild to moderate range, the ongoing treatment plan for the athlete would always include attention to the ankle. Massage is effective at this level of maintenance care.

HEALING TIME

Healing of illnesses and sports injuries can take some time. After swelling is reduced, healing depends on blood supply. A good blood supply will help move nutrients, oxygen, and infection-fighting cells to the damaged area to work on repair. Athletes tend to have a better blood supply and to heal faster than those with chronic illness, smokers, and those with sedentary lifestyles. Ultimately, healing time varies from person to person, and the athlete cannot force healing.

For someone who is reasonably fit, following are the average lengths of healing time for various injuries and illnesses:

Fractured finger or toe: 3 to 5 weeks
Fractured clavicle: 6 to 10 weeks
Sprained ankle—minor: 5 days; severe, 3 to 6 weeks
Mild contusion: 5 days
Strains/muscle pulls: a few days to several weeks, depending on severity and location of injury
Mild shoulder separation: 7 to 14 days
Major shoulder separation: 6 to 12 months
Common viral infection—cold and flu: 7 to 14 days
Common bacterial infection: 14 days

Healing time for any injury or illness can take longer if the athlete returns to activity too soon. The athlete should never exercise the injured area if there is pain during rest. When the injured area no longer hurts at rest, the athlete may start to exercise it slowly with simple range-of-motion exercises. If the athlete feels pain, he or she should stop and rest. Over time, the athlete can return to activity at low intensity and build up to the previous level. The athlete can increase intensity of exercise only when he or she can do the activity without pain.

The athlete may find that the injured area is more susceptible to reinjury, and closer attention should be paid to warning signs of overdoing it. Soreness, aching, and tension must be acknowledged, or the athlete may end up with an even more serious injury in the future. An athlete is more prone to injury or reinjury when ill.

Knowing when to return to activity after illness is difficult. Typically, illness symptoms above the clavicle (i.e., head cold or sinus problems) are less serious. Activity is okay but should not cause fatigue. More serious illnesses should be supervised by the physician.

The massage therapist has different roles in the injury and illness rehabilitative process than in the maintenance and recovery process described in Unit Two. These roles include support of general healing and restorative processes, management of soreness related to rehabilitation, design and implementation of conditioning programs, and management of compensation patterns from the injury or from protective gear while working closely with the health care team.

Various treatments are used during injury rehabilitation. Therapeutic modalities consist of mechanical, electrical, and thermal interventions used by athletic trainers and physical therapists. These modalities control or reduce swelling, reduce pain, and help maintain strength. Standard therapies such as ultrasound, electrical stimulation (E-Stim, or transdermal electrical nerve stimulation), paraffin baths, and hot/cold whirlpool and massage have a proven track record for lessening time lost to injury. Acupuncture has been shown to produce positive effects as well.

Swelling is particularly problematic because it contributes to a spinal cord reflex that inhibits muscle function and interferes with rehabilitative exercise (i.e., joint motion, shock absorption, and balance). Massage supports lymphatic drainage and is especially beneficial in the management of swelling located outside the joint capsule. The lymphatic drain application is time-consuming, and the massage therapist typically has more time than the trainer to apply the method. Some facilities have pneumatic compression devices that rhythmically compress and release against the tissue. These devices are helpful in encouraging fluid movement.

Some modalities are beneficial in that they influence blood flow to the injured area and modify the pain response. Massage is especially effective in this regard. At times, too much emphasis is placed on therapy when the greatest healing methods are time, rest, and proper nutrition. The massage therapist, along with others treating the injury, needs to respect the body and not "overdo" treatment. Nonsteroidal antiinflammatory drugs can interfere with the normal healing response and can cause nausea, stomach pain, stomach bleeding, or ulcers. In rare cases, prolonged use can disrupt normal kidney function. The risk of these conditions increases with age. Individuals with liver problems should consult their physician before using products that contain acetaminophen. Be aware of these symptoms because many athletes self-medicate using over-the-counter medication.

When injury occurs and the athlete is forced to miss training time, levels of **cardiorespiratory fitness** may decrease rapidly. The client needs to rest the injured body part and work the rest of the body during the recovery stage, especially during the playing season. Alternative activities that allow the athlete to maintain existing levels of cardiorespiratory fitness need to begin as early as possible in the rehabilitation period. Depending on the nature of the injury, a number of activities can help the athlete maintain fitness levels. When a lower extremity injury occurs, non–weight-bearing activities such as pool activities should be incorporated. Cycling also can maintain cardiorespiratory fitness. Because these activities may require using muscles different from those that the athlete typically uses, post-exercise soreness can occur. Massage is appropriate to help manage soreness, thereby supporting the cardiorespiratory fitness regimen.

Continued rehabilitation of the injured area is important, even though the symptoms may seem to have resolved. Symptoms may be reduced significantly during the second stage of healing; however, the area is not healed fully until the third stage, called *remodeling*, has been completed. A saying that rings true is that healing takes time (often as long as a year to be complete).

When the athlete begins to practice and compete, ongoing rehabilitation using hydrotherapy, massage, and electrical modalities can prevent or manage recurrence of swelling and soreness.

PRICE THERAPY

The acronym PRICE describes the standard procedure for addressing an injury in the acute phase. The massage therapist should be supportive of this treatment procedure.

The first treatment indicated for any acute injury is reducing any swelling. Swelling causes pain and loss of motion, which in turn limit the use of muscles, which then can weaken, shorten, and resist repair.

Never apply heat to an acute injury. Heat increases circulation and increases swelling.

PRICE therapy consists of the following:

Protection: Immobilize the affected area to encourage healing and to protect it from further injury. The athlete may need to use elastic wraps, slings, splints, crutches, or canes.

Rest: Avoid activities that increase the pain or swelling. Rest is essential for tissue healing. But this does not mean complete bed rest. The client can do other activities and exercises that do not stress the injured area. Swimming and water exercise may be well tolerated.

Ice: To decrease pain, muscle spasm, and swelling, apply ice to the injured area. Ice packs, ice massage, or slush baths can help. Twenty-minute applications, 4 to 6 times a day, are recommended.

Compression: Because swelling can result in loss of motion in an injured joint, compress the area until the swelling has ceased. Wraps or compressive (Ace) elastic bandages are best.

Elevation: To reduce swelling, raise the affected area above the level of the heart, and above jointed areas that lie between the injury and the heart, for example, a sprained ankle would be elevated above the knee, which in turn would be placed higher than the hip. Use of this position is especially important at night.

RECOVERY PROCESS

Objective

9. Create effective strategies for massage application for acute, subacute, and remodeling phases of healing to support the recovery process.

Whether the person is a competitive athlete or a recreational exerciser or is recovering from a traumatic injury, a viral infection, or a heart attack, healing presents a challenge. How the person understands and responds to pain and limitation is an individual experience based on many factors. However, certain responses and psychological skills can help most persons take an active role in their own recovery. See Unit One for more information.

Individuals often initially feel overwhelmed by an injury. The ability to cope improves greatly if the athlete or the rehabilitation client works closely with the doctor, trainer, and other health care providers to develop a clear plan for recovery.

Successful rehabilitation begins with the client becoming informed about the injury. The client must know the extent of the injury, anticipated recovery time, and the plan to recover safely and effectively. The client must see himself or herself as an active participant in rehabilitation planning and the treatment process. The client may not understand every scientific aspect of recovery, so careful and accurate explanation of massage method application, how it affects underlying physiology, and its relationship to the total rehabilitation program is necessary. This information must not conflict with explanations provided by other health care professionals. Be ready to answer the athlete's questions respectfully, but keep answers within the scope of massage practice. If the question is outside that scope, suggest that the athlete consult someone with more training.

How the athlete responds to the injury is important. Although certain sports or activities present greater risk for injury than others, an injury generally is not expected and is never planned or welcomed. Injuries have different meaning for different persons. For some, an injury might be life-threatening or career-ending. For others, an injury might take them away from a team or social structure that gives them a sense of identity and community. An injury also can interfere with a job or responsibilities at home. Therefore, athletes and rehabilitation clients must understand the coping skills required to help them through the loss, using professional help if necessary. This was described in Unit One. Directing or redirecting the response to injury of the athlete or the rehabilitation client may aid recovery. At the very least, it can help the client maintain a positive outlook during healing. Suggestions include the following:

- Consider pain and injury as something that will go away and will heal.
- Mentally and physically befriend the pain as a guide to recovery. Pushing too hard may cause reinjury, but fearing pain may lead to an approach that is too passive.
- Be positive every day about the ability to cope with and recover from injury.
- Use the desire to recover to help integrate the sense of self and mental and physical healing power.
- Connect with emotions and let them guide through the healing process: if the client becomes emotionally overwhelmed, encourage activity that is enjoyable and distracting. When the client feels emotionally strong, that energy should be used to progress in recovery.

The athlete or rehabilitation client should express his or her needs and concerns about the rehabilitation program directly to the health care team. However, these discussions likely will occur first with the massage therapist, because massage therapists tend to spend longer uninterrupted time with athletes, who experience blood chemistry changes (lower cortisol, increased serotonin, dopamine, endorphins, and oxytocin) that promote personal bonding during massage. Although our hands are busy, we are able to listen when clients are relaxing and are ready to talk. Identify any negative mental responses to injury, and reframe them to promote a positive approach to healing. If you do not know how to do this, do not say anything, and refer the client to someone who is proficient in these types of communication skills. If you have advance permission from the client, describe the particular significant circumstances, if any, during the massage when the client's questions surfaced, to assist the communication process with the professional to whom you have referred the client. Then let go, and just be supportive of the medical team, knowing that you chose to refer when appropriate.

Help the client to be creative, humorous, and positive in his or her approach to the daily inconveniences caused by injury. The person in rehabilitation needs to ask for and receive help and must be surrounded by emotionally and physically supportive persons.

Several specific mental techniques also can aid in recovery. These methods usually are presented by the psychologist but are supported by the massage therapist. See Unit One for more detailed information on these methods, which follow here:

- **Progressive relaxation**: Direct the client to start with the head and work down, alternately flexing the muscles in each body part (producing tension), then relaxing them. Have the client mentally and physically memorize the feeling of relaxation.
- **Breathing**: Breath control can help modify stress and response to pain. Massage can support a functional breathing pattern.
- **Visualization**: Use of imagery can enhance healing by creating a positive internal atmosphere by focusing on a scene that creates a positive, nurturing, and healing state of mind during the massage. During practice of this technique, use music that the athlete finds peaceful to reinforce the imagery. The massage therapist usually does not guide the visualization but can support the effectiveness of the method. The relaxed client can concentrate on total body healing and can visualize a color or sound that represents healing as it moves slowly through the entire body, cell by cell. Others prefer to focus on the injured area while creating a healing image such as blood vessels sending out healing roots, holding the image, and "seeing" the area

healing. Some persons combine these techniques and images.

Some persons prefer to visualize only, whereas others like to combine visualization with mental statements such as, "I am healing," "I am calm," and "I will get better." The massage therapist also can visualize and use an energetic intention for healing during the massage process.

Visualization is helpful as a form of distraction from pain. Use imagery to pull away from the body to a scene or favorite experience. Additionally, this technique may be helpful in facilitating sleep.

Remember that the prospect of prolonged recovery from an injury can be daunting for anyone. Successful completion of a rehabilitation program challenges physical and psychological capacities to the fullest. Patience, commitment, and persistence are necessary for any professional working in a rehabilitation setting. The massage therapist requires solid emotional stability and a bit of detachment to keep the possible emotional storms of the client from affecting him or her personally. Remember that the rehabilitation process is about the *client*–it is not about you.

IN MY EXPERIENCE

I recall a conversation with an athlete's wife. The player had undergone surgery to remove a loose body from his knee. The procedure was successful, but the mood swings of the player were difficult, to say the least. The wife asked me how I could stand even being around her husband. I gave her a knowing smile and replied, "He pays me."

After an athlete sustains an injury, he or she must move forward through the psychological and physical stages of healing. Psychological stages include shock, realization, mourning, acknowledgment, and coping. Physically, an athlete must progress through the stages of initial pain, swelling, and loss of the previous level of control of the injured limb or body part. The athlete also faces the challenges of reestablishing strength, balance, coordination, and confidence to a safe level before returning to competition. Once the symptoms resolve or the medical staff believes it is safe to return to activity, the athlete must achieve fitness gradually, then sport performance, and finally must be able to demonstrate, to the satisfaction of the medical staff, that he or she is able to participate without the potential for further damage to the injured area. The medical staff may require the athlete to wear protective padding, bracing, or other modifications to protect the injured area.

The team physician should be ultimately responsible for deciding when the athlete is ready to return to practice or competition. That decision should be based on collaborative input with the physical therapist/athletic trainer and from the massage therapist, the coach, and the athlete.

WHEN TO RETURN TO TRAINING AND COMPETITION

Appropriate functional assessment indicates that the extent of recovery is sufficient to allow successful performance. Typically, the following types of assessments are used:

- **Strength**: Power, strength, or muscular endurance is great enough to protect the injured structure from reinjury.
- **Neuromuscular control/proprioception/kinesthesis**: The athlete has "relearned" how to use the injured body part.
- **Cardiorespiratory fitness**: The athlete has been able to maintain aerobic fitness at or near the level necessary for competition.
- **Sport-specific demands**: The demands of the sport or of a specific position will not predispose the athlete to reinjury.

Once the athlete has demonstrated sufficient physical recovery, prophylactic strapping, bracing, and padding, all of which provide additional support, may be necessary for an injured athlete who has not healed enough to return to activity.

The responsibility of the athlete involves the ability to listen to his or her body, to recognize a potential reinjury situation, and to be able to understand the importance of continuing to engage in conditioning exercises that will reduce the chances of reinjury.

Psychological factors also influence the athlete's return to activity and competition at high levels without fear of reinjury. The role of the massage therapist is to continue to support the healing process for up to 1 year and to manage any lingering pain or compensation.

SUMMARY

This chapter has discussed injury in general, types of injury, progress of healing, predisposition to injury, injury prevention, and the massage therapist's role when working in injury rehabilitation. Also discussed were illness and appropriate massage treatment for someone who is ill. Because most cases of injury and illness involve pain, the next chapter specifically addresses this issue.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1 Using the information about common causes of injury, develop an injury prevention strategy for each of the following situations. Include massage if appropriate, explain how massage would be applied, and describe the expected outcomes.

a. Inappropriate training
b. Warm-up/cool-down
c. Age
d. Posture deviations
e. Muscle weakness
f. Lifestyle
g. Psychological/emotional factors

Example: Fatigue—restorative sleep supported by general massage targeting parasympathetic response, reduced training/competition schedule, and improved self-regulation

2 Write three case studies, fictional or real, that describe a client in acute, subacute, and remodeling stages of healing. In one of the case studies, the client should be ill as well as injured.

Example: Acute—68-year-old female fell 1 day ago while race walking. She has various bruises and abrasions on her right arm and leg. A mild lateral right ankle sprain is evident. Otherwise, she is fine.

3 Based on your cases, develop an appropriate massage treatment plan to assist each client.

Example: General nonspecific massage lasting 45 minutes, avoiding areas of abrasion. Lymphatic drain applied over the bruises with skin drag only. Light touch energy-based application on right ankle. Suggest arnica and rescue remedy. Offer lavender essential oil as part of the massage with helichrysum over the bruises.

CHAPTER

16 Pain Management

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1 Describe pain in relationship to injury and rehabilitation.

2 Apply massage targeting pain management mechanisms.

KEY TERMS

Acute Pain
Adrenaline
Central Nervous System Hypersensitivity
Chronic Pain
Cortisol
Counterirritation
Dopamine
Endocannabinoid (eCB)
Endorphin
GABA
Hyperstimulation Analgesia
Nociceptors
Noradrenaline
Peripheral Nerves
Serotonin
Substance P

OUTLINE

PAIN

Objective

1. Describe pain in relationship to injury and rehabilitation.

Pain is a major issue for athletes and for those in rehabilitation. Pain management is most effective as a multidisciplinary intervention. Clients involved in physical rehabilitation likely have pain from the injury and from the rehabilitation. Athletes often play and practice with pain. Massage coupled with other pain management strategies is essential for exercise compliance, persistence in training protocols, and enhanced performance.

Pain is a universal experience. The degree to which a person reacts to pain results from biological, psychological, and cultural makeup. Past encounters with painful injury or illness also can influence pain sensitivity. Athletes who are prone to recurring injury in the same area can experience increasing pain sensation for the same or even a lesser degree of injury.

When pain persists beyond the time expected for an injury to heal or an illness to end, it can become a chronic condition. No longer is pain just the symptom of another disease, it is a separate condition unto itself. Unfortunately, pain coexists with athletic training, performance, and competition. The massage therapist must understand pain and must use massage methods to effectively manage pain. This chapter expands on content in Units One and Two and provides specific massage strategies for pain management.

WHAT IS PAIN?

Pain basically results from a series of exchanges involving three major components: **peripheral nerves**, spinal cord, and brain (Figure 16-1).

PERIPHERAL NERVES

Peripheral nerves encompass a network of nerve fibers that branch throughout the body. Attached to some of these fibers are special nerve endings (**nociceptors**) that can sense an unpleasant stimulus, such as a cut, a burn, or painful pressure.

Millions of nociceptors reside in skin, bones, joints, and muscles and in protective membranes around the internal organs. Nociceptors are concentrated in areas prone to injury, such as the fingers and toes. As many as 1300 nociceptors may be present in just 1 square inch of skin. Skin

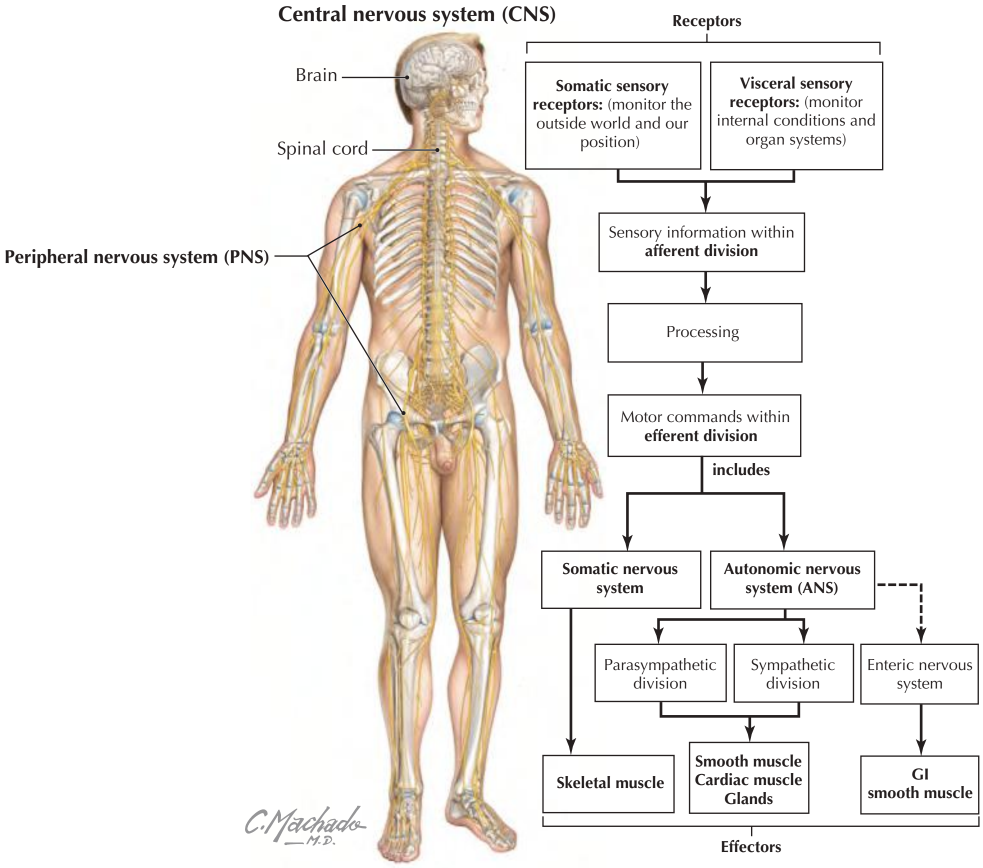


FIGURE 16-1 General organization of the nervous system. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

stimulation during massage that is intense enough to stimulate the "good hurt" response causes the nociceptors to fire. This is one of the mechanisms of **counterirritation** and is a major component of massage benefits for pain management.

Muscles, protected beneath the skin, have few nerve endings. Internal organs–protected by skin, muscle, and bone–have even fewer. Some nociceptors sense sharp blows; others sense heat. One type senses pressure, temperature, and chemical changes. Nociceptors also can detect inflammation caused by injury, disease, or infection.

Massage that addresses these receptors must have enough compressive force to elicit a neuroresponse, but must not be so aggressive as to cause an increase in nociceptor sensitivity or actual tissue damage.

When nociceptors detect a harmful stimulus, they relay their pain messages in the form of electrical impulses along a peripheral nerve to the spinal cord and brain. The speed with which the messages travel can vary. Sensations of severe pain are transmitted almost instantaneously. Dull, aching pain–such as an upset stomach, earache, or aching joint–is relayed on fibers that transmit at slower speed.

When pain messages reach the spinal cord, they meet up with specialized nerve cells that act as gatekeepers, which filter pain messages on their way to the interpretive areas of the brain, where the pain is felt and understood, and coping strategies are developed.

For severe pain that is linked to bodily harm, the "gate" is wide open, and messages take an express route to the brain. Nerve cells in the spinal cord respond to these urgent warnings by triggering other parts of the nervous system into action, especially the motor nerves to signal muscles to move away from harm–a process described as a *reflex arc*. Weak pain messages, however, such as those resulting from a scratch, may be filtered or blocked out by the gate. Often athletes do not realize that they have these minor injuries, and the massage therapist is the first to notice them. Athletes can be unaware of even major injury in the excitement of competition.

SPINAL CORD

Within the spinal cord, messages also can change. Other sensations may overpower and diminish the pain signals. This is called *counterirritation* or **hyperstimulation analgesia**. Again, massage is an effective intervention for creating counterirritation or hyperstimulation analgesia to suppress pain sensation (Figure 16-2).

Nerve cells in the spinal cord also release chemicals such as endorphins or **substance P** that amplify or diminish the strength of a pain signal that reaches the brain for interpretation. Massage can influence these chemical responses,

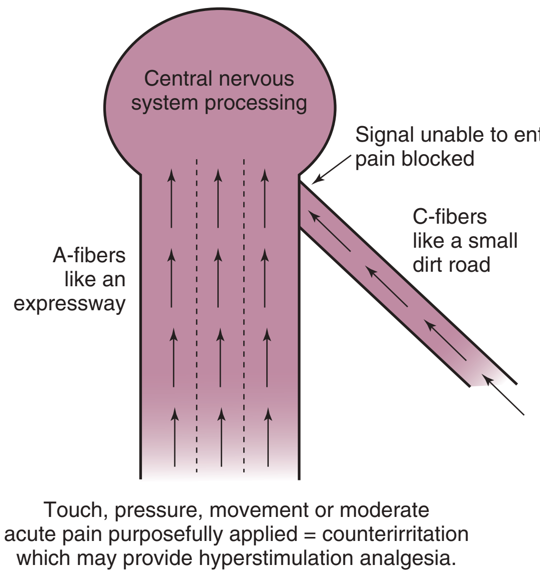


FIGURE 16-2 Gate control theory of pain (based on Melzack and Wall's gate control theory of pain). (From Fritz S: *Mosby's essential sciences for therapeutic massage: anatomy, physiology, biomechanics, and pathology,* ed 4, St Louis, 2013, Mosby.)

although research has not yet identified the exact mechanism.

BRAIN

When pain messages reach the brain, they are processed first by the thalamus, which is a sorting and switching station. The thalamus quickly interprets these messages as pain and forwards them simultaneously to three specialized regions of the brain: the physical sensation region (somatosensory cortex), the emotional feeling region (limbic system), and the thinking (cognitive) region (frontal cortex). Awareness of pain is therefore a complex experience of sensing, feeling, and thinking. Pain tolerance results from the interplay of these functions. Athletes *must* have a high pain tolerance to sustain performance and length of the career. Massage can influence all these areas, that is, somatic sensation through nerve stimulation, the limbic system by calming sympathetic dominance and nurturing, and cognitive areas through education, thus reframing and providing symptom relief.

The brain responds to pain by sending messages that trigger the healing process. Signals are sent to the autonomic nervous system, which then sends additional blood and nutrients to the injury site. Pain-suppressing chemicals send stop-pain messages to the injury site. Use of pain-suppressing medication that mimics the chemicals of the body is controversial, and nonsteroidal antiinflammatory drugs (NSAIDs) may even slow healing. However, the stress of severe **acute pain** can slow the healing process, and intractable **chronic pain** suppresses the immune system. In these cases, use of pain medication is appropriate when supervised by the physician.

PAIN SENSATION

Pain comes in many forms of physical sensations, including stiff, achy, tight, stuck, heavy, sharp stabbing, tearing, tingling, numbing, picky, throbbing, hot, gripping, and cramping.

These pain sensations were described in the assessment section of Unit Two. Pain varies from mild to severe. Severe pain grabs your attention more quickly and generally produces a greater physical and emotional response than is produced by mild pain. Severe pain can be incapacitating, making it difficult or impossible for a person to function.

The location of pain can affect the response to it. A headache that interferes with the ability to focus or work may be more bothersome than, for example, arthritic pain in the ankle. Therefore, the headache would receive a stronger pain response.

The emotional and psychological state, memories of past pain experiences, upbringing, and attitude also affect how individuals interpret pain messages and tolerate pain.

The emotional state can work by improving tolerance to severe pain. Athletes condition themselves to endure pain that would incapacitate others. However, simple insignificant pain areas, especially if involved in performance, can bother athletes more than seems reasonable. Athletes may not realize the difference between good and bad hurt during massage, making them vulnerable to tissue damage and injury from too intense a massage application. Also, the athlete's misconception of "no pain, no gain" interferes with appropriate pain response.

IN MY EXPERIENCE

It is amazing to me how contact sport athletes can run and bang into each other and hardly notice it. Then during their massage appointment, their first response is, "Don't hurt me." I also wonder about the athlete who has a big gash in the calf, a huge bruise on the thigh, and a grade 1 shoulder separation but complains about that "stuck fat sensation" in the elbow. The more elite athletes seem to be more sensitive to smaller irritations and somehow ignore pain resulting from major trauma. I believe therapeutic massage that targets the seemingly "small stuff" that other health care professionals might disregard is one of the greatest benefits that massage therapists offer to clients.

DIFFERENCES IN ACUTE AND CHRONIC PAIN

Acute pain is triggered by tissue damage. Acute pain is the type of pain that generally accompanies illness, injury, or surgery and is location-specific. Acute pain may be mild and may last just a moment, as from an insect sting, or it can be severe and may last for weeks or months, as from a burn, a pulled muscle, or a broken bone.

Over a fairly predictable period and with treatment of the underlying cause, acute pain generally fades away. Massage targets acute pain with symptom management and healing support. Such pain is fairly easy to treat.

Chronic pain is different. It lingers after the injury has healed. Pain may remain constant, or it can come and go. The original injury shows every indication of being healed, yet the pain remains–and may be even more intense.

Chronic pain can occur with no indication of injury. The cause of chronic pain is not well understood, and there may be no evidence of disease or damage to body tissues that doctors can link directly to the pain. This is extremely frustrating for the medical team and for the client. It is now thought that **central nervous system hypersensitivity** can be an aspect of chronic pain. The central nervous system can develop an exaggerated response to stimuli. It appears that functional changes in the central nervous system result in amplification and spread of pain, and intensification of other sensations. On a local level, this condition is called *complex regional pain syndrome*, and it can develop after an acute injury. On a more systemic level, central nervous system hypersensitivity is linked to chronic pain such as fibromyalgia and chronic fatigue syndrome. If this is the underlying cause of chronic pain, massage needs to be applied cautiously to ascertain the client's response.

MASSAGE AND PAIN MANAGEMENT

Objective

2. Apply massage targeting pain management mechanisms.

Various mechanisms influencing pain are affected during massage. Neurotransmitters that perpetuate and inhibit the pain response are affected by massage application. The neurochemical most readily recognized by athletes is **endorphin**. Endorphins are part of a group of peptides that act as internal pain modulators of the body, similar to morphine. Endorphins have become recognized as part of the "runner's high" phenomenon. Actually, various neurotransmitters and hormones work together to alter the pain perception, inhibiting and/or enhancing it. Massage seems to alter the chemical interaction. Pain-inhibiting chemicals influenced by massage are from the entire endorphin class, and also include **serotonin**, gamma-aminobutyric acid (**GABA**), and **dopamine**. Recall from Chapter 3 that the **endocannabinoid (eCB)** system is involved in modulation of pain and inflammation. The pain-facilitating chemicals influenced by massage are **adrenaline**, **noradrenaline**, **cortisol**, and substance P. Research remains scant on just how this all works, but what we understand is sufficient for strategic development and justification of massage for pain modulation. (Review Chapter 3.)

Massage influences the nervous system–central and peripheral (somatic and autonomic). Massage that results in counterirritation and hyperstimulation analgesia functions by activating the gate control for transmission of pain signals (see Figure 16-2).

Reducing mechanical pressure on peripheral somatic nerves by increasing pliability in the tissues modulates pain sensation. Massage can reduce stimulation of nociceptors in tissues. Massage can inhibit proprioceptors. When this occurs, joint function and the muscle length/tension relationship is normalized, decreasing pain. Supporting parasympathetic dominance increases pain tolerance.

Reducing hydrostatic pressure of edema by lymphatic drain application reduces excessive accumulation of interstitial fluid and decreases pressure on pain receptors. Similar results occur when tissue density is reduced, using connective tissue methods to increase ground substance pliability or to reduce adhesion from random connective tissue fiber distribution.

Pain also can occur if circulation is not appropriate. Ischemic tissues are sensitized to pain. Arterial and venous circulation is involved, and massage can target normalization.

Massage has a compassionate and comforting quality that can increase pain tolerance.

PAIN MANAGEMENT MASSAGE STRATEGIES

Massage application targeted to pain management incorporates the following principles:

1. General full-body application of 45- to 60-minute duration is given with a rhythmic and slow approach as often as is feasible. Goal: parasympathetic dominance inflammatory response reduction.
2. Pressure depth is moderate to deep with compressive, broad-based application. No poking, frictioning, or pain-causing methods are used. Goal: support serotonin, endocannabinoids, and GABA, and reduce substance P and adrenaline.
3. Drag is slight unless connective tissue is being targeted. Drag is targeted to lymphatic drain and skin stimulation. Goal: reduce swelling and create counterirritation/hyperstimulation analgesia through skin stimulation.
4. Nodal points on the body that have a high neurovascular component are massaged with a sufficient depth of pressure to create a "good hurt" sensation but not defensive guarding or withdrawal. These nodal points are the locations of cutaneous nerves, trigger points, acupuncture points, and reflexology points. Feet, hands, and head, as well as the area along the spine, are excellent target locations. Goal: gate control response, endorphin and other pain-inhibiting chemical release.
5. Direction of massage varies, but massage deliberately targets fluid movement. Goal: circulation.
6. Mechanical forces of shear, bend, torsion, and others are introduced into connective tissues. Avoid applications that would initiate an inflammatory response. Goal: increased tissue pliability and reduced tissue density.
7. Mechanical force application of shear, bend, and torsion is used to address adhesion or fibrosis but needs to be targeted specifically and to be limited in duration. Goal: reduce localized nerve irritation and improve local circulation.

8. Muscle energy methods and lengthening are applied rhythmically and gently and are targeted to shortened muscles. Goal: reduce nerve and proprioceptive irritation and circulation inhibition.
9. Stretching to introduce tension force is applied slowly, without pain, and is targeted to shortened connective tissue. Goal: reduce nerve and proprioceptive irritation.
10. Massage therapists are focused, attentive, and compassionate but maintain appropriate boundaries. Goal: support entrainment, bioenergy normalization, and palliative care.

Additional methods that modulate pain sensation and perception that can be incorporated into the massage involve simple applications of hot and cold hydrotherapy, analgesic essential oils, calming and distracting music, and (maybe) North side magnet application. These methods were discussed in Unit Two.

SUMMARY

Massage is effective for managing acute and chronic pain and for supporting other pain treatments such as medication, ultrasound, and hydrotherapy. The massage therapist needs to really understand the concept of management. A common error is to think of massage targeting pain reduction as therapeutic change. Massage to manage pain is palliative. Methods used to address the reason for pain are more accurately described as therapeutic change. Massage that is too aggressive, that causes inflammation, and that creates excessive pain during application that persists beyond the actual massage is done incorrectly.

Massage therapists need to learn to back off from attempting to "fix" the problem when pain management is the goal. Massage while targeting pain management as presented in this chapter is an appropriate strategy.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1 It is now thought that central nervous system hypersensitivity can be an aspect of chronic pain. The central nervous system can develop an exaggerated response to stimuli. How might massage be used to address this issue?

2 Describe the difference between massage treatment for acute pain and for chronic pain.

3 Justify the benefits of using massage as an active part of a comprehensive pain management program.

CHAPTER

17

Common Categories of Injury

OUTLINE

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1 Describe and apply appropriate massage for the following common syndromes and injury categories:

a Overtraining syndrome
b Muscle soreness and stiffness
c Muscle cramp, spasm, and guarding
d Contusions
e Wounds
f Strains
g Sprains
h Chronic muscle injury
i Degenerative joint disease
j Dislocation
k Bone injury
l Nerve injury

KEY TERMS

Acute Bone Fractures
Articular Crepitus
Atrophy
Bone Injuries
Bursitis
Capsulitis
Chronic Joint Injuries
Compression
Contracture
Degenerative Joint Disease
Diastasis
Disk Herniation
Dislocation
Entrapment
Luxation
Nerve Impingement
Nerve Injuries
Nerve Root Compression
Osteochondrosis
Periostitis
Stress Fractures
Subluxation
Synovitis
Tendonitis
Tendonosis
Traumatic Osteoarthritis

This chapter categorizes similar injuries into general treatment protocols for massage application. What changes are the targeted locations. For example, a sprained knee or wrist is similar in basic pathology, and only the anatomy is different. A wound on the leg or the foot is still a wound. Specific treatment strategies are provided for these general categories, which then are applied to specific injuries by region in Chapter 20. The student will need an orthopedic injury text for further information.

OVERTRAINING SYNDROME

Objective

1. Describe and apply appropriate massage for the following common syndromes and injury categories:
   a. Overtraining syndrome

A commonly encountered problem in physical conditioning and training is overexertion. A gradual pattern of overloading the body is necessary for training effects; however, many athletes and training personnel still believe that if there is no pain, there is no gain. Overtraining occurs when athletes work too hard to improve performance and train beyond the ability of the body to recover.

Overtraining is reflected in muscle soreness, decreased joint flexibility, and general fatigue 24 hours after activity. Four specific indicators of possible overexertion are acute muscle soreness, delayed-onset muscle soreness, muscle stiffness, and muscle cramping and spasms.

Common warning signs of overtraining include the following:

- Mild leg soreness, general aching
- Pain in muscles and joints
- Washed-out feeling, tired, drained, lack of energy
- Sudden drop in ability to run typical distance or times
- Insomnia
- Headaches
- Inability to relax, fidgety
- Insatiable thirst, dehydration
- Lowered resistance to common illnesses such as colds and sore throat

The massage professional needs to be aware of these warning signs and must refer to a physician for proper management. Proper diagnosis by the physician can rule out potentially serious problems. Interventions include rest, drinking plenty of fluids, alteration of diet if needed, and general nonspecific massage that is even less targeted and intense than the pain management protocol presented in the previous chapter. Massage supports parasympathetic dominance, pain management, fluid movement, and sleep. Do not overmassage someone with overtraining syndrome. Adaptive capacity already is strained, and massaging too much (e.g., too aggressively or by pursuing too many outcomes in a single session) can add strain to the client's adaptive ability.

MUSCLE SORENESS AND STIFFNESS

Objective

1. Describe the application of appropriate massage for the following common syndromes and injury categories:
   b. Muscle soreness and stiffness
   c. Muscle cramp, spasm, and guarding

Overexertion during strenuous muscular exercise often results in muscular soreness. Most persons, at one time or another, have experienced muscle soreness, usually resulting from some physical activity to which they are unaccustomed.

ACUTE-ONSET MUSCLE SORENESS

Acute-onset muscle soreness accompanies fatigue. This muscle pain is transient and occurs during and immediately after exercise. The pain is caused by lack of oxygen to the muscles and buildup of metabolic waste from anaerobic functions. The pain dissipates as oxygen is restored and metabolic wastes produced are removed from muscle tissue and are eliminated or converted. Massage is not especially effective in treating acute-onset muscle soreness. If massage is used immediately after exercise, the focus is arterial and venous circulation. Do not attempt to stretch or aggressively treat. Cramping usually will occur.

DELAYED-ONSET MUSCLE SORENESS

Delayed-onset muscle soreness (DOMS) becomes most intense after 24 to 48 hours and then gradually subsides so that the muscle becomes symptom-free after 3 or 4 days. Delayed-onset muscle soreness leads to increased muscle tension, swelling, stiffness, and resistance to stretching. Delayed-onset muscle soreness is thought to result from several possible causes. It may occur from small tears (microtrauma) in the muscle tissue, which result in an inflammatory process and seem to accompany eccentric or isometric actions. Soreness also may occur because of disruptions in the connective tissue that holds muscle tendon fibers together. Another contribution to delayed-onset muscle soreness is increased interstitial fluid resulting in hydrostatic pressure on pain-sensitive structures.

Muscle soreness can be produced by many types of muscular activities. A common deterrent for ongoing interference with physical activity is post-exercise soreness from movements that produce tension as the involved muscles are forced to lengthen. The muscle actions needed for these movements are known as *eccentric* or *negative* actions. These types of movement activities include movements that resist gravity or forward momentum, such as downhill running, lowering of heavy barbells, and the downward phase of push-ups or sit-ups; movements that resist forces exerted by stronger opponents, such as performing a pin or a hold in wrestling and a block in football, are also eccentric. Current explanations for muscle soreness include lactic acid accumulation, muscle spasms, and muscle damage. Lactic acid and muscle spasms have been largely discredited as reasons, but as described in

Chapter 3, the muscle damage explanation has a sound scientific basis.

Movements that cause muscle soreness have been shown to produce localized damage to the muscle fiber membranes and contractile elements. Chemical irritants such as histamine are released from damaged muscles and can irritate pain receptors in the muscle. Muscle damage often causes swelling of the muscle tissue, which creates enough fluid pressure to stimulate pain receptors. Swelling has been shown to persist long after muscle soreness has disappeared. Pain receptors gradually adapt to the swelling or to some other factors present that reduce pain perception. Because no effective treatment for muscle soreness has been identified, training programs should be designed to minimize or prevent soreness.

Typical recommendations for treatment of delayed-onset muscle soreness include gentle stretching, topical application of analgesic creams and/or ice, submersion in hot baths, hot and cold contrast exposure, Epsom salt soaks, and sauna. Each of these treatments may provide temporary relief, but none is effective for long. Delayed-onset muscle soreness is common and annoying but not serious. The athlete can do many things to prevent, avoid, and shorten delayed-onset muscle soreness such as:

- Warm up thoroughly before activity and cool down completely afterward
- Use easy stretching after exercise
- Start an exercise program with easy to moderate activity and build up intensity over time
- Avoid making sudden major changes in the type of exercise
- Avoid making sudden major changes in the amount of time spent exercising

Soreness will go away in 3 to 7 days with no special treatment, and the athlete should avoid any vigorous activity that increases pain. The individual should allow the soreness to subside thoroughly before performing any vigorous exercise. Easy, low-impact aerobic exercise will increase blood flow to affected muscles, which may help diminish soreness.

Treatment of delayed-onset muscle soreness usually involves general massage with a lymphatic drainage focus. Muscle soreness can be treated with ice applied within the first 48 to 72 hours.

Gentle stretching of the affected area with gentle massage helps. Do not overmassage, work aggressively, or use any methods that would increase swelling or cause tissue damage.

Almost all professional sports teams use various ointments and liniments on sore athletes, but sports medicine doctors may not fully understand how liniments work. The massaging action of rubbing in the liniment and working it into muscles may be what actually relaxes the muscle and may be part of the mechanism of action.

Two basic types of ointments/liniments are available. The first typically contains menthol and an aspirin-like chemical, methyl salicylate. When liniment is massaged on the skin, the skin becomes slightly irritated, which causes an increase in blood flow to the area. This produces heat, which relaxes stiff muscles. Some salicylate may enter the bloodstream. Because salicylate is the active ingredient in aspirin, it also may have some pain-relieving effect. A counterirritant action occurs as well.

The second type of ointment depends on a substance called *capsicum*, which is the active ingredient in jalapeño and other hot peppers. An extract of this chemical now is being used as a prescription ointment for arthritis pain, which is an indication that these ointments really do have benefit. These hotter ointments have a much stronger irritating effect on the skin to stimulate blood flow and give off enough heat that they can cause a burn, so caution is required. Do not allow these preparations to come into contact with any mucous membranes or with the eyes.

Make sure the client has no skin sensitivity to an ointment that will cause an allergic reaction.

MUSCLE STIFFNESS

Muscle stiffness is different from muscle pain. Stiffness occurs when a group of muscles has been worked hard for a long time. Fluids that collect in the muscles during and after exercise are absorbed into the bloodstream at a slow rate. As a result, the muscle becomes swollen, shorter, and thicker and therefore resists stretching. Light exercise, lymphatic drainage types of massage, and passive mobilization assist in reducing stiffness. Stiffness also results in decreased pliability of connective tissue. This occurs when the ground substance thickens as part of an enzyme process during sympathetic dominance.

Massage is effective for muscle stiffness, particularly in the management of fluid retention. See the discussion on lymphatic drainage in Unit Two. All pain management approaches are appropriate. Massage performed to restore connective tissue pliability and hydration helps to reduce stiffness. These conditions are not the result of an increase in muscle tone but rather reflect an issue of fluid dynamics. Do not use aggressive massage.

MUSCLE CRAMPS AND SPASM

Muscle cramps and spasm can lead to muscle and tendon injuries. A *cramp* is a painful involuntary contraction of a skeletal muscle or muscle group. Cramps often occur because of lack of water or other electrolytes, from muscle fatigue, and from an interruption of appropriate neurologic interaction between opposing muscles. A *spasm* is a reflex reaction caused by trauma to the musculoskeletal system.

The two types of cramps or spasms are the clonic type, with alternating involuntary muscular contraction and relaxation in quick succession, and the tonic type, with rigid muscle contraction that lasts for a time. The massage therapist applies compression firmly in the belly of the cramping muscle and gently massages, moves, and stretches surrounding joint areas. If cramps recur, send the client for hydration and electrolytes. Cramps and spasm respond to proper hydration and rest.

MUSCLE GUARDING

After injury, muscles that surround the injured area contract in effect to splint that area, thus minimizing pain by limiting regional movement. Often this splinting is referred to incorrectly as a *muscle spasm*. *Muscle guarding* is a more appropriate term for the involuntary muscle contractions that occur in response to pain after musculoskeletal injury. Muscle guarding is appropriate during acute and subacute healing processes. Massage application *should not* attempt to reduce muscle guarding until later stages of the subacute phase. Use gentle massage to reduce pain sensation.

CONTUSIONS

Objective

1. Describe and apply appropriate massage for the following common syndromes and injury categories:
   d. Contusions

A bruise, or contusion, occurs because of a sudden traumatic blow to the body. The severity of a contusion can range from superficial and minor to extremely serious with deep tissue compression and hemorrhage.

The extent to which an athlete may be hampered by this condition depends on the location of the bruise and the force of the blow. This type of injury is common in contact sports. An impact to the muscles can cause more damage than might be expected and should be treated appropriately. The muscle is crushed against the bone, and if the injury is not treated correctly or if it is treated too aggressively, a condition such as myositis ossificans with calcification of the tissues may result. The speed of healing of a contusion, as with all soft tissue injuries, depends on the extent of tissue damage and internal bleeding.

The three types of contusions are intramuscular, intermuscular, and bone bruise.

Intramuscular contusions occur as tearing of the muscle within the sheath that surrounds it. This means that initial bleeding may stop early (within hours) because of increased pressure within the muscle; however, the fluid is unable to escape because the muscle sheath prevents it. The result is considerable loss of function and pain; days or weeks may be needed for recovery. The typical bruise discoloration may not appear with this contusion type, especially in the early stages. Because a bruise is not seen, the severity of the injury may not be recognized. The typical bruise may appear finally in the subacute phase and indicates progressive healing.

Intermuscular contusions consist of tearing of the muscle and part of the sheath surrounding it. The initial bleeding will take longer to stop. Recovery is often faster than with intramuscular contusions because the blood and fluids can flow away from the site of injury through tears in the muscle sheath. Bruising discoloration occurs with this type of contusion.

A bone contusion can penetrate to the skeletal structures, causing a *bone bruise*. Bone bruises are painful and require a fairly extensive healing time.

Symptoms of contusions include the following:

- Pain
- Swelling
- Discoloration
- Restricted movement

If after 2 to 3 days the swelling has not gone, an intramuscular injury is likely. If bleeding has spread and has caused bruising away from the site of injury, the injury is likely to be intermuscular. Contusions are classified as grade 1, 2, or 3, depending on severity (Box 17-1).

Caution is necessary when providing massage over contusions. Compressive force and depth of pressure need to be modified to prevent further injury. Lymphatic drainage types of applications are usually appropriate. Once bruising dissipates, in all three grades of contusion, kneading is used to prevent fibrosis. Over the next 3 to 6 months, continue to apply bending and torsion forces of kneading to support the remodeling stage of healing.

BOX 17-1 Contusion Grades

GRADE 1

Tightness
Minor swelling
Nearly a full range of motion

Treatment

Treatment includes PRICE and lymphatic drainage massage with skin drag methods only.

GRADE 2

Painful movement
Swelling
Compression causing pain
Limited range of movement

Treatment

Treatment consists of ultrasound and electrical stimulation, lymphatic drainage massage application using skin drag methods only, and a rehabilitation program consisting of stretching, strengthening, and gradual return to full function.

GRADE 3

Severe pain
Immediate swelling
Isometric contraction will be painful and might produce a bulge in the muscle.

Treatment

Seek medical attention immediately.
PRICE: Use ultrasound and electrical stimulation.
Perform lymphatic drainage massage using skin drag methods only. Wait at least 48 hours before applying massage.
If necessary, relieve pressure.

WOUNDS

Objective

1. Describe and apply appropriate massage for the following common syndromes and injury categories:
   e. Wounds

The first concern with any wound is the need to control bleeding. In terms of first aid, this usually means use of a pressure bandage. The next concern is the need to prevent wound contamination by cleaning the wound and applying a sterile bandage and possibly an antibiotic ointment. Last, immobilization of the injured part, along with medical intervention, is needed. Many wounds will have to be sutured or stitched.

The purpose of suturing is to pull the tissues together just enough that no dead spaces will exist below the skin where blood and fluid can accumulate. If space is present, it eventually could serve as a breeding ground for infection. Wounds heal better when the edges are close together.

Generally speaking, the deeper the wound, the more serious the consequences. With minor wounds, the outer layer of skin, the epidermis, is scraped away or opened up to permit bacteria and materials to enter. With a more severe wound, the next layer deeper, the dermis, is injured. This contains connective tissue, sweat glands, hair follicles, nerves, and lymph and blood vessels, and the potential for infection to spread increases.

Wounds can be classified as follows (Figure 17-1):

- *Abrasion.* In this wound, the outer surface of skin has been scraped away. Usually some minor oozing of blood and serum occurs.

Depending on how the injury was obtained, dirt or foreign matter usually is ground into it. To treat an abrasion such as a scraped knee, the wound first must be cleaned to remove dirt that could cause an infection and therefore impair healing.

Once cleaned, the wound should be blotted dry with sterile gauze, and pressure should be applied over the injured site for a few minutes for the purpose of controlling bleeding. Application of first aid or antibiotic cream to the abrasion could help to prevent infection and keep the bandage from sticking to the raw wound. For the best protection, the bandage should cover an inch beyond the wound. An ice pack over the final bandage can serve to reduce swelling and ease some of the discomfort.

- *Incision.* A wound of this kind is made with a sharp, knife-like object that leaves a cut with smooth edges. Incisions are often part of surgical care procedures.
- *Laceration.* This wound type is similar to an incision but with jagged edges caused by a tear. Because incisions and lacerations go beyond the outer layer of skin and into the deeper layers that contain blood vessels, a lot of bleeding occurs. If the wound is deep enough to cut

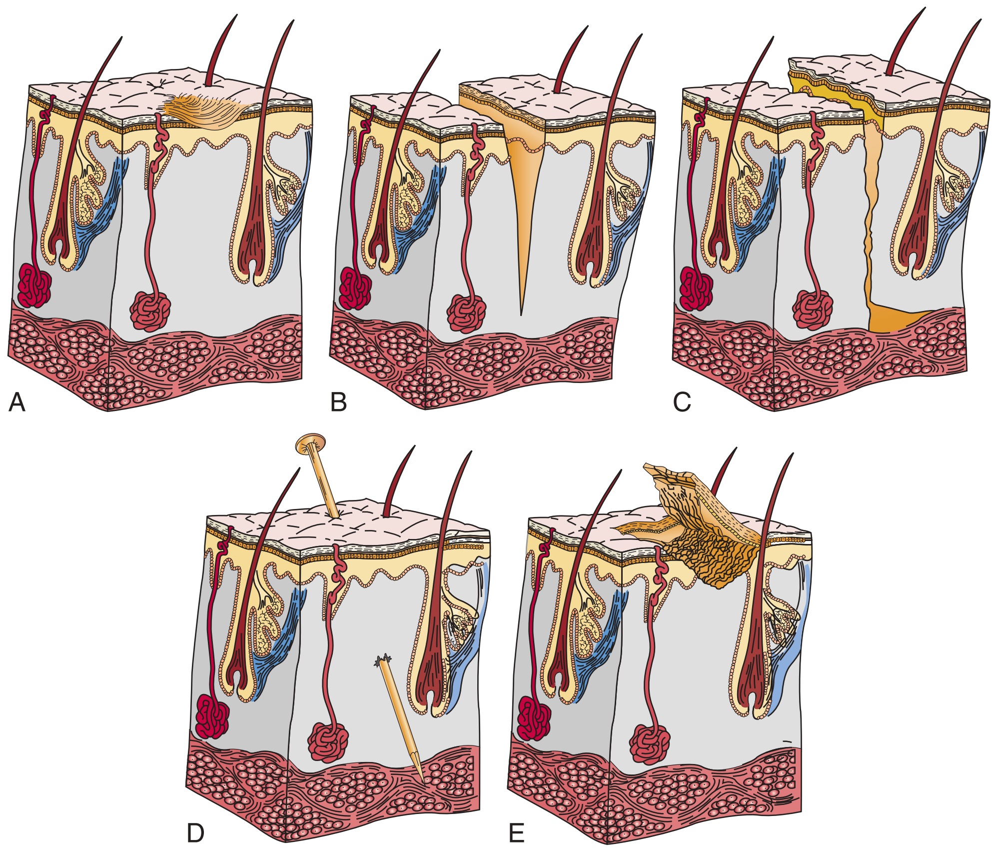


FIGURE 17-1 Types of wounds. **A,** Abrasion. **B,** Laceration. **C,** Incision. **D,** Puncture. **E,** Avulsion. (From Young AP, Kennedy DB: *Kinn's the medical assistant: an applied learning approach,* St Louis, 2003, Saunders.)

an artery, blood will squirt out with each heartbeat because of high pressure in these vessels. Care involves applying pressure dressing and getting the victim to medical care, during which sutures usually are needed to close the wound fully or partially.

- *Puncture.* As its name implies, a puncture occurs when a foreign object is pushed into the skin. The wound can be superficial or deep. Minimal bleeding is evident externally, but internal bleeding can occur. A deep puncture wound requires medical care, and a tetanus injection may be required. Some arthroscopic surgical procedures produce wounds that are more like punctures than incisions.
- *Avulsion.* With this type of injury, the skin is pulled or torn off. Severed tissue should be saved and taken to the hospital. A pressure dressing is applied over the wound until medical care is received. Once a dressing is applied, leave it alone and do not take it off to check the wound.

THERAPEUTIC MASSAGE APPLICATION FOR WOUNDS

Follow these guidelines when performing therapeutic massage for wounds (Figure 17-2).

Massage Applied Days 1 to 3

Sanitation and infection prevention are essential. Proceed with caution.

Avoid the area during massage to protect the wound from contamination.

Lymphatic drainage can be used above and below the wound. Do not perform drainage if any signs of infection are present: heat, swelling, red color (especially any type of red streaking), pus, or sour smell.

FIGURE 17-2 Therapeutic massage application for wounds and contusions. Wound, subacute early (3 to 5 days).

Day 3

Use bend, shear, and tension forces around the wound far enough away to prevent any chance of contamination. The goal is to drag the skin gently in multiple directions to prevent formation of adhesions. Connective tissue formation is random at this time. Do not disturb the wound edges.

Increase the intensity and depth of forces in the area that has been treated, and move closer to the wound. Decrease intensity and gently apply bend, shear, and stretch (tension) forces to the tissue. Do not disturb wound edges.

Day 7

Again, increase intensity in previously treated areas, and then move closer to the wound. At this point, the wound should be moving a bit from the forces loading adjacent tissue, but the wound edges must not be disturbed. Progressively increase intensity daily by moving closer and closer to the wound.

As soon as the wound is healed completely (14 days is typical, but it can take longer), begin to bend and shear the scar tissue and stretch it with tension.

The wound must be healed completely before you can work directly on it. Before working on the scar, address the tissue surrounding the wound. Address this tissue after the acute phase has passed. Usually this happens after 2 to 3 days. Maintain ongoing attention to the scar for at least 6 months. These methods can be taught to the client or family member.

OLD SCARS

Old scars that are adhered to underlying tissue can be softened and stretched. All mechanical forces are used in multiple directions on the scar at each session until the scar tissue and tissues at least 1 inch away from the scar become warm and slightly red. The intensity should be enough that the client experiences a burning stretching sensation (Figure 17-3). A small degree of inflammation is desired, and the area may be a bit tender to the touch after the massage but not painful to movement. Ideally, treatment should occur every other day, allowing the tissue to recover on alternate days. These methods can be taught to the client or family member.

STRAINS

Objective

1. Describe and apply appropriate massage for the following common syndromes and injury categories:
   f. Strains

Note: A specific massage treatment protocol for strain and sprains is provided on p. 299.

A *strain* is a stretch, tear, or rip in the muscle or in adjacent tissue such as fascia or muscle tendons (Figure 17-4). Strains also are called *pulls* and *tears*. The cause of

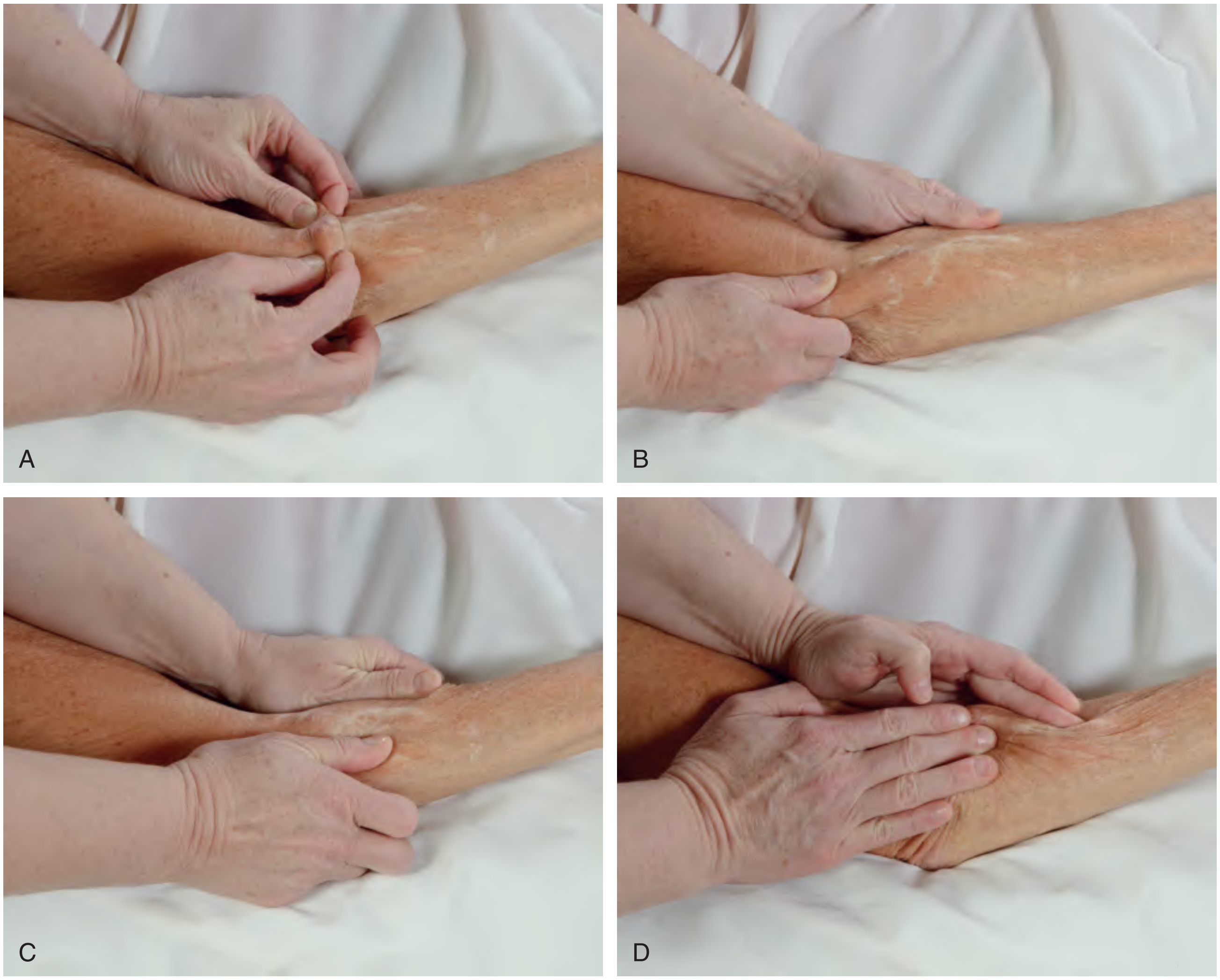


FIGURE 17-3 Old scars. **A,** Skin roll to identify areas of adherence. When found, increase lift and move through bind. **B,** Pull and twist (tension and torsion forces) adhered tissue. **C,** Direct tissue stretching. **D,** Shear force. Shear areas of adhesion work just through the bind.

muscle strain is often not clear. Often a strain is produced by an abnormal muscular contraction during reciprocal coordination of agonist and antagonist muscles. This type of injury often occurs when muscles suddenly and powerfully contract. Possible explanations for the muscle imbalance may be related to a mineral imbalance caused by profuse sweating, fatigue, metabolites collected in the muscle itself, or a strength imbalance between agonist and antagonist muscles. A muscle may become strained or pulled—or may even tear—when it stretches unusually far or abruptly. A muscle strain may occur while slipping on the ice, running, jumping, throwing, lifting a heavy object, or lifting in an awkward position.

A strain may range from a tiny separation of connective tissue and muscle fibers to a complete tendinous avulsion (breaking away from the bone) or muscle rupture. The resulting pathologic condition is similar to that of a contusion or sprain, with capillary or blood vessel hemorrhage. Typically, persons with a strain experience pain, muscle guarding, and muscle weakness. They also can have localized swelling, cramping, or inflammation and, with a minor or moderate strain, usually some loss of muscle function. Clients typically have pain in the injured area and general weakness of the muscle when they attempt to move it. Severe strains that partially or completely tear the muscle or tendon are usually very painful and disabling.

GRADES OF MUSCLE STRAIN

A grade 1 (mild) strain is accompanied by local pain, which is increased by tension of the muscle and minor loss of strength. Mild swelling and local tenderness occur.

A grade 2 (moderate) strain is similar to the mild strain but has moderate signs and symptoms, mild bruising, and impaired muscle function.

A grade 3 (severe) strain has signs and symptoms that are severe, with loss of muscle function and bruising and commonly a palpable defect (small hole) in the muscle. Injuries often occur at the junction where the muscle and

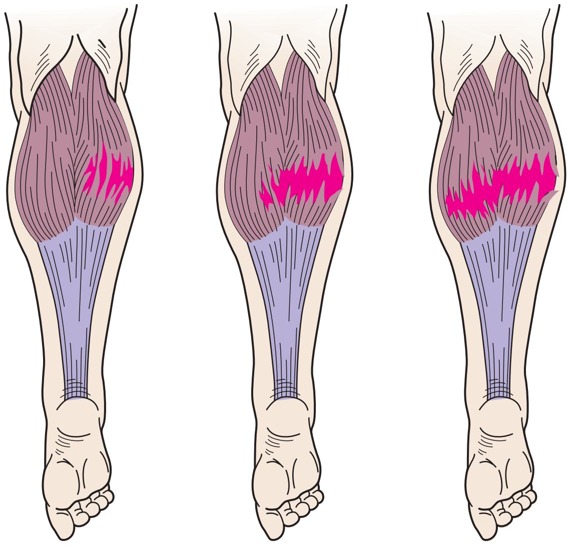


FIGURE 17-4 Calf pull with degrees of severity. (From Salvo SG, Anderson SK: *Mosby's pathology for massage therapists,* ed 2, St Louis, 2008, Mosby.)

the tendon meet, called the *musculotendinous junction*, or where the tendon attaches to the periosteum of the bone, called the *tenoperiosteal junction*. Junction sites of ligament, tendon, and joint capsules are relatively vascular and show increased stiffness. These junctions are therefore more prone to injury.

After a tear of the connective tissue of the muscle, fibroblasts lay down collagen. If the tear is significant, adhesions often form in connective tissue layers. Because of the development of abnormal cross-links in the collagen and adhesions within the fascia of the muscle during healing, a muscle that has had a strain injury typically shortens and loses some of its extensibility. After a tear of the muscle fiber, satellite cells help myoblasts develop into muscle fibers. The regeneration is usually complete in 3 weeks. Immobilization causes decreased cellular activity, decreased collagen formation in the fascia, and loss of muscle fibers. Therefore, controlled movement is essential for optimal healing.

Muscle dysfunctions that contribute to susceptibility to muscle strain include sustained hypertonicity, sustained inhibition, abnormal position, and abnormal torsion in the soft tissue. These contractions can be caused by the following:

- Poor posture
- Static stress (nonproductive isometric contraction)
- Muscle injury
- Joint dysfunction
- Emotional or psychological stress: anxiety and anger
- Chronic overuse
- Disuse-deconditioned syndrome

Massage addresses muscle dysfunction by reversing inappropriate soft tissue adaptation in response to these conditions.

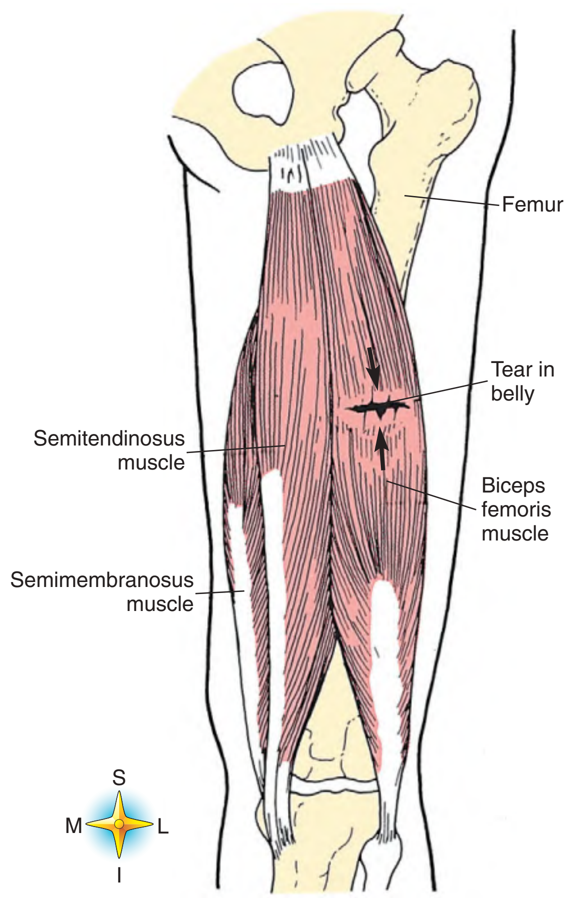


FIGURE 17-5 Muscle strain. This muscle strain is located in the biceps femoris muscle of the hamstring group (in this case, a tear in the mid-portion of the belly of the muscle). Arrows show direction of massage stroke. (From Thibodeau GA, Patton KT: *The human body in health and disease,* ed 5, St Louis, 2009, Elsevier.)

The muscles that have the highest incidence of strain in sports are the hamstring group, the sacrospinalis group of the back, the deltoid, and the rotator cuff group of the shoulder. Contact sports such as soccer, football, hockey, boxing, and wrestling put athletes at risk for strains. Gymnastics, tennis, rowing, golf, and other sports that require extensive gripping can increase the risk of hand and forearm muscle strain. Elbow muscle strains sometimes occur in persons who participate in racquet sports, throwing, and contact sports.

Muscle strain usually causes a protective muscle guarding response. This guarding should not be reduced by massage because it protects the area from further injury.

Massage needs to target the following goals during muscle strain injury repair:

- Minimize adhesion formation.
- Promote circulation.
- Increase lubrication of the tissues.
- Promote proper alignment of collagen fibers.
- Support movement to stimulate replacement of connective tissue and regeneration of muscle fibers.

TREATMENT FOR STRAINS

Treatment for strains consists of two stages. The goal during the first stage is to reduce swelling and pain. Use PRICE—*p*rotection, *r*est, *i*ce, *c*ompression, and *e*levation—for the first 24 to 48 hours after the injury. Severe strains may require surgery to repair torn muscle or tendons. Surgery usually is performed by an orthopedic surgeon. Gentle massage around the area encourages circulation, and lymphatic drainage manages swelling and supports healing. During acute and subacute phases, the soft tissue should be massaged in the direction of the fibers and crowded toward the site of injury to promote reconnection of the ends of separated fibers (Figure 17-5). Depth of pressure, duration, and intensity need to be adjusted during the various healing phases. Once the acute phase of healing is complete, methods that support mobile scar formation can be introduced, including moving the tissue away from the injury site and massaging across the fibers.

The second stage of treating a strain is rehabilitation, for which the overall goal is to improve the condition of the injured part and restore its function with an exercise program designed to prevent stiffness, improve range of motion, and restore normal flexibility and strength.

SPRAINS

Objective

1. Describe and apply appropriate massage for the following common syndromes and injury categories:
   g. Sprains

Note: A specific massage treatment protocol for strain and sprain is found on p. 299 (Figure 17-6).

A *sprain* is an injury to a ligament and/or a joint capsule that results in overstretching or tearing. A sprain can result from a fall, a sudden twist, or a blow to the body that forces a joint out of its normal position. Typically, sprains occur when persons fall and land on an outstretched arm, slide, land on the side of their foot, or twist a knee with the foot planted firmly on the ground. One or more ligaments can be injured during a sprain. The severity of the injury depends on the extent of injury to a single ligament (whether the tear is partial or complete) and the number of ligaments involved, and if any fractures are involved. Effusion of blood and synovial fluid into the joint cavity during a sprain produces joint swelling, local temperature increase, pain or point tenderness, and skin discoloration. Ligaments and joint capsules heal slowly because of a relatively poor blood supply. Nerves in the area often produce a great deal of pain.

Although sprains can occur in the upper and lower parts of the body, the most common site is the ankle. The talus bone and the ends of two of the lower leg bones (tibia and fibula) form the ankle joint. This joint is supported by several lateral and medial ligaments. Most ankle sprains happen when the foot turns inward as a person runs, turns, falls, or lands on the ankle after a jump. This type of sprain is called an *inversion injury*. One or more of the lateral ligaments are injured—usually the anterior talofibular ligament. The calcaneofibular ligament is the second most frequently torn ligament. A more serious ankle sprain often is called a *high ankle sprain*. This happens when the ankle rolls over the foot, and the membrane between the tibia and the fibula is damaged (Figure 17-7).

The knee is another common site for a sprain. A blow to the knee or a fall is often the cause. Twisting also can result in a sprain.

Sprains frequently occur at the wrist, typically when persons fall and land on an outstretched hand.

The usual signs and symptoms of a sprain include pain, swelling, bruising, and loss of the ability to move and use the joint (functional ability). These signs and symptoms vary in intensity, depending on the severity of the sprain. Sometimes a person feels a pop or a tear when the injury happens.

In general, a grade 1 or mild sprain causes overstretching or slight tearing of the ligaments with no joint instability. A person with a mild sprain usually experiences minimal pain and swelling, and little or no loss of functional ability. Bruising is absent or slight, and the person usually is able to put weight on the affected joint. Persons with mild sprains usually do not need an x-ray examination, but such an examination may be performed if the diagnosis is unclear.

A grade 2 or moderate sprain causes partial tearing of the ligament and is characterized by bruising, moderate pain, and swelling. A person with a moderate sprain usually has some difficulty putting weight on the affected joint and experiences some loss of function. An x-ray examination may be needed to determine whether a fracture is causing the pain and swelling. Magnetic resonance imaging is used occasionally to help differentiate between a significant partial injury and a complete tear in a ligament.

A grade 3 or severe sprain completely ruptures ligaments. Pain, swelling, and bruising are usually severe, and the patient is unable to put weight on the joint. An x-ray film usually is taken to rule out a broken bone. This injury may be difficult to distinguish from a fracture or dislocation.

When diagnosing any sprain, the doctor will ask the person to explain how the injury happened and will examine the affected joint and check its stability and ability to move and bear weight. For persons with a severe sprain, particularly of the ankle, a hard cast may be applied.

Rehabilitation includes different types of exercises, depending on the injury. For example, persons with an ankle sprain may be told to rest their heel on the floor and write the alphabet in the air with their big toe. A person with an injured knee or foot will work on weight-bearing and balancing exercises. Rehabilitation commonly lasts for several weeks.

Another goal of rehabilitation is to increase strength and regain flexibility. Depending on the individual rate of

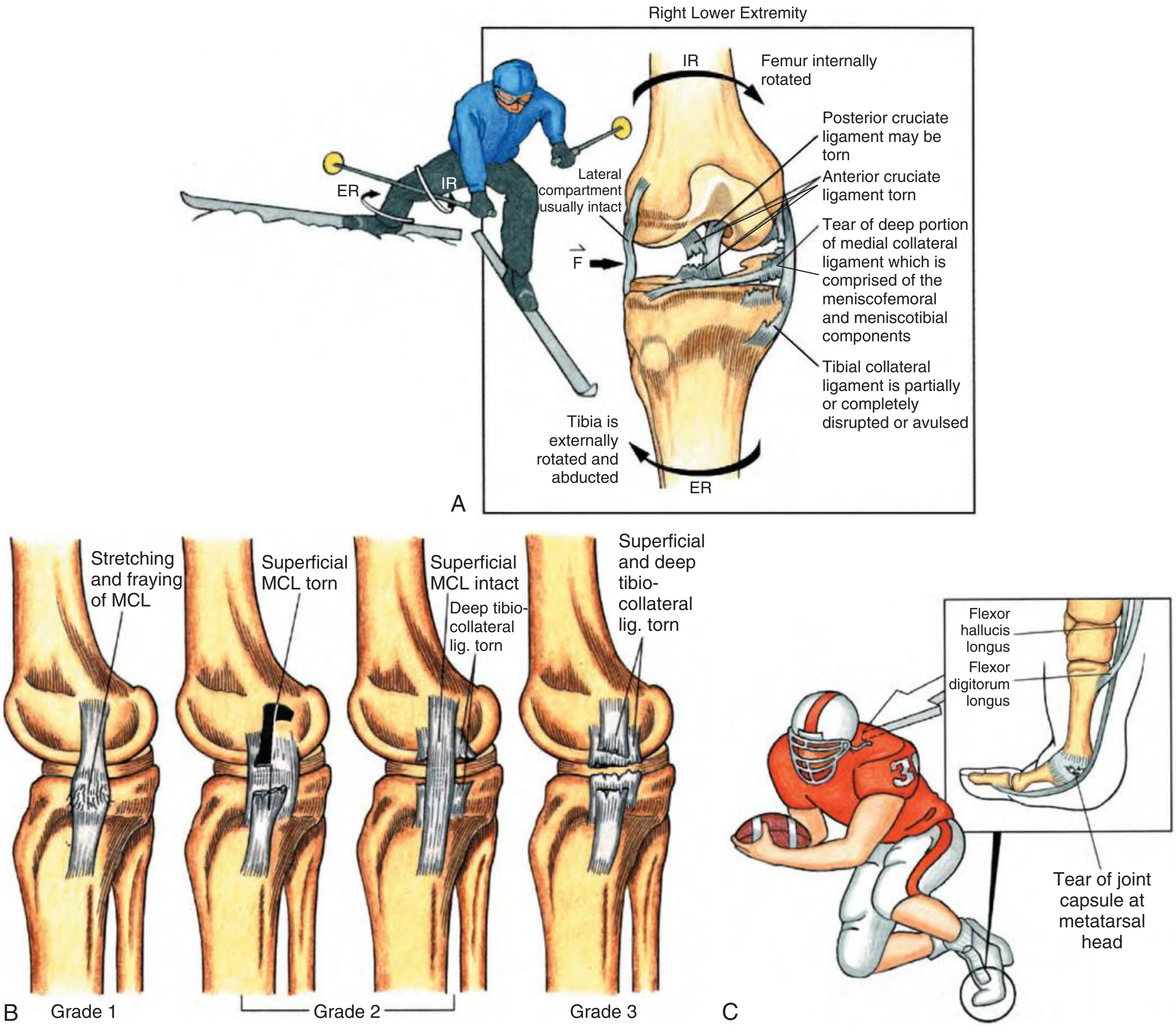


FIGURE 17-6 Examples of sprains. **A,** Anterior cruciate and medial collateral tear with tibial collateral sprain. **B,** Medial collateral ligament sprains. **C,** Turf toe injury in American football player resulting in hyperextension and sprain of the great toe. (From Saidoff DC, McDonough AL: *Critical pathways in therapeutic intervention: extremities and spine,* St Louis, 2002, Mosby.)

recovery, this process begins about the second week after the injury. During this phase of rehabilitation, the client progresses to more demanding exercises as pain decreases and function improves.

The final goal is the return to full daily activities, including sports when appropriate. Sometimes persons are tempted to resume full activity or to play sports despite pain or muscle soreness. Returning to full activity before normal range of motion, flexibility, balance, and strength are regained increases the chance of reinjury and may lead to a chronic problem.

The extent of rehabilitation and the time needed for full recovery after a sprain depend on the severity of the injury and individual rates of healing. For example, a moderate ankle sprain may require 3 to 6 weeks of rehabilitation before a person can return to full activity. With a severe sprain, 8 to 12 months may be needed before the ligament is healed fully.

MASSAGE APPLICATION: STRAINS AND SPRAINS

The following strategies describe how to manage muscle tears and tendon strains and ligament sprains, as well as incisions and skin wounds, and explain why they are addressed in a similar fashion.

Regardless of the soft tissue type and the area of the injury, these injuries result in tissue and fiber separation. For treatment purposes, the injured area can be explained simply as a hole in the tissue created during the injury. Healing involves closing the hole and restoring function.

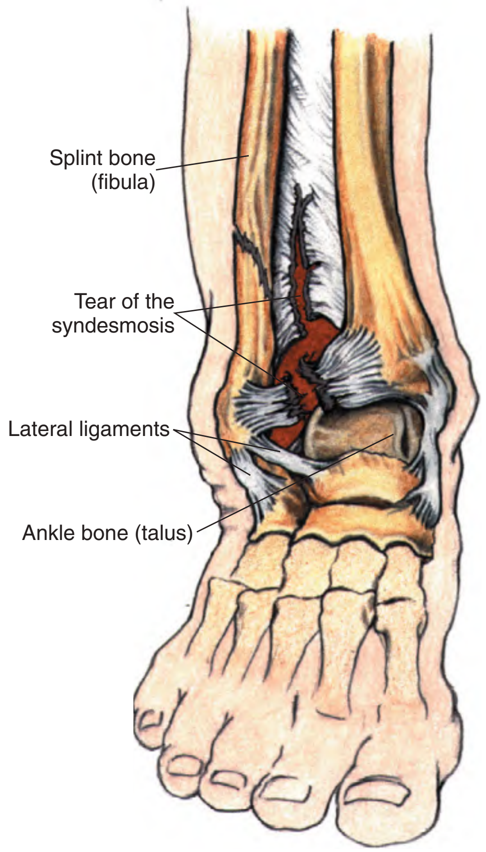


FIGURE 17-7 High ankle sprain. Sprain of the distal tibiofibular syndesmosis, injury to the deltoid or lateral ligaments of the ankle joint. (From Peterson L, Renstrom P: *Sports injuries: their prevention and treatment,* Chicago, 1983, Year Book Medical.)

Appropriate massage application occurs after the medical team has made a diagnosis. These types of injuries typically are graded as first, second, and third degree, or as mild, moderate, and severe. Grade 1 (mild) is a little hole, grade 2 (moderate) is a medium-sized hole, and grade 3 (severe) is a big hole.

Other tissue injuries such as punctures, abrasions, cuts, ulcers, and surgical incisions are "holes" as well. Bone breaks can be conceptualized in the same simple manner.

Healing of these injuries follows a typical pattern in terms of acute, subacute, and remodeling phases (Table 17-1).

Massage can offer support during all stages of the healing process. Tissue healing involves two main processes: regeneration and replacement. *Regeneration* occurs when functional tissue cells regrow. Bone is active regenerative tissue. "Holes" in the bone heal well if the ends of broken bones are lined up and held in that position. Skin heals well, especially if deep, large wounds are sutured.

Muscle tissue does not regenerate well. However, the closer the ends of the breach in the tissue (the hole), the better is the potential for muscle cell regeneration to occur.

Most "holes" heal through the replacement process. Connective tissue that fills up an injury is called a *scar*.

The goal of healing is to create an environment where the least amount of scar tissue is needed to repair the injury. Therefore, strategies used to make the "hole" as small as possible are appropriate. Interventions such as sutures, casts, and immobilization accomplish the goal by sewing the ends of the tissue together or by positioning injured tissues so that they approximate (touch). Little

TABLE 17-1 Stages of Tissue Healing and Massage Interventions

	Stage 1: Acute Inflammatory Reaction	Stage 2: Subacute Repair and Healing	Stage 3: Chronic Maturation and Remodeling
Characteristics	Vascular changes Inflammatory exudate Clot formation Phagocytosis, neutralization of irritants Early fibroblastic activity	Growth of capillary beds into area Collagen formation Granulation tissue; caution necessary Fragile, easily injured tissue	Maturation and remodeling of scar Contracture of scar tissue Collagen aligns along lines of stress forces (tensegrity)
Clinical signs	*Inflammation*	*Decreasing Inflammation*	*Absence of Inflammation*
	Pain before tissue resistance	Pain during tissue resistance	Pain after tissue resistance
Massage intervention	*Protection*	*Controlled Motion*	*Return to Function*
	Control and support effects of inflammation: PRICE Promote healing and prevent compensation patterns: • Passive movement mid-range • General massage and lymphatic drainage with caution Support, rest with full-body massage 3 to 7 days	Promote development of mobile scar: • Cautious and controlled soft tissue mobilization of scar tissue along fiber direction toward injury • Active and passive, open- and closed-chain range of motion, mid-range Support healing with full-body massage 14 to 21 days	Increase strength and alignment of scar tissue: • Cross-fiber friction of scar tissue coupled with directional stroking along lines of tension away from injury • Progressive stretching, and active and resisted range of motion; full range Support rehabilitation activities with full-body massage 3 to 12 months

From Fritz S: *Mosby's fundamentals of therapeutic massage,* ed 5, St Louis, 2012, Mosby.

surgical "holes" are one of the major benefits of arthroscopic and laparoscopic surgical procedures and have represented a major advancement in medical treatment.

Understanding the tissue regeneration or replacement process is important in acute and subacute stages of healing. Any application or activity that brings the ends of the healing tissue apart will prolong healing and increase scar formation. Because scar tissue is nonfunctional tissue that has a tendency to shorten and become nonpliable, the smaller the scar, the better the tissue should function after healing is complete. One of the major errors made during massage is creating forces that disrupt healing by pulling apart the ends of healing tissue. During any tissue breach, the surrounding muscle tissue contracts to pull the ends of the injured tissue together and prevent the ends from separating. This is called *muscle guarding*. Massage must *not* interfere with this appropriate protective response. This appropriate guard response often is mistaken for muscle tension or trigger point activity that should be eliminated. To the contrary, reducing muscle activity and lengthening and stretching the tissue are ineffective and have the potential to prolong, disrupt, and negatively affect the healing process, thereby increasing the likelihood of formation of excessive scar tissue.

The guarding process typically involves co-contractions of agonist and antagonist muscle groups around the injured area. This appropriate process further stabilizes the area, protecting the healing area and keeping the torn tissue ends close together. The result is a temporary reduction in range of motion of the area and the sensation of stiffness or a knot. Again, this process must not be disturbed during acute and early subacute healing stages. Stretching and aggressive joint movement techniques are inappropriate at this time.

Frictioning and compressing in the early stages of tissue healing is inappropriate as well. This approach to massage is contraindicated during acute and early subacute stages. Errors in massage application include mistaking grade 1 and 2 injury, particularly in deeper layers of the muscle, for trigger point activity, and applying these methods too soon during the healing process. Friction will disturb the formation of healing tissue, and compression into the injured area *may spread* the fibers and disturb tissue formation.

TREATMENT STRATEGIES

Methods that are appropriate during acute and early subacute phases of healing include general full-body massage as described in this text to support the restorative capacity. Perform massage as often as feasible, with every other day being ideal. Include in the general massage the area of the injury (Figure 17-8).

Acute Phase

During the first 24 hours, PRICE should be used. Because it is assumed that the medical team has evaluated the injury, the massage therapist should follow all recommendations. If pain medication is prescribed, the therapist needs to evaluate and factor into the treatment approach the possible interaction with massage. Pain medication and antiinflammatory drugs alter pain mechanisms. Therefore, the therapist must monitor pressure levels carefully. Massage application must not produce pain in the injured area during this stage.

With medical team approval, massage can be applied to the injured tissue in a specific and precise manner to approximate (push together) the ends of the torn tissue. This method should be applied only to tissue that can be accessed easily from the body surface around joints, such as ankle and knee, or to pulls and tears in surface muscles. The method is ineffective for muscle tears in deeper layers and for tendons and ligaments that are deep to surface tissue. The approach works because injured tissue is sticky during the first 48 hours after injury. Massage is applied to push the tissue together mechanically with the intention of decreasing the size of the "hole" by approximating the injured tissues of the hole to encourage the torn ends to stick together. This should be a beneficial strategy because the smaller the hole, the faster the healing.

Identification of the exact location of the injury is necessary. This usually is indicated by a painful point, and the athlete can best locate this spot if the trainer or other medical personnel have not located it for you. Understanding the anatomic structure of the area is essential because a deliberate stroke is applied in the direction of tendon, ligament, or muscle fibers so that the sticky ends of the new injury touch. The application must not be painful, and it must not create additional inflammation or specifically touch the injury. This method is repeated for up to 5 minutes and is applied slowly and rhythmically. The hand is lifted and is repositioned for each stroke, allowing crowding together of the tissue ends. This method can be repeated 3 to 4 times per day within the first 3 days of the injury. If during the acute injury phase, the area surrounding the injury becomes excessively stiff and painful, the area can be shaken rhythmically and gently for up to 10 minutes. This repetitive movement will decrease swelling and guarding just a bit, making the client more comfortable.

Subacute Phase

Massage in the subacute phase is best given every other day and involves full-body massage to address any compensation resulting from the body protecting the injury. This can occur as guarding, changes in gait from limping, or altered sleep patterns. Applying massage to corresponding reflex areas as indicated can help manage pain, normalize some tension, and reduce mild compensation (see Figure 4-1, p. 47).

Massage can begin to reduce tension by 50% in muscles that are guarding at the injury site. Work on larger surface muscles in the area. Do not massage deeper stabilizing groups because these muscles are still providing a protective function.

Continue with strokes at the injury site in the opposite direction, gradually increasing pressure and drag over the typical 10-day subacute period. Light cross-fiber (bend and shear) force can be applied 5 to 7 days after injury. This application should not cause pain.

Remodeling Phase

Massage should be performed 2 to 3 times per week. The injured area should be filled completely with connective tissue and some tissue regeneration. Muscle guarding is still present, particularly in the deep stabilizing muscles, but movement in the mid-range with application of a moderate resistance load should not be painful. The intent of massage at this point is to encourage strength and function of the new tissue. Gradually, over the next 4 weeks, tension in the deep stabilizing muscles should be reduced as muscle strength increases in the injured area. Massage is applied across the grain of the fibers to encourage scar

FIGURE 17-8 Examples of massage of grade 1+ lateral ankle sprain. **A,** Acute, 24 to 48 hours. Palpate most tender area. **B,** Manage swelling with lymphatic drain. **C,** Gently approximate tissues over sprain. **D,** Subacute: tension force. **E,** Subacute: reduce guarding general massage. **F,** Remodeling: reduce guarding, address trigger points.

FIGURE 17-8, cont'd **G,** Remodeling: support pliable scar formation using shear force. **H,** Move tissue into ease. **I,** Move tissue into bind. **J,** Massage tissues around fibular head while client moves ankle in slow circles.

mobility and to reduce adhesion. This massage application can be mildly painful but not so intense as to cause flinching or inflammation.

Massage is applied across fiber direction to the entire length of the injured structure, be it a ligament or a tendon and attached muscle. Pressure, drag, and force introduced to the healing area gradually increase over the 4-week interval. The area should not be painful during movement the next day. However, it may be a bit sore to touch. This massage application is included in the context of full-body general massage with continued awareness of compensation patterns.

By the end of this treatment phase, 6 to 8 weeks has passed. It takes up to 6 months for a grade 1 to 2 injury to heal fully and 6 to 12 months for a grade 2 to 3 injury to heal fully. During this time, the massage therapist should address the area periodically with the cross-fiber massage process as previously described.

This procedure sequence can be used for any wound, sprain, or strain. The method is most effective for grade 1 and 2 injuries. Grade 3 injuries take longer to heal and may have had some sort of medical intervention such as surgery, casting, or other stabilization. Each of the three healing stages is longer with severe injuries, and the acute phase may last up to a week. Swelling that occurs with these types of injuries is managed with lymphatic drainage. Surgery creates swelling just as traumatic injury does, but it is much more controlled; therefore, the actual tissue damage is minimized. Arthroscopic surgery is a wonderful advancement in joint surgery; however, during the procedure, fluid is introduced into the joint capsule, which helps separate the joint, allowing the procedure to wash away any debris and keeping the field of vision clear for the surgeon. The body has to remove any water left in the joint cavity after the procedure is complete. Restoring range of motion as quickly as possible helps the body absorb and eliminate the intracapsular fluid, which helps the joint heal after the procedure. Swelling beyond the acute phase must be managed for all injuries, and lymphatic drainage massage is one of the most effective methods. Lymphatic drainage is described in Unit Two.

With more severe injuries, massage treatment needs to be more focused to manage compensation patterns and edema from body adjustment to the injury and rehabilitation activities such as weight training and range-of-motion activities. Scar mobility and return to function are the goals.

Log on to your Evolve website to view Video 17-1: Therapeutic Massage Application for Wounds, Strains, and Sprains.

CHRONIC SOFT TISSUE INJURIES

Objective

1. Describe and apply appropriate massage for the following common syndromes and injury categories:
   h. Chronic muscle injury

Chronic soft tissue injuries consist of a low-grade inflammatory process with a proliferation of fibroblasts and scarring. An acute injury that is managed improperly or an athlete who returns to activity before healing is complete can contribute to a chronic injury.

MYOSITIS AND FASCIITIS

In general, the term *myositis* means inflammation of muscle tissue. More specifically, it can be considered a fibrositis, or connective tissue inflammation. Fascia that supports and separates muscle can become chronically inflamed after a traumatic or repetitive injury. A typical example of this condition is plantar fasciitis.

TENDON INJURIES

Tendinopathy describes two conditions that are likely to occur together: tendon inflammation, known as *tendonitis*, and tiny tears in the connective tissue in or around the tendon, known as *tendinosis*. The tendon contains wavy parallel collagenous fibers that are organized in bundles surrounded by a gelatinous material that decreases friction. A tendon attaches a muscle to a bone and concentrates a pulling force in a limited area. When a tendon is loaded by tension, the wavy collagenous fibers straighten in the direction of the load; when tension is released, the collagen returns to its original wavy shape. In tendons, collagen fibers will break if their physiologic limits have been exceeded. A breaking point occurs after a 6% to 8% increase in length. Because a tendon has usually double the strength of the muscle it serves, tears most commonly occur in the muscle belly, the musculotendinous junction, or a bony attachment (Figure 17-9).

Tendon injuries usually progress slowly over a long time. Repeated acute injuries can lead to a chronic condition. Constant irritation caused by poor performance techniques or ongoing stress beyond physiologic limits eventually can result in a chronic condition.

Repeated microtrauma from overuse can evolve into chronic muscle strain, resulting in reabsorption of collagen fibers and eventual weakening of the tendon or other connective tissue structures. Collagen reabsorption also occurs in the early period of sports conditioning. During reabsorption, collagenous tissues are weakened and are susceptible to injury; therefore, a gradually paced conditioning program process is necessary.

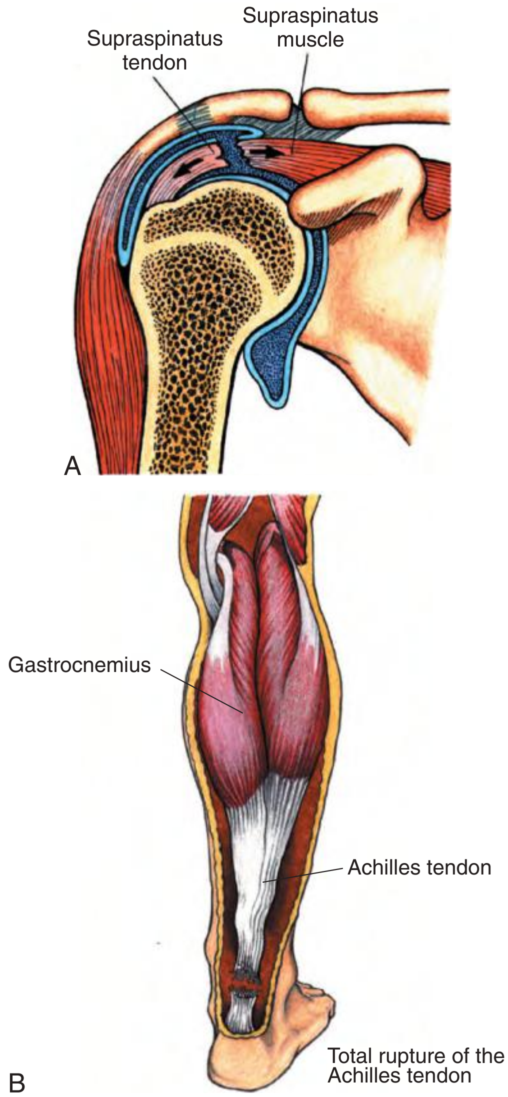


FIGURE 17-9 Tendon injuries. **A,** Full-thickness tear of the rotator cuff tendons. **B,** Total rupture of Achilles tendon. (**A** from Saidoff DC, McDonough AL: *Critical pathways in therapeutic intervention: extremities and spine,* St Louis, 2002, Mosby. **B** from Peterson L, Renstrom P: *Sports injuries: their prevention and treatment,* Chicago, 1983, Year Book Medical.)

Tendonitis is inflammation or irritation of a tendon. Tendonitis is characterized by gradual onset, diffuse tenderness because of repeated microtraumas, and degenerative changes. Obvious signs of tendonitis are swelling and pain.

This condition, which causes pain and tenderness just outside a joint, is most common around the shoulders, elbows (tennis elbow), and knees, but it also can occur in the hips and wrists.

Tendons usually are surrounded by a sheath of tissue similar to the lining of the joints (synovium). They are subject to wear and tear, direct injury, and inflammatory diseases. The most common cause of tendonitis is injury or overuse. Occasionally, an infection within the tendon sheath is responsible for the inflammation. This condition also may be associated with diseases such as rheumatoid arthritis. *Tenosynovitis* is inflammation of the synovial sheath surrounding a tendon. In its acute stage, pain onset is rapid and **articular crepitus** (crackling noise or vibration produced during joint movement) and diffuse swelling are noted. In chronic tenosynovitis, the tendons become locally thickened, with pain and articular crepitus present during movement.

Tendonitis produces pain, tenderness, and stiffness near a joint and is aggravated by movement. The type of tendonitis typically is named for the associated joint. For instance, tennis elbow causes pain on the outer side of the forearm near the elbow when the forearm is rotated, especially when the hand is gripping, which involves the wrist. Achilles tendonitis causes pain just above the heel. Adductor tendonitis leads to pain in the groin, patellar tendonitis causes pain just below the kneecap, and biceps tendonitis leads to shoulder pain. If the tendon sheath becomes scarred and narrowed, this may cause locking of the tendon, as seen with trigger finger.

Risk factors for developing tendonitis include excessive repetitive motions of the arms or legs. For instance, baseball players, swimmers, tennis players, and golfers are susceptible to tendonitis in their shoulders, arms, and elbows. Soccer and basketball players, as well as runners and dancers, are more prone to tendon inflammation in their legs and feet.

Improper technique in any sport is one of the primary causes of overload on tissues such as tendons, which can contribute to tendinopathy.

Sometimes the discomfort of tendinopathy disappears within a matter of weeks, especially if the joint area is rested and iced. In elderly persons and those who continue to use the affected area, tendonitis often heals more slowly and is more likely to progress to a chronic condition termed **tendonosis**. Tendonosis often involves a change in the structure of the tendon to a weaker, more fibrous tissue.

If tendonitis is severe and leads to the rupture of a tendon, surgical repair may be required. This is almost certainly the case if the rupture occurs in the Achilles tendon. Usually, rest and medications to reduce pain and inflammation are the only treatments required. The pain of tendonitis is usually worse with activities that use the muscle that is attached to the involved tendon. Appropriate massage that can support healing is described on p. 306.

Atrophy and Contracture

Two complications of muscle and tendon conditions are **atrophy** and **contracture**. Muscle atrophy is the wasting away of muscle tissue. The main cause of atrophy in athletes is immobilization of a body part, inactivity, or loss of nerve stimulation. A second complication is muscle contracture–an abnormal shortening of muscle tissue with a great deal of resistance to passive stretch. A contracture is associated with a joint that, because of muscle injury, has developed unyielding scar tissue. Whether inflammation or fibrosis is present determines the type of massage used. Inflammation can be caused by rubbing short structures, and massage should focus on restoring normal length to muscles and connective tissue in the area. Therapeutic exercise is necessary to strengthen muscles that have been inhibited. If tissue has become fibrotic, connective tissue methods are used to restore pliability.

Treatment

The goals of tendonitis treatment are to relieve pain and reduce inflammation. Tendonitis is treated with PRICE.

Steroid injection into tissue or around a tendon may be used to relieve tendonitis. Injections of cortisone reduce inflammation and can help ease pain. These injections must be used with care because repeated injections may weaken the tendon or cause undesirable side effects. *Do not massage over an injection site.* The steroid works by pooling around the inflamed area. Massage disperses the medication.

Persons with tendonitis and tendonosis also may be helped by a program of specific exercise designed to strengthen the force-absorbing capability of the muscle-tendon unit. When a tendon is torn, a reconstructive operation may be necessary to clean inflammatory tissue out of the tendon sheath or to relieve pressure on the tendon by removing bone. Surgeons can repair tendon tears to reduce pain, restore function, and, in some cases, prevent tendon rupture.

To avoid recurrence of tendinopathy, warming up before exercising and cooling down afterward is important. Strengthening exercises may help prevent further episodes of tendinopathy.

BURSITIS, CAPSULITIS, AND SYNOVITIS

The soft tissues that are an integral part of the synovial joint can develop chronic problems.

Bursitis

Bursae are fluid-filled sacs found in places at which friction might occur within body tissues. Bursae provide protection between tendons and bones, between tendons and ligaments, and between other structures where there is friction. Sudden irritation can cause acute **bursitis**. Overuse of muscles or tendons and constant external compression or trauma can result in chronic bursitis.

Signs and symptoms of bursitis include swelling, pain, and some loss of function. Repeated trauma may lead to calcific deposits and degeneration of the internal lining of the bursa. Bursitis in the knee, elbow, and shoulder is common among athletes. Massage can be used to lengthen the shortened structures, reducing friction. Use of muscle energy methods and inhibiting pressure at the belly or at muscle attachments can affect muscle tension. Connective tissue application is beneficial for increasing pliability. Ice applications and rehabilitative exercise are indicated.

Short-term use of antiinflammatory medication may be helpful. Steroid injections at the site are a common treatment. Massage is contraindicated in the area of steroid injection until the medication is absorbed completely by the body. A safe waiting period for massage is 5 to 7 days. Massage application should not increase inflammation in the area.

Capsulitis

Capsulitis is an inflammation process affecting the joint capsule. Usually associated with capsulitis is **synovitis**, which is inflammation of the synovial membrane. Synovitis occurs acutely, but usually chronic conditions arise with repeated joint injury or with joint injury that is managed improperly. Chronic synovitis involves active joint congestion with edema. As with the synovial lining of the bursa, the synovium of a joint can undergo degenerative tissue changes. Several movements may be restricted, and joint noises such as grinding or creaking may be noted. Again, massage is focused on managing pain and supporting mobility without creating irritation. Massage with mechanical force application may be used to increase pliability of the joint capsule in these conditions as long as the inflammatory response is not increased.

Acute Synovitis

The synovial membrane of a joint can be injured acutely by a contusion or a sprain. Irritation of the membrane causes an increase in fluid production, and swelling occurs in the capsule. The result is joint pain during motion, along with skin sensitivity from pressure at certain points. In a few days with proper care, the excessive fluid is absorbed, and swelling and pain are diminished. This condition is managed best by the athletic trainer.

Massage Strategies for Tendonitis and Bursitis

Observe the following massage strategies for clients with tendonitis and bursitis:

1. Initially the inflamed tendon or bursa area is not directly massaged. Instead the area is iced. Massage is targeted to reducing the reason for inflammation by lengthening the shortened tissue.

   Progressively deep gliding is applied from the least affected muscle attachment over the muscle belly and stops just before the area of inflammation is reached. For example, Achilles tendonitis would be treated with gliding beginning at the knee and ending at the Achilles attachment. The depth of pressure and drag gradually increases, with the method applied up to 10 times during each massage session. Corresponding reflex areas also are addressed (i.e., ankle, wrist, and forearm).
2. The next step is to apply sustained compression in the muscle belly of the inflamed tendon while the client moves the affected jointed area in a slow range of motion, usually a circle, but sometimes back and forth. This method is followed by gliding as described in step 1. These strategies typically are used for 3 to 10 sessions.
3. Once no significant improvement is noted, add connective tissue methods as described in Unit Two. Active release and kneading are effective. Do not massage directly on the specific location of the inflammation. Treatment should be combined with steps 1 and 2 and should span several sessions.
4. If after a reasonable treatment period (6 to 10 weeks) the tendon or bursa remains painful, controlled use of deep transverse friction can be attempted. Friction would be applied along with the first three steps of this protocol and would be repeated every other day for 1 to 2 weeks, then reduced to every third day. Improvement should be noted in the first 2 weeks to justify continued use of deep transverse friction.

For these massage strategies to be successful, the client needs to ice the area consistently, be involved in appropriate rehabilitation, and be consistent with massage sessions.

CHRONIC JOINT INJURIES

Objective

1. Describe and apply appropriate massage for the following common syndromes and injury categories:
   i. Degenerative joint disease
   j. Dislocation

DEGENERATIVE JOINT DISEASE

As with other chronic physical injuries or problems, chronic synovial joint injuries stem from microtrauma and overuse. The two major categories are **osteochondrosis** and **traumatic osteoarthritis**. A major cause of **chronic joint injuries** is failure of the muscles to control or limit deceleration during eccentric function. Athletes can avoid such injuries by avoiding chronic fatigue and training when tired and by wearing protective gear to enhance absorption of impact forces (Figure 17-10).

Traumatic arthritis is usually the result of accumulated microtraumas. With repeated trauma to articular joint surfaces, the bone and the synovium thicken, and pain, muscle spasm, and articular crepitus (grating on movement) occur. Joint wear leading to arthritis can result from repeated sprains that leave a joint with weakened ligaments. Joint wear can arise from misalignment of the musculoskeletal structure, which stresses joints, or it can arise from an irregular joint surface caused by repeated articular chondral injuries. Loose bodies that have been dislodged from the articular surface can irritate and produce arthritis. Athletes with joint injuries that are immobilized improperly or who are allowed to return to activity before proper healing has occurred eventually may be afflicted with arthritis. Massage applications for chronic joint injury are managed with palliative care to control pain, and the following protocol is added during the general massage protocol.

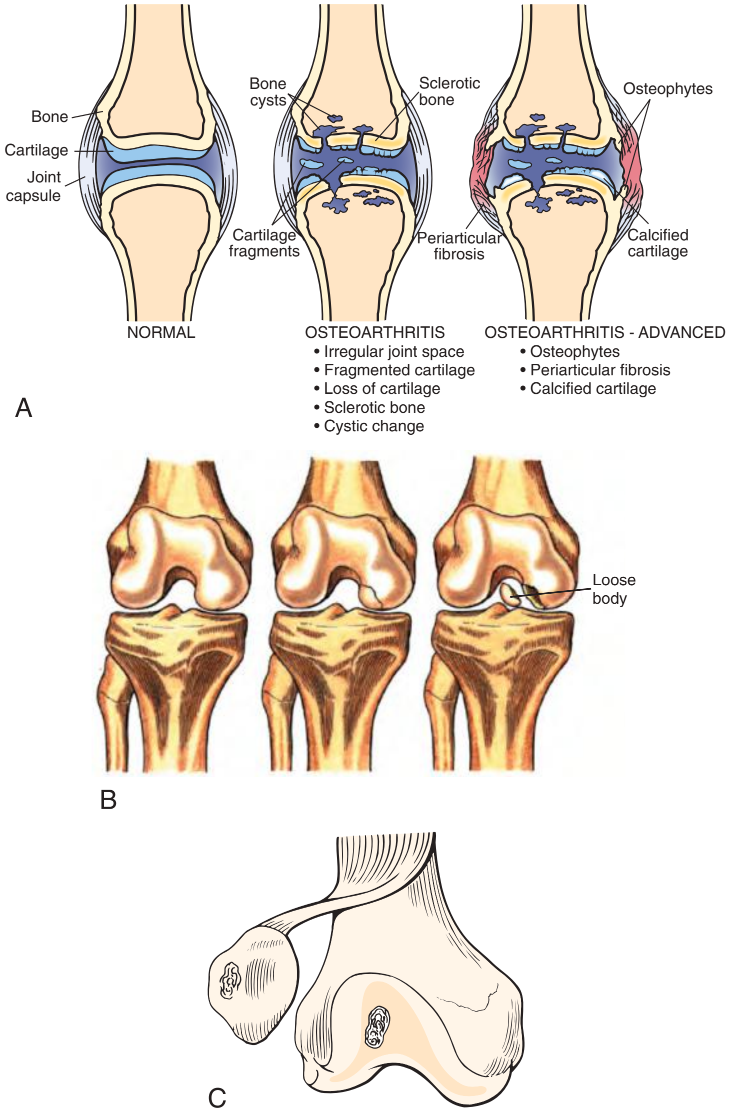


FIGURE 17-10 Degenerative joint disease. (**A** from Damjanov I: *Pathology for health-related professions,* ed 2, Philadelphia, 2000, Saunders. **B** and **C** from Saidoff DC, McDonough AL: *Critical pathways in therapeutic intervention: extremities and spine,* St Louis, 2002, Mosby.)

MASSAGE FOR ARTHROSIS AND ARTHRITIS

Repetitive impact and joint trauma predispose the joints to arthritic development. Therapeutic massage has benefits as part of a comprehensive treatment program for chronic joint pain and mobility. Neuromuscular involvement is of two types: guarding response and inhibition.

Guarding is the response of the body to protect the joint. Guarding occurs with an isometric co-contraction of the muscles that surround an affected joint. The strategy is a good one if it occurs during the acute phase of an injury for a short time but is problematic with chronic problems such as arthritis. Guarding compresses the joint space, reduces mobility, and causes an uneven force distribution throughout the joint, which over the long term aggravates the arthritic condition. An arthritic joint needs mobility to encourage synovial fluid production and cartilage health. Co-contraction of the guarding response reduces mobility by increasing muscle shortening in the agonist/antagonist muscles that surround the joint, compressing the bone ends in the joint capsule.

Flexors, internal rotators, and adductor muscle groups exert more pull than extensors, external rotators, and abductors during co-contraction, and joint fit is altered because flexors, internal rotators, and adductors are compressing the bone ends to a greater degree than extensors, external rotators, and abductors. Anytime the joint does move, the bone end can rub, increasing inflammation and further damaging the cartilage.

Massage can manage the guarding response and encourage more normal neuromuscular function. Normalizing gate and muscle activator firing pattern sequences is important. Short, tense muscles can be inhibited by muscle energy methods and lengthening. Compression applied at the muscle belly or at the attachments affects muscle spindle cells or Golgi tendon receptors, allowing motor tone to reduce and muscles to lengthen to a more normal resting length. Trigger point activity specifically located in the muscle belly of short muscles can be addressed with trigger point methods. Do not treat trigger points in a long inhibited muscle. Address reflex areas in paired joints, such as knee/elbow, ankle/wrist, toes/fingers, hip/glenohumeral joint, and sacroiliac joint/sternoclavicular joint.

Arthritic joints tend to display increased edema. Extracapsular fluid around the joint limits movement and can inhibit normal muscle function, especially firing patterns. Lymphatic drainage methods are effective. An increase in intracapsular fluid (effusion) is an attempt to keep bone ends separated, and under most conditions it should be left untreated during massage. If the fluid inside the capsule becomes excessive, treatment is best left to the doctor. Needle aspiration can relieve pressure. Synvisc, or artificial synovial fluid, can be injected into the joint space if insufficient intracapsular fluid exists. Treatment of arthritis is a condition management situation because guarding and edema usually recur. Ideally, massage would be given every other day, but massage given 2 times per week can be effective in symptom management.

Pain is another issue with arthritic joints. All pain management massage methods are appropriate, with massage creating counterirritation and hyperstimulation analgesia. Use of a counterirritant ointment with capsicum is helpful if the skin will tolerate it.

Antiinflammatory medications are commonly prescribed. Side effects and symptoms affect the heart, kidney, liver, and gastrointestinal system. These medications can thin blood, and bruising is likely. Massage pressure and intensity need to be altered. Make sure compression during massage is broad-based, and avoid friction. Massage methods should not increase inflammation. Antiinflammatory essential oils mixed in with the massage lubricant are appropriate.

Hydrotherapy is effective for arthritic joints. (See Unit Two.) In general, ice goes on the joint, and heat is applied to surrounding soft tissue.

All methods used to treat **degenerative joint disease** seek to reduce pain and increase mobility, but not reduce stability. In the rare situation that steroid injection is used, massage is contraindicated in the area.

Note: Rheumatoid arthritis is a systemic disease and is not discussed in this text.

DISLOCATION AND DIASTASIS

Dislocations are second to fractures in terms of disabling the athlete (Figure 17-11). A dislocation is an injury in which the ends of the bones that form a joint are forced from their normal positions. The cause is usually trauma, such as a hard blow to a joint or a fall. In some cases, an underlying disease such as rheumatoid arthritis may cause dislocation of a joint.

The highest incidence of dislocation involves the fingers and the shoulder joint. Dislocations, which result primarily from forces causing the joint to go beyond its normal anatomic limits, are divided into two classes: **subluxation** and **luxation**. Subluxations are partial dislocations in which an incomplete separation between two articulating bones occurs. Luxations are complete dislocations, presenting total disunion of bone apposition between articulating surfaces. Dislocations are common injuries in contact sports, such as football and hockey, and in sports that may involve falls, such as downhill skiing, gymnastics, and volleyball.

Dislocations may occur in major joints–shoulder, hip, knee, elbow, or ankle–or in smaller joints, such as a finger, thumb, or toe. The injury temporarily deforms and immobilizes the joint and may result in sudden and severe pain.

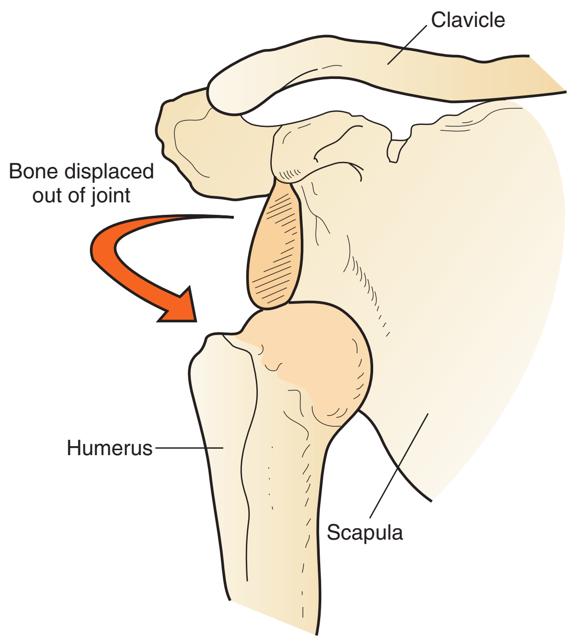


FIGURE 17-11 Shoulder dislocation. (From Salvo SG, Anderson SK: *Mosby's pathology for massage therapists,* ed 2, St Louis, 2008, Mosby.)

Signs and symptoms of a dislocation may include the following:

- A deformed and immovable joint
- Swelling
- Intense pain
- Tingling or numbness near the injury

At times, x-ray examination of the dislocation, as with a fracture, is the only absolute diagnostic measure. First-time dislocations or joint separations may result in rupture of the stabilizing ligamentous and tendinous tissues surrounding the joint, and in avulsion, or pulling away from the bone. Trauma is often so violent that small chips of bone are torn away with the supporting structures (avulsive fracture), or the force may separate growth epiphyses or cause a complete fracture of the neck in long bones. These possibilities indicate the importance of administering complete and thorough medical attention for first-time dislocations.

Two types of **diastasis** may occur: a disjointing of two bones parallel to one another, such as the radius and ulna and tibia and fibula (usually called a *high ankle sprain*); and the rupture of a "solid" joint, such as the symphysis pubis. A diastasis commonly occurs with a fracture.

Treatment

A dislocation requires prompt medical attention, returning bones to their proper positions without damaging the joint structure. Depending on the amount of pain and swelling, a local anesthetic may be administered before reduction.

Surgery is required if blood vessels or nerves are damaged, or if the doctor cannot move the dislocated bones back into their correct positions. Surgery also may be necessary because lax joint capsules or ligaments stretched during the injury cause predisposition to recurring dislocations.

The doctor may immobilize the joint with a splint or sling and may prescribe a pain reliever and a muscle relaxant. After the splint or sling has been removed, a slow and gradual rehabilitation program is provided to restore stability, range of motion, and strength of the joint. The client should avoid strenuous activity involving the injured joint until full movement is regained and normal strength and stability of the joint are achieved.

It often has been said, "Once a dislocation, always a dislocation." In some cases, this statement is true because once a joint has been partially or completely dislocated, the connective tissues that stabilize and hold it in its correct alignment are stretched to such an extent that the joint will be vulnerable to subsequent dislocations. Chronic, recurring dislocations may take place without severe pain because of the slack condition of stabilizing tissues. The massage practitioner needs to be aware of any history of dislocation. Increased muscle tension and connective tissue formations may occur around the dislocated joint as an appropriate stabilization process. The massage therapist needs to take care to maintain joint stability while supporting mobility. Do not lengthen shortened structures to the point that the joint is vulnerable to another dislocation.

With a fairly simple dislocation without major nerve or tissue damage, the joint likely will return to a near or fully normal condition. As with most injuries, returning to activity too soon may cause reinjury to the joint or may dislocate it again. Massage therapists must acknowledge the instability of dislocated joints. Muscle guarding around the joint provides stability. Massage manages muscle tension that is excessive without interfering with joint stability. Typically, the massage application is inhibiting compression in the belly of the excessively short muscle without stretching. The lengthening response is enough to reduce pain and increase mobility. If lengthening or stretching is necessary, the massage is applied only directly to the tissue. Movement of the joint to stretch the area is not recommended. Also, massage corresponding reflex areas such as shoulder/hip and elbow/knee.

BONE INJURIES

Objective

1. Describe and apply appropriate massage for the following common syndromes and injury categories:
   k. Bone injury

Because of its viscoelastic properties, bone will bend slightly. However, bone is generally brittle and is a poor shock absorber because of its mineral content. This brittleness increases under tension forces more than under compression forces. **Bone injuries** generally can be classified as **periostitis**, **acute bone fractures**, and **stress fractures**.

PERIOSTITIS

An inflammation of the periosteum can result from various sports traumas, mainly contusions or attachments of short soft tissue structures. Periostitis often appears as skin rigidity of the overlying muscles. It can occur as an acute episode or can become chronic. The lymphatic drainage type of massage is indicated.

ACUTE BONE FRACTURES

A bone fracture can occur as a partial or complete break of a bone. Fracture can occur without external exposure or can extend through the skin, creating an external wound (open fracture). Because of normal tissue remodeling, a bone may become vulnerable to fracture during the first few weeks of intense physical activity or training. Weight-bearing bones undergo bone reabsorption and become weaker before they become stronger.

Fractures can result from direct trauma, and the bone breaks directly at the site where a force is applied. A fracture that occurs some distance from where force is applied is called an *indirect fracture*. A sudden, violent muscle contraction or repetitive abnormal stress to a bone also can cause a fracture (Figure 17-12).

STRESS FRACTURES

Another type of bone break is a stress fracture. The exact cause of stress fracture is not known, but a number of likely possibilities are known, such as overload caused by muscle contraction, altered stress distribution in the bone accompanying muscle fatigue, change in ground traction force such as movement from a wood surface to a grass surface, or performance of a rhythmically repetitive stress such as distance running.

Early detection of the stress fracture may be difficult. Because of their frequency in a wide range of sports, stress fractures always must be suspected in susceptible body

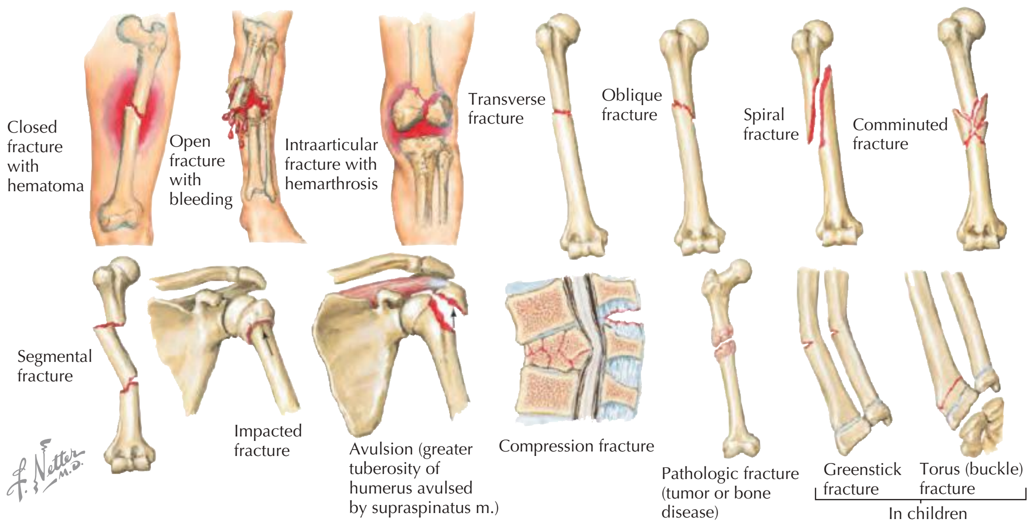


FIGURE 17-12 Fracture types. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

areas that fail to respond to usual treatment. The most common sites of stress fracture are the tibia, fibula, metatarsal shaft, calcaneus, femur, lumbar vertebrae, ribs, and humerus.

Major signs of a stress fracture include swelling, focal tenderness, and pain. In early stages of the fracture, the athlete complains of pain when active but not at rest. Later, the pain is constant and becomes more intense at night. Percussion by light tapping on the bone at a site other than the suspected fracture will produce pain at the fracture site.

Management of stress fractures varies with the individual athlete, the injury site, and the extent of injury. Stress fractures that occur on the concave side of bone heal more rapidly and are managed more easily compared with those on the convex side. A stress fracture on the convex side can rapidly become a complete fracture.

Treatment

Bone is an active tissue that regenerates well. It heals completely as long as initial treatment is appropriate. Treatment of fractures typically involves realignment of the broken segments of bone (reduction). Some fractures, such as stress fractures, do not require reduction. Simple fractures can be treated with closed reduction and immobilization (cast). More complicated fractures may require more complicated surgical repair involving use of various pins, screws, and plates. Infection is a great concern if the bone penetrates the skin. The massage practitioner needs to be aware of the potential for stress fractures and must refer the client if necessary.

Complete fracture healing takes a minimum of 6 weeks and much longer if the injury is complex. Bone heals well if conditions are present that support healing such as proper nutrition, appropriate rehabilitation from qualified medical professionals, stress management, and restorative sleep.

Massage Application to Support Fracture Healing

Massage application does not address bone fractures directly. Instead massage supports general healing and any compensation from changes resulting from use of various types of immobilization or crutches, changes in gait, or postural stabilization.

When applying massage during the first 1 or 2 weeks, completely avoid the area of the fracture, and as always be attentive to sanitation during the massage. The massage should be relaxing, nonpainful, and focused to support parasympathetic dominance. Sufficient pressure needs to be used during the general massage to generate a serotonin and endorphin response to aid in pain management.

As the client becomes more mobile, compensation develops in response to the fracture, treatment, and rehabilitation. General massage can be expanded to address neighboring areas that are sore and aching. These adaptations often occur in the neck, shoulder, and low back areas in the postural muscles. Muscle guarding commonly occurs around the fracture area. This tension pattern will not shift while the area is in acute and subacute healing phases. General pain control measurements are used to help the client be more comfortable. Avoid any deep or aggressive methods. Repetitive light stroking or gentle holding of tissues that are aching in response to guarding can generate hyperstimulation analgesia. Massage in the corresponding reflex areas can increase comfort. For example, if the break occurs in the right lower leg (fibula), massage the left forearm.

Once the immobilization (cast or other) is removed and with approval from the medical team, soft tissue mobilization around the break can begin. The forces used are applied so as not to disturb the healing bone. Instead, the tissues generally are moved around the bone. Tension and torsion forces are used to increase soft tissue pliability in the area of immobilization, where tissue often becomes atrophied and dense. The process is gentle at first, moving tissues into and out of bind. Drag is increased over the following weeks of rehabilitation. Therapeutic exercises will reverse the atrophy of surrounding muscles. If surgical areas exist, the same approach is used in the specific incision areas and for scar tissue management.

NERVE INJURIES

Objective

1. Describe and apply appropriate massage for the following common syndromes and injury categories:
   l. Nerve injury

The two main forces that cause major nerve injury are compression and tension. As with injuries to other tissues in the body, nerve injury may be acute or chronic. Injured peripheral nerve tissue can heal over time (Figure 17-13).

Any number of traumas directly affecting nerves can produce a variety of sensory responses, including pain. For example, a sudden nerve stretch or pinch (burners, stingers) can produce muscle weakness and a sharp burning pain that radiates down a limb. Neuritis, a chronic nerve problem, can be caused by a variety of forces that usually have been repeated or continued for a long time. Symptoms of neuritis can range from minor nerve problems to paralysis.

Pain felt at a point of the body other than its actual site of origin is known as *referred pain*. Another potential cause of referred pain is a trigger point, which occurs in the muscular system. Massage applications for **nerve injuries** are palliative to reduce pain. If the nerve is being impinged by short muscles and fascia, massage can be used to restore normal length of these tissues and reduce pressure on the nerve.

NERVE IMPINGEMENT

Nerve impingement commonly is called a *pinched nerve*. Two types of impingement exist: **entrapment** and **compression**.

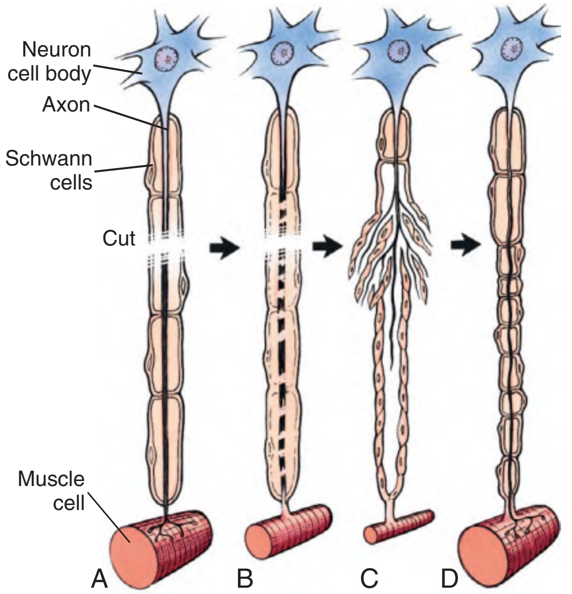


FIGURE 17-13 Repair of a peripheral nerve fiber. **A,** Injury results in a cut nerve. **B,** Immediately after the injury occurs, the distal portion of the axon degenerates, as does its myelin sheath. **C,** The remaining neurilemma tunnels from the point of injury to the effector. New Schwann cells grow within this tunnel, maintaining a path for regrowth of the axon. Meanwhile, several growing axon sprouts appear. When one of these growing fibers reaches the tunnel, it increases its growth rate, growing as much as 3 to 5 mm per day. (The other sprouts eventually disappear.) **D,** The connection of the neuron with the effector is reestablished. (From Thibodeau GA, Patton KT: *Anatomy and physiology,* ed 7, St Louis, 2009, Elsevier.)

Entrapment results when soft tissue (e.g., muscles, ligaments) exerts inappropriate pressure on nerves; compression occurs when hard tissue (e.g., bone) exerts inappropriate pressure on nerves. Regardless of what is impinging (pressing) on the nerve, the symptoms are similar; however, the therapeutic intervention varies. Therapeutic massage is beneficial in entrapment but less so with compression.

Tissues that can bind and impinge on nerves are the skin, fascia, muscles, ligaments, and bones. Shortened muscles and connective tissue (fascia) often impinge on major and minor nerves, causing discomfort. Because of the structural arrangement of the body, these impingements often occur at major nerve plexuses. The specific nerve root, trunk, or division affected determines the condition, producing disorders such as thoracic outlet syndrome, sciatica, and carpal tunnel syndrome.

If the cervical plexus is impinged, the person most likely will have headaches, neck pain, and breathing difficulties. The muscles most responsible for pressure on the cervical plexus are the suboccipital and sternocleidomastoid muscles. Shortened connective tissue at the cranial base also presses on these nerves. Many cutaneous (skin) branches of the cervical plexus transmit sensory impulses from the skin of the neck, ear area, and shoulder. Motor branches innervate muscles of the anterior neck. Impingement causes pain in these areas.

The brachial plexus is situated in the neck and the axilla and consists of virtually all nerves that innervate the upper limb. Any imbalance that increases pressure on this complex of nerves can result in pain in the shoulder, chest, arm, wrist, and hand. The muscles most often responsible for impingement on the brachial plexus are the scalenes, pectoralis minor, and subclavius muscles. The muscles of the arm also occasionally impinge on branches of the brachial plexus. Brachial plexus impingement is responsible for thoracic outlet symptoms, which often are misdiagnosed as carpal tunnel syndrome. Whiplash injury, stingers, and burners often cause impingement on the brachial plexus.

Carpal tunnel syndrome is caused by compression of the median nerve as it passes under the transverse carpal ligament at the palmar aspect of the wrist. The syndrome can occur when fluid retention causes swelling of the hand and wrist. The syndrome is common in persons who use their hands in repetitive movements, usually resulting from inflammation that leads to compression on the nerve. The symptoms are palmar by pain and numbness in the first three digits. Sometimes surgically opening the transverse carpal ligament can help relieve the pain.

Impingement on the lumbar plexus gives rise to low back discomfort, which is marked by a belt-like distribution of pain and by pain in the lower abdomen, genitals, thigh, and medial lower leg. The main muscles that impinge on the lumbar plexus are the quadratus lumborum, multifidi, and psoas. Shortening of the lumbodorsal fascia exaggerates a lordosis and can cause vertebral impingement on the lumbar plexus.

The sacral plexus has about a dozen branches that innervate the buttock, lower limb, and pelvic structures. The main branch is the sciatic nerve. Impingement on this nerve by the piriformis muscle is a cause of sciatica. Shortened ligaments that stabilize the sacroiliac joint can affect the sacral plexus. Pressure on the sacral plexus can cause pain in the gluteal muscles, leg, genitals, and foot.

Various forms of massage reduce muscle spasm, lengthen shortened muscles, and soften and stretch connective tissue, restoring a more normal space around the nerve and alleviating impingement. When massage is combined with other appropriate methods, surgery is seldom necessary. If surgery is performed, the massage practitioner's role is to manage adhesions to prevent reentrapment of the nerve in the future and to maintain soft tissue suppleness around the healing surgical area. As healing progresses, extend the focus of therapeutic massage to deal with the forming scar more directly. Before doing any work near the site of a recent incision, the practitioner must obtain the physician's approval. In general, work close to the surgical area can begin after the stitches have been removed and all inflammation has dissipated. Follow the massage strategies for wounds.

NERVE ROOT COMPRESSION

Many different conditions can result in compression of the nerve root, including tumors, subluxation of vertebrae, and muscle spasms (entrapment) and shortening. Disk degeneration is a common cause. As degeneration progresses and the fluid content of the disk decreases, the disk becomes narrower. As a result, the amount of space between vertebrae is reduced. Because spinal nerves exit and enter in the spaces between the vertebrae, this situation increases the likelihood of **nerve root compression**. The condition most commonly occurs in the areas where the spine moves the most: C6 to C7, T12 to L1, L3 to L4, and L5 to S1 (*C,* cervical; *T,* thoracic; *L,* lumbar; *S,* sacral). The result is radiating nerve pain often associated with protective and stabilizing muscle guarding, weakness, or both.

DISK HERNIATION

Disk herniation occurs when the fibrocartilage surrounding the intervertebral disk ruptures, releasing the nucleus pulposus. Resultant pressure on spinal nerve roots may cause pain and may damage surrounding nerves. This condition most often occurs in the lumbar region and involves the L4 or L5 disk and L5 or S1 nerve roots. This particular back pain radiates from the gluteal area down the lateral side or back of the thigh to the leg or foot. Back strain or injury often causes disk herniation, but occasionally coughing and sneezing may precipitate the condition. Improper form during weight lifting is a common source of injury in the athlete.

The symptoms of herniation are similar to those produced by a compressed disk but often are more severe. In extreme cases, surgical intervention may be necessary; otherwise, conservative care is used. Conservative treatment consists of rest, exercise, and other methods, including massage to reduce spasm. Traction can be beneficial.

Massage Treatment

Various forms of massage are important for managing the muscle spasm and pain associated with nerve irritation from the herniated disk. The muscle spasm/guarding response serves a stabilizing and protective function. Without some protective muscle guarding, the nerve could be damaged further, but too much muscle contraction increases the discomfort. Therapeutic intervention seeks to reduce pain and excessive tension and to restore moderate mobility while supporting resourceful compensation produced by the muscle tension pattern.

Athletes often experience nerve impingement, and physical rehabilitation exercises are used to treat nerve impingement in the general population. Repetitive strain, posture changes, and compensation from traumatic injury are common causes. The elderly are prone to cervical and lumbar nerve impingement because of age-related tissue and bone changes. Nerve pain usually radiates in a line following the tract of the nerve. Massage applied to reduce soft tissue binding on the nerve needs to address the soft tissue effectively but *not* irritate the underlying nerve. If the impingement consists of entrapment and compression, muscle tension actually may be protective, attempting to stabilize bony structures and prevent further compression on the nerve. Massage application addressing the soft tissue, combined with repositioning of the underlying structure with manipulation and therapeutic exercise, is required for effective treatment.

Massage methods used to treat entrapment vary depending on what is impinging the nerve:

Muscle shortening: Use muscle energy methods such as positional release and lengthening. Direct inhibiting pressure at the spindle cell and/or Golgi tendon organs combined with application of tension and bend force will lengthen the muscle.

Connective tissue: Mechanical force, bend, torsion, and compression force increase ground substance pliability. Adhesion/fibrosis can be addressed with bend, shear, torsion, and tension force to encourage more appropriate fiber alignment.

Fluid: Lymphatic drainage combined with passive and active joint movement.

Bone: Compression usually is managed best by the trainer, physical therapist, physician, or chiropractor. In simple situations, joint play and indirect functional methods may help. The body area is placed in an ease position, and the client exerts muscle force to pull the body back into the neutral position (described in Unit Two). The pull of the muscle on the bone can help the structure to reposition, thus reducing nerve compression.

The location of the nerve entrapment is identified with palpation. When the area is located, the symptoms will be reproduced. If the nerve is irritated in this location, sustained compression or intense stretching only increases the irritation. Once the impingement is located, next identify the nature of the impingement—muscle tension, connective tissue bind, fluid buildup, or structural misalignment—and then treat accordingly. When in doubt, apply all methods but do not overwork the area. Begin with general massage around the area before targeting the actual impingement site.

In athletes with muscle bulk and dense tissues, actually reaching the area of impingement is often difficult. In this case, use muscle energy methods, especially positional release. Normalization of firing patterns and gait reflexes is usually necessary. If the impingement is the result of muscle spasm, short-term use of muscle-relaxing medication is effective.

SUMMARY

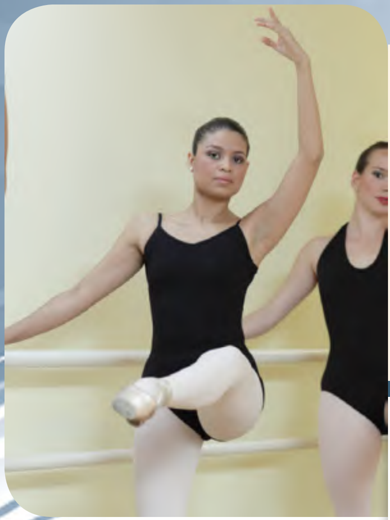
This chapter categorized injury types and explained the commonalities of these injuries.

The strategies were described for beneficial and safe therapeutic massage application. These conditions use treatment assessment procedures described in Unit Two and usually are treated in the context of full-body massage, which also is described in Unit Two.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1. List the general injury categories that have lymphatic drainage as the major intervention.
2. List the general injury categories that have scar tissue management as a portion of the recommended treatment strategies.
3. List the general injury categories that would indicate appropriate application of muscle energy methods and lengthening.
4. List the common injuries that usually are caused by a traumatic event.
5. List the common injuries that have repetitive strain as the major causal factor.



CHAPTER

18

Medical Treatment for Injury

OUTLINE

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1. Explain the importance of appropriate use of surgery and medication to treat injury.
2. List indications and contraindications for massage.
3. Perform appropriate presurgical and postsurgical massage application.
4. Alter massage to interact appropriately with use of medication and injected substances.

KEY TERMS

Arthroscopic Surgery
Muscle Relaxers
Nonsteroidal Antiinflammatory Drugs (NSAIDs)
Pharmacology
Postsurgical
Presurgical
Steroid Injections

Advances in surgical techniques, rehabilitation, treatment, and **pharmacology** have prolonged the careers of many athletes and have improved the quality of life for the general public. Sport medicine professionals now can treat and rehabilitate patients with injuries and illnesses that in the past could end a career or cause permanent disability. This chapter describes current approaches to treatment and explains how massage can support successful outcomes.

SURGERY

Objectives

1. Explain the importance of appropriate use of surgery and medication to treat injury.
2. List indications and contraindications for massage.
3. Perform appropriate presurgical and postsurgical massage application.

ARTHROSCOPY

Arthroscopic surgery involves the use of fiberoptic cameras and small surgical instruments to visualize and treat intraarticular structures of the joint (Figure 18-1). The most common arthroscopic procedures include removal of loose bodies, trimming of articular cartilage flaps and meniscal tears, and débridement of scar tissue. Arthroscopic procedures can also be used to obtain a more accurate diagnosis through visual inspection of the joint. Although many of today's magnetic resonance images are of very high quality, at times a visual inspection through arthroscopy is needed to make an accurate diagnosis. In particular, arthroscopy can be used to diagnose the size, depth, and condition of articular cartilage lesions.

The technique of arthroscopic surgery involves the placement of three to four small incisions (portals) around the joint. Standard arthroscopic incisions create small, approximately 1 to 2 cm, portals. Fluid is introduced in the joint to allow better visualization and separation of structures and to remove any blood that might be present from surgical incisions or injuries.

The portals are used for placement of the arthroscopic camera to visualize the work inside the joint. A beam of light and a small camera are used to project an image of the interior of the joint onto a video monitor.

Sterile fluid is used to expand the joint, and a probe is frequently used to manipulate and investigate joint structures. Because the portal incisions are so small, stitches

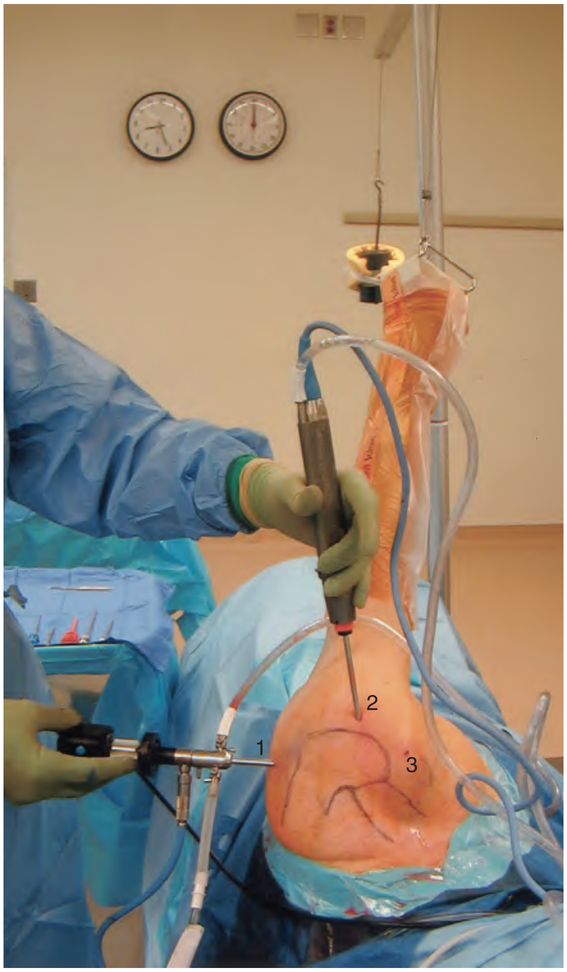


FIGURE 18-1 Arthroscopic portals. Posterior (*1*), anterior (*2*), and lateral (*3*). (From Miller MD, Cole BJ: *Textbook of arthroscopy*, Philadelphia, 2004, Saunders.)

FIGURE 18-2 Arthroscopy. (From Miller MD, Cole BJ: *Textbook of arthroscopy*, Philadelphia, 2004, Saunders.)

usually are not required to close the surgical wounds (Figure 18-2).

Arthroscopy can be used to examine and repair the damaged joint in a single operation. First used primarily on the knee joint, arthroscopy now can diagnose and treat problems in the shoulder, elbow, wrist, hip, and ankle. Whether joint problems are the result of an acute event, such as a sports injury, or a chronic condition, such as arthritis, arthroscopy has improved the quality of patient care and can be performed on individuals of all ages.

Arthroscopy not only makes joint surgery less invasive, it also reduces recovery time. Because less disruption of joint structures occurs, pain and swelling to surrounding structures are lessened. This can allow earlier return to range-of-motion and strengthening exercises.

Although some complex procedures still require traditional open surgery, many procedures can be performed by using arthroscopy.

As with any surgical procedure, risks are associated with arthroscopy, including the following:
- Nerve injury
- Infection
- Bleeding
- Stiffness

Almost all arthroscopic surgeries now are performed on an outpatient basis. Steri-Strips are frequently used to close the arthroscopic portals, allowing skin incisions to heal and minimizing scarring. A loose, sterile dressing is applied for 3 to 4 days. Depending on the procedure, patients may be allowed to bear weight as tolerated with the use of crutches and may wean off the crutches when they can walk without a limp. Rehabilitation should begin as soon as the surgeon permits so that the joint does not lose range of motion and so that muscle atrophy can be reduced. Showers generally are allowed at 3 or 4 days after surgery. Most patients recover fully.

MASSAGE APPLICATION

Before Surgery (24 to 48 Hours)

The goals of **presurgical massage** are to reduce anxiety and support restorative sleep. A rested, calm person requires less anesthesia and copes better with the stress of the surgical procedure. Do not work directly on targeted surgical areas with deep pressure, intense drag, or any methods with the potential for tissue damage. Use a palliative approach. Target breathing function, parasympathetic dominance, and neurochemical balance.

After Surgery (24 to 48 Hours)

The goals of **postsurgical massage** include pain control, reduction of anxiety, and restoration of sleep. Additional benefits can include wound and pain management, as well as lymphatic drainage. Depending on the procedure, massage can begin within 24 to 48 hours. The massage focus targets pain management, reduced anxiety, and sleep support. The duration is short and more frequent, such as 2 times per day. Target areas may include tissue other than the surgical site. Often the neck, shoulders, and low back are sore from bed rest or positioning during surgery. Massage of the head, face, hands, and feet is usually effective in calming the client. Do not use methods that cause pain. Do not apply massage near the surgery site. Some outpatient procedures allow the client to return home the day of the surgery or the next day. Infection control is important; therefore, maintain meticulous sanitation.

3 Days After Surgery

The goals of massage are to improve lymphatic drainage, to manage postsurgical edema, and to manage pain. For most surgical procedures involving arthroscopy, the patient will be home and ambulatory. Work on the surgical site should be avoided, but careful and gentle work around the joint may be appropriate. (See the discussion of wounds in Chapter 17.) This is considered acute care, and the surgical sites are wounds. Sanitation and infection control continue to be top priorities. If the patient has been instructed to do range-of-motion exercises, massage supports the movement pattern. Work with reflex patterns. Paired functional areas include the following:

- Right shoulder, left hip, and vice versa
- Right elbow, left knee, and vice versa
- Right wrist, left ankle, and vice versa
- Right hand, left foot, and vice versa

Functional muscle units are as follows:

- Flexors with opposite side flexors and same-side extensors
- Extensors with opposite side extensors and same-side flexors
- Internal rotators with opposite side internal rotators and same-side external rotators
- External rotators with opposite side external rotators and same-side internal rotators
- Adductors with adductors and abductors with abductors

Trunk paired patterns are as follows:

- Neck flexors with trunk flexors
- Neck extensors with trunk extensors
- Neck lateral flexors with trunk lateral flexors

These relationships are especially helpful in the treatment of acute tissue inflammation that can be the result of surgical procedures. Because massage on the surgical area is contraindicated, paired areas can be addressed to create beneficial reflex responses (Box 18-1).

The effect of massage is increased if the client can move the area gently while the targeted reflex areas are massaged. Intentional and deliberate focus is important. For the first example, in Box 18-1, when massaging the right biceps, be thinking about the left hamstring. Using these reflexes does not mean that you are massaging the arm for the benefit of the arm. The arm is massaged to influence the leg. Continue to promote lymphatic drainage and massage daily if possible.

Subacute Phase: 7 Days After Surgery

The goals of massage are to improve lymphatic drainage, to manage postsurgical edema, to manage pain, and to support mobility. Stitches (if present) should be removed, and gentle scar tissue work can begin in the surgical area. Use strategies for wound healing but avoid pull on the incision. Use gentle bending and shear force to increase tissue pliability. Intensity increases each day, and by 14 days, if the incision is fully healed, tension force is added. At 18 to 20 days, add torsion force and work directly on the incision unless a contraindication, such as delayed healing, exists.

Continue to promote lymphatic drainage of the area, and reset all firing patterns and gait reflexes. Support all rehabilitation exercises prescribed and monitored by the physician, physical therapist, and athletic trainer. Massage the client 3 to 4 times per week if possible.

Remodeling Stage: 3 to 4 Weeks After Surgery

The goals of massage are to improve lymphatic drainage, to manage postsurgical edema, to manage pain, and to support pliable scar formation and rehabilitation procedures. Resume use of a full-body general protocol as presented in Unit Two. Continue to manage edema and muscle activation patterns and reflex patterns. Address scar tissue each massage. Normalize all residual muscle guarding. Continue this focus for at least 6 months. Massage 2 times per week if possible.

Total joint replacement surgery follows the same postsurgical patterns, but each healing phase will take longer, especially in the elderly.

REGENERATIVE THERAPY AND JOINT REPLACEMENT

Advances are occurring in the treatment of joint injury and deterioration. Tissue engineering is a new treatment strategy. Tissue engineering uses a person's own tissues or cells to help heal injuries (Fosang and Beier, 2011). Stem cell

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BOX 18-1 Examples of Massage After Surgery

EXAMPLE 1: ARTHROSCOPIC KNEE SURGERY ON THE LEFT KNEE

Reflexive massage would be targeted to the right elbow including the biceps to influence the hamstring reflexively, the triceps to influence the quadriceps, and the wrist and finger flexors at the elbow to influence the calf. Lymphatic drainage is promoted and circulation is supported for the entire arm. Then massage application moves to the left elbow and is targeted to influence the right hamstring and the left quadriceps reflexively. Wrist extensors at the elbow target the calf. Then move to the right leg. The hamstrings on the left are influenced reflexively by massage of quadriceps on the right. The quadriceps on the left is influenced by massage of the hamstring on the right.

EXAMPLE 2: SPORTS HERNIA IN THE RIGHT GROIN

Reflexive massage is applied to the left anterior and lateral neck, the pectoralis major and pectoralis minor on the left, the region of the scapula on the right, and the neck extensor on the right.

research has been ongoing, and mesenchymal stem cells (MSCs) have the ability to differentiate into various cell types, including osteoblasts, chondrocytes, and myocytes. MSCs can be isolated from various tissues such as bone marrow, adipose tissue, skeletal muscle, synovium, placenta, and teeth. Treatment typically involves introducing the regenerative substance into the target area and allowing repair to occur. For massage therapists, recommendations include avoidance of the area until the physician indicates that it is appropriate for the patient to receive massage therapy to address joint function. Tissues around the joint can be treated, but aggressive movement methods should be avoided.

Advancements are also being made in joint replacement technology. The goal of replacement surgery is to replace damaged and deteriorating joint structures to decrease pain and restore function. New technology for imaging and computer-assisted implant placement has been developed, allowing more precise reconstruction of damaged joints instead of total replacement. New implant designs and materials are being developed to facilitate surgery and prolong the life span of replacements, for example, a "partial" knee replacement essentially caps the damaged area and preserves the integrity of the joint itself.

STEROID INJECTIONS (CORTISONE)

Objectives

4. Alter massage to interact appropriately with use of medication and injected substances.

Steroid injections are a common and effective treatment for a variety of conditions in which inflammation causes pain, swelling, and other problems. Glucocorticoids, particularly prednisone and cortisone, are used in injections for inflammation and pain. These hormones help reduce inflammation and pain in the body. Cortisone is the most well-known injectable steroid, and it has a proven antiinflammatory effect on tissues, particularly joints and tendons. This family of steroids is not the same as anabolic steroids, which are used to enhance muscular development and are largely illegal in the United States and in international athletic competition.

Glucocorticoids are thought to interfere with immune system processes that result in inflammation, but the exact method by which they do this is not known. Injections of glucocorticoids are known to target the area of pain and inflammation better and faster than orally ingested forms. Cortisone injections typically result in pain relief in a matter of days, which may last up to a month.

Some common conditions that can be treated by steroid injections include the following:

- Tennis elbow (lateral epicondylitis)
- Golfer's elbow (medial epicondylitis)
- Joint pain of varying nature (osteoarthritis)
- Bursitis of the shoulder, hip, or knee
- Frozen shoulder
- Plantar fasciitis
- Carpal tunnel syndrome
- Herniated disk and other back pain

Steroid injections cannot cure any of these conditions and are targeted to symptom management. They generally are used as a last resort after antiinflammatory drugs and physical therapy have been tried and have failed to provide relief. Steroid injections may help with chronic, painful inflammation and may reduce recovery times, but unless the underlying cause is determined and treated, injections will provide only temporary relief. More than three to four injections within a year in the same area of the body are not recommended because glucocorticoids can result in the following potentially serious adverse effects:

- Weight gain
- High blood pressure
- Cataracts
- Diabetes
- Puffy face
- Osteoporosis (thinning of the bones)
- Reduced immunity and increased risk of infection
- Long-term joint and tendon damage
- Ulcers

Adverse effects are more likely to occur with steroid pills than injections, but research indicates that as few as four injections per year can damage a joint permanently or introduce risk of tendon rupture.

Because cortisone needs to surround the area of inflammation to work successfully, massage in the area of the injection is contraindicated for at least a week.

VISCOSUPPLEMENTATION

4. Alter massage to interact appropriately with use of medication and injected substances.

Synovial fluid is necessary for joint function. Hyaluronic acid is a naturally occurring substance found in the synovial (joint) fluid. Synovial fluid acts as a lubricant to enable the articular surfaces to move smoothly over each other; it also serves as a shock absorber for joint loads. Viscosupplementation injects a preparation of hyaluronic acid into the joint when a lower-than-normal concentration of hyaluronic acid is found in the joint fluid. People with osteoarthritis/osis ("wear-and-tear") may benefit. It is most effective if arthritis is in its early stages (mild to moderate). The long-term efficacy of viscosupplementation is not yet known, and research continues in this area (Carulli et al., 2012). The knee is commonly treated with this method. Hyaluronic acid does not have an immediate pain-relieving effect; a local reaction such as pain, warmth, or slight swelling may be noted immediately after the shot. These symptoms generally do not last long, and an ice pack is appropriate. For the first 48 hours after the injection, excessive weight bearing on the leg should be avoided. Multiple injections may be used. Hyaluronic acid does seem to have antiinflammatory and pain-relieving properties, and the effects may last for several months (Schiavinato and Whiteside, 2012).

The massage therapist should adapt massage in the treatment area and avoid aggressive methods.

PLATELET-RICH PLASMA (PRP) INJECTIONS

Objectives

4. Alter massage to interact appropriately with use of medication and injected substances.

Platelet-rich plasma, or PRP, injection is used to treat soft tissue injury by supporting natural healing processes. This therapy is most beneficial when the injury is in the acute or early subacute phase (Bava and Barber, 2011; Sampson et al., 2008). Platelets contain growth factors that are responsible for the proliferative healing phase of an injury. The body's first response to soft tissue injury is to deliver platelet cells to trigger repair and attract stem cells to the injured area. PRP injection therapy supports natural healing processes by delivering a higher concentration of platelets. To create PRP therapy, a small sample of blood is drawn from the recipient, and the platelets are separated from other components in the blood. The concentrated PRP is then injected into and around the injured tissue, jump-starting and supporting the body's natural healing process.

This procedure takes approximately 1 to 2 hours, including PRP preparation and recovery time, and can be performed safely in a medical office. Typically, up to three injections may be given within a 6-month period, usually 2 to 3 weeks apart. The need for surgery can be greatly reduced by treating injured tissues before damage progresses and the condition becomes irreversible.

PRP injections work at the area of injury; therefore, do not massage over the injection site within 5 days of the procedure.

PHARMACOLOGY

Objectives

4. Alter massage to interact appropriately with use of medication and injected substances.

The main pharmacologic agents used for sport injuries are **nonsteroidal antiinflammatory drugs (NSAIDs)** and steroidal antiinflammatory drugs, **muscle relaxers**, and pain control medication. Antibiotics are commonly used to prevent and treat infection.

Massage application needs to be altered to support the effects of medications without causing tissue damage because pain perception is altered. Massage may be substituted for muscle relaxers and pain medication, but this must be a medical decision directed by the physician.

NSAIDs are prescribed for competitive athletes and other physically active individuals because of their analgesic (pain reduction) and antiinflammatory benefits. Common NSAIDs and analgesics available over the counter include ibuprofen (Advil, Motrin IB), ketoprofen (Actron, Orudis-KT), and naproxen (Aleve). Related drug classes include aspirin (Genuine Bayer Aspirin, Bufferin, Ecotrin). Acetaminophen (Tylenol) is an analgesic that does not have antiinflammatory properties. A common prescription antiinflammatory drug, celecoxib (Celebrex), is a cyclooxygenase (COX)-2 inhibitor that is thought to be easy on the stomach. However, it does produce cardiovascular adverse effects.

In general, NSAIDs may increase the potential for bruising, so the massage therapist needs to monitor pressure during the massage. Maintain broad-based contact, and do not poke, probe, or dig on the tissues.

NSAIDs act therapeutically by inhibiting prostaglandin synthesis, thereby reducing pain and inflammation. Excessive NSAID use may increase the potential for renal problems. This potential is magnified if prolonged exercise is combined with severe heat stress and/or dehydration. Proper hydration before and throughout exercise can minimize the damage that NSAIDs can cause to the kidneys (Wharam et al., 2006; Popkin et al., 2010).

Muscle relaxers reduce motor tone in muscle, altering normal protective mechanisms for overstretching and overcontracting. Massage and various muscle energy lengthening and stretching methods may be contraindicated to prevent tissue damage.

Common muscle relaxers include the following:
- Cyclobenzaprine (Flexeril)
- Metaxalone (Skelaxin)
- Carisoprodel and aspirin (Soma)
- Tizanidine (Zanaflex)

SUMMARY

Advances in surgical and pharmacologic treatment of physical exercise–related injuries have allowed individuals to compete and perform daily life activities with significantly less pain. These advances will continue as medical technology progresses.

Athletic clients and those in physical rehabilitation may be taking medication for non–exercise-related conditions. A thorough clinical history including all medication supplements and herbal remedies is necessary. Massage needs to be altered on an individual basis to consider the patient's medication use. Refer to the Evolve website that accompanies this book for a list of medications for massage.

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evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1 Prepare a letter to an orthopedic surgeon explaining the benefits and risks of massage before and after surgery.
2 List and explain at least 10 adaptations for massage application if surgery and medication are provided.

Example: Client not comfortable on massage table at massage office. Will need to work with client in a reclining chair or at client's home.

CHAPTER

19 Systemic Illness and Disorders

OBJECTIVE

After completing this chapter, the student will be able to perform the following:

1 Apply appropriate massage interventions for clients with infections, inflammation, cardiovascular/respiratory disease, thermoregulating disorders and heat-related illnesses, and breathing pattern disorder.

KEY TERMS

Bacterial Infection
Breathing Pattern Disorder
Cardioprotection
Cardiovascular/Respiratory Disease
Cerebrovascular Constriction
Coronary Artery Disease (CAD)
Dehydration
Frostbite
Fungal Infection
Heat Cramps
Heat Exhaustion
Heat Rash
Heatstroke
Heat Syncope (Heat Collapse)
Hyperthermia
Hypothermia
Immune Function
Inflammation

OUTLINE

Orthopedic injuries most commonly are associated with sports; however, infectious diseases also cause problems for athletes. Return to play issues and prevention of infection are especially important in athletes. Illness is different from injury. Illness involves the whole body; injury is more local. Both illness and injury can involve the inflammatory response. Various illnesses can target a body system. For example, a cold is an upper respiratory infection. This is different from a localized bruise on the quadriceps. Illness can be the result of infection by a pathogen–bacteria, viruses, or fungi–in which the immune system is unable to stop the progression of invasion. Illness can also be autoimmune, such as systemic lupus erythematosus (SLE), or it may be the result of an overreaction of the immune response as occurs in allergies and multiple sclerosis. Illness can be caused by a body system failure as occurs in cardiovascular disease, kidney failure, and diabetes. Systemic and local inflammatory response is an underlying factor in immune function and dysfunction. Acute inflammation is necessary for healing, but chronic inflammation is the underlying factor in many autoimmune diseases.

Disorders occur when the body's homeostatic regulations are unable to adapt in response to internal or external influences. Examples are thermoregulating disorders and breathing pattern disorder, which is extremely common and is discussed extensively in this chapter.

Athletes, like other people, have allergies and systemic disease, and these conditions must be factored into the focused treatment plan. Cardiovascular/respiratory disease rehabilitation is a major reason for therapeutic exercise.

IMMUNE FUNCTION

Objective

1. Apply appropriate massage interventions for clients with infections.

Overtraining and aggressive physical activity can suppress the immune system, predisposing to infection. Illness should be diagnosed and treated by the physician. If **bacterial infection** is detected, antibacterial medication may be prescribed. Digestive upset including diarrhea is common. Fever below 102° F (39° C) is usually productive during infection (often referred to as a low-grade inflammatory response) and should not be reduced unless complicating factors are present. Sanitation is always important, but even more so during illness. The main target of massage intervention is **immune function** support. The basic treatment plan consists of reducing the stress response, supporting parasympathetic dominance, managing pain, and promoting sleep.

IMMUNITY IN ATHLETES

In the resting state, the adaptive immune system appears to be largely unaffected by intensive and prolonged exercise training. However, the innate immune system, which consists of those immune cells that act as a first line of defense against infectious agents, appears to respond differentially to the chronic stress of intensive exercise. Natural killer cell activity tends to be enhanced and neutrophil function suppressed.

In general, when analyzed in resting individuals, the immune systems of athletes and nonathletes appear to be more similar than different. Of various immune function tests that show some change with athletic activity, only salivary immunoglobulin (Ig) A has emerged as a potential marker of infection risk. It is possible that each bout of prolonged exercise leads to short-term but clinically significant changes in immune function. Altered immunity may last between 3 and 72 hours. During this time, viruses and bacteria may gain a foothold, increasing the risk for both subclinical and clinical infection.

Taken together, the data suggest, but do not prove, that the immune system is suppressed and stressed for a short time after prolonged endurance exercise. If this is so, infection risk may be increased when the endurance athlete goes through repeated cycles of heavy exertion, especially if the athlete is experiencing other stressors of the immune system such as lack of sleep, mental stress, malnutrition, and weight loss.

Athletes resist reducing training workloads. Improper nutrition and psychological stress can compound the negative influence that heavy exertion has on the immune system. Indicators of overtraining include immunosuppression, loss of motivation for training and competition, depression, poor performance, and muscle soreness. Parasympathetic dominance is a very important area of therapeutic massage intervention for stress management and immune system function. In addition, several lifestyle practices may be beneficial. The athlete needs to eat a well-balanced diet, keep other life stresses to a minimum, avoid overtraining and chronic fatigue, obtain adequate sleep, and space vigorous workouts and competitive events as far apart as possible (Box 19-1).

MASSAGE IMPLICATIONS

When an athlete is ill, DO NOT overmassage. Regardless of the ongoing treatment plan, back off and apply general, nonspecific massage for no longer than 45 to 60 minutes with a relaxation/palliative outcome, and encourage rest, sleep, proper fluid intake, and nutritional support. If low-grade productive fever is present, the client may benefit more from sleep than from massage. The presence of a fever indicates caution for massage application. If massage is provided when low-grade fever is present, the duration and intensity of the massage should be adjusted to support comfort care only.

If massage is indicated, it would be palliative and targeted to support parasympathetic dominance, sleep, and reduction of general aching. Do not massage if fever is above 100° F (38° C), or if the client is fatigued. In general, if symptoms are manifested primarily above the shoulders, it is acceptable to massage the client. If symptoms involve the whole body, then massage could strain adaptive capacity. Ask whether the client has any sort of skin infection, and be aware of skin changes. Avoid local areas where suspected infection is present. Hand hygiene is the single most important practice in reducing the transmission of infectious agents. Cleaning and disinfection are primarily important for frequently touched surfaces. Follow all Standard Precautions from the Centers for Disease Control. Remember that athletes may be immunosuppressed. Do not expose athletes to illness. If the massage therapist is ill, he or she should avoid working until no longer contagious.

INFLAMMATION

Objective

1. Apply appropriate massage interventions for clients with inflammation.

Within limits, inflammation is a valuable aspect of the immune response. **Inflammation** is the body's normal protective response to infection and injury. Antigens are molecules, usually protein, that are on the surfaces of pathogens such as bacteria or viruses. Our bodies attack such foreign materials using white blood cells, which can produce antibodies. These antibodies help the immune system destroy antigens.

Inflammation triggered by injury operates slightly differently from an infection. When tissues are damaged, they

BOX 19-1 Common Infections

MONONUCLEOSIS

Mononucleosis is a disease that is most commonly caused by the Epstein-Barr virus; it causes lack of energy and stamina. Significant complications of mononucleosis include enlargement of the spleen. In extreme cases, the spleen may rupture, causing sharp, sudden pain in the left side of the upper abdomen. Occasionally, a streptococcal (strep) infection accompanies the sore throat of mononucleosis, and antibiotics are prescribed for these infections.

FLU

The influenza virus is generally passed from person to person by airborne transmission (i.e., by sneezing or coughing). It may also be spread by touching something that has been handled by someone infected with the virus and then touching your own mouth, nose, or eyes. Fever, headache, and body aches usually last for 3 to 5 days, but upper respiratory symptoms and fatigue may last for 2 weeks or longer.

COLDS

A cold is a viral infection of the upper respiratory system. A cold usually begins with fatigue, a feeling of being chilled, sneezing, and a headache, followed in a couple of days by a runny nose and a cough. Symptoms typically peak 2 to 3 days after onset of infection and usually resolve in 7 to 10 days. Cold viruses are spread by personal contact and by breathing the air near people with colds. Therefore, if at all possible, athletes should avoid being around sick people before and after important events.

GASTROENTERITIS

Gastroenteritis (also known as *gastric flu*, *stomach flu*, or *gastro* and *stomach virus*) is inflammation of the gastrointestinal tract involving both the stomach and the small intestine and resulting in diarrhea, vomiting, and abdominal cramps.

Most cases are caused by rotavirus or norovirus. Less common causes include bacteria or their toxins, as well as parasites. Transmission may occur as the result of improperly prepared foods, contaminated water, or close contact with those who are infectious.

The foundation of management is adequate hydration. For mild or moderate cases, this typically can be achieved via oral rehydration solution.

STAPH

Staphylococcus is a bacterium that can cause a wide variety of infections, from minor skin infections, such as impetigo, boils, cellulitis, carbuncles, and abscesses, to life-threatening diseases such as pneumonia, meningitis, osteomyelitis, endocarditis, and sepsis.

Methicillin-resistant *Staphylococcus aureus* (MRSA) is responsible for several difficult-to-treat infections in humans. Antibiotic resistance makes MRSA infection more difficult to treat. MRSA is especially troublesome for athletes because they are in close physical contact and may have open wounds and weakened immune systems.

HERPES SIMPLEX

Herpes infection is caused by the herpes simplex virus (HSV). After an incubation period of 3 to 10 days, symptoms are similar to those of viral influenza–like illness; the difference noted is that fluid-filled lesions usually surround the mouth and the nose. HSV is a painful, often recurring, infection seen as clusters of small, fluid-filled sacs on a base of red skin. Viruses may remain dormant in the body for years, manifesting themselves in situations of depressed immunity and stress. The outbreak is usually preceded by symptoms that can include irritability, headache, tingling, and burning or itching of the skin at the site of recurrence. Recurrent HSV labialis (fever blisters or cold sores) can shed the virus intermittently between episodes and in the absence of lesions. Treatment of primary HSV is most effective with antiviral drugs such as acyclovir or valacyclovir.

FUNGAL INFECTIONS

Infections involving fungi may occur on the surface of the skin, in skin folds, and in other areas kept warm and moist by clothing and shoes. *Candida* is a yeast—similar to a fungus. It most often affects the skin around the nails or the soft, moist areas around body openings.

- Tinea capitis: a common fungal infection of the scalp manifested by gray scaly patches accompanied by mild hair loss in many cases
- Tinea corporis: a fungal infection on the body commonly referred to as "ringworm"—a name gleaned from its characteristic ring-like appearance
- Tinea cruris: a fungal infection in the groin area, commonly referred to as "jock itch"
- Tinea pedis: the most common fungal infection that affects the feet; it is commonly referred to as "athlete's foot."

Fungal infections may be treated initially with topical preparations for 2 to 4 weeks. More widespread, inflammatory, or otherwise difficult-to-treat cases may require the use of systemic antifungal drugs.

COMMON AND PLANTAR WARTS

Warts are epithelial tumors caused by several types of human papilloma virus. Common warts present as cauliflower-shaped, raised lesions. Plantar warts occur as flat lesions with pinpoint bleeding on weight-bearing surfaces; they can be debilitating in athletes because of the pain. Transmission occurs by direct skin-to-skin contact, by contact with floors, or by cryotherapy with liquid nitrogen.

release chemicals, such as histamine and serotonin. These chemicals attract white blood cells. This natural "defense" process brings increased blood flow to the area, resulting in an accumulation of fluid. As the body mounts this protective response, symptoms of inflammation develop. These include the following:

- Swelling
- Pain
- Heat
- Redness

Inflammation can be acute or chronic. When it is acute, inflammation occurs as an immediate response to trauma or infection. The inflammatory response supports the removal of cellular debris caused by trauma and any pathogens present, but if excessive, it causes damage to surrounding tissues.

Chronic inflammation is a perpetuating factor in many chronic conditions. Chronic inflammation is a factor in disorders such as asthma, lupus, and rheumatoid arthritis, as well as in tendinopathies caused by microdamage in the collagen fibers, followed by an acute inflammation, which can evolve to chronic inflammation if healing processes are disrupted (Solomonow, 2012).

Overuse tendinopathies are a common cause of pain and disability in athletes. These conditions occur as failed healing responses to overuse tendon injury (Battery and Maffulli, 2011; Del Buono et al., 2011). Substance P (SP) is a neurotransmitter involved in the transmission of pain impulses from peripheral receptors to the central nervous system.

Substance P may be produced by primary fibroblastic tendon cells called *tenocytes* (Backman et al., 2011). When tendons are submitted to mechanical loading, substance P production is increased. Massage may suppress substance P levels (Field et al., 2002). If this is the case, then massage might be beneficial in the reduction of pain perception.

Having a massage after strenuous exercise appears to reduce inflammation in muscles at the cellular level. Massage may reduce the activity of inflammation-inducing proteins called *cytokines* in muscle cells. Massage may alter genes, thus reducing inflammation and supporting muscle adaptation to exercise (Crane et al., 2012).

MASSAGE IMPLICATIONS

Inflammation in the body has a variety of causes; when the inflammatory response is triggered at a cellular level, cellular damage along with resultant release of inflammatory mediators such as cytokines may occur. Tenocyte cells within tendons, when mechanically loaded to the point of microdamage, result in increased levels of substance P, which not only increase pain transmission but also increase cell proliferation; this can support healing if cells are damaged, or overgrowth if excessive. It may be possible for massage to then reduce the inflammatory response by decreasing the response of cytokines, and to reduce pain transmission by decreasing the level of substance P.

CARDIOVASCULAR/RESPIRATORY ILLNESSES

Objective

1. Apply appropriate massage interventions for clients with cardiovascular/respiratory disease.

The most common reason for mature people to be in rehabilitation is **cardiovascular/respiratory disease**. Exercise is a necessary part of the rehabilitation and treatment plan for these conditions.

Cardiovascular disease is the number one cause of death in the United States; **coronary artery disease (CAD)** is the number one cause of death due to cardiovascular disease. CAD is caused by the collection of plaque (i.e., buildup of cholesterol, calcium, and fibrous tissue) inside a coronary vessel, resulting in a narrowing of coronary arteries (stenosis) that decreases the delivery of oxygen to the heart owing to reduced coronary blood flow.

Events leading to cardiac injury during a heart attack begin with a transient blockage of coronary blood vessels that is usually caused by a blood clot that has broken loose from an area of coronary stenosis. This reduction in blood flow to the heart is called *ischemia* and is typically followed by restoration of blood flow (reperfusion) when the clot dissolves. Commonly known as a heart attack, the overall process of ischemia followed by reperfusion results in cardiac injury and is technically referred to as *ischemia-reperfusion (I-R) injury*.

The magnitude of cardiac injury that occurs during an I-R insult is a function of the duration of ischemia—that is, a longer period of ischemia results in greater cardiac injury. For example, a relatively short duration of ischemia (e.g., 5 minutes) does not result in permanent cardiac damage but may depress cardiac function for 24 to 48 hours after the event. In contrast, a long duration of ischemia (20 minutes or longer) promotes permanent cardiac injury (muscle cell death), resulting in a myocardial infarction. The severity of a myocardial infarction is significant because cardiac muscle cells are not easily capable of regeneration; therefore, after myocardial infarction, the pumping capacity of the heart is permanently diminished.

Regular exercise lowers the risk of developing CAD and reduces the risk of cardiac injury during a heart attack. The mechanism of exercise-induced protection against cardiac injury (called **cardioprotection**) is unknown but may be linked to increases in "heat-shock" proteins (discussed later) and antioxidants in the heart. Animal research suggests that supplementation with nutritional antioxidants reduces I-R–induced cardiac injury and disease. Additional research is required to determine whether dietary antioxidants can provide myocardial protection in humans.

Finding ways to reduce the mortality of cardiovascular disease remains an important public health goal. In this regard, numerous studies reveal that regular exercise is cardioprotective. For example, epidemiologic studies indicate that compared with sedentary individuals, physically active people have a lower incidence of heart attack. These investigations also demonstrate that the survival rate of heart attack victims is greater in physically active individuals than in their sedentary counterparts.

Numerous epidemiologic studies indicate that regular physical activity reduces the risk of cardiovascular mortality independent of other lifestyle modifications such as diet or smoking.

The biological mechanism responsible for exercise-induced protection against cardiovascular disease continues to be investigated. In this regard, it is clear that regular exercise reduces several cardiovascular risk factors, including hypertension, diabetes mellitus, obesity, blood lipids, risk of thrombosis (blood clotting), and endothelial (blood vessel) dysfunction. Therefore, it appears that the relationship between exercise and reduced cardiovascular mortality rates is due to the reduction of one or more risk factors.

Although it is clear that regular exercise reduces the risk of developing cardiovascular disease, it is also well established that exercise training improves myocardial tolerance to I-R injury. Endurance exercise training reduces myocardial injury resulting from an I-R insult.

At present, the mechanisms behind the exercise-induced myocardial protection against I-R injury are unknown. However, at least three primary mechanisms may explain this effect: (1) improved collateral circulation; (2) induction of myocardial heat-shock proteins; and (3) improved myocardial antioxidant capacity.

Proteins play an important role in maintaining homeostasis in cardiac and other cells. Damage to existing proteins or impaired protein synthesis during I-R injury results in disturbed cellular homeostasis. To combat this type of disturbance, cells respond by synthesizing a group of proteins called *heat-shock proteins*. These proteins are induced by a variety of stressful conditions, including elevated body temperature and prolonged exercise.

Improved protection against free radical–mediated cardiac injury is another possible mechanism of exercise-induced cardioprotection during an I-R insult. Free radicals are highly reactive molecules with available incomplete bonds on their surface that are produced during myocardial I-R injury. Antioxidants are molecules that can remove free radicals by filling their incomplete bonds and forming a new, less reactive molecule, thereby preventing free radical–mediated cellular injury. One can make this analogy: rust is the free radical, and Rustoleum paint is the antioxidant that stops the spread of rust when applied.

Cells contain several naturally occurring enzymatic and nonenzymatic antioxidants. Primary enzymatic antioxidant defenses include superoxide dismutase, glutathione peroxidase, and catalase. Important nonenzymatic defenses are provided by compounds such as glutathione, the trace mineral selenium, and vitamins A, E, and C. Each of these antioxidants is capable of quenching radicals and preventing cellular injury.

MASSAGE IMPLICATIONS

Massage supports the necessary exercise program involved with cardiofitness and rehabilitation by managing muscle soreness and joint aching. Massage contributes to increased compliance with exercise programs. Procedures need to be altered to account for medications being taken by the client, as well as the client's age and general adaptive capacity. Otherwise, the methods discussed in Unit Two are appropriate.

HEAT-RELATED ILLNESSES

Objective

1. Apply appropriate massage interventions for clients with thermoregulating disorders and heat-related illnesses.

The body's ability to maintain a constant internal temperature is called *thermoregulation* (Box 19-2). If the internal temperature drops significantly below normal, this is called **hypothermia**. If the internal temperature rises significantly above normal, this is called **hyperthermia**. The body's inability to maintain a steady temperature is a thermoregulating disorder that can result in various illnesses. The most common problems are heat-related.

Exercising in a hot, humid environment can cause various forms of heat-related illness, including heat rash, heat syncope, heat cramps, heat exhaustion, and heatstroke. Athletes cannot safely exercise at full capacity in the heat.

HEAT RASH

Heat rash, also called *prickly heat*, is a benign condition associated with a red, raised rash accompanied by sensations of prickling and tingling during sweating. It usually occurs when the skin is continuously wet with

BOX 19-2 What to Watch for: Signs of Heatstroke

FUZZY THINKING
Cannot follow the plays
Seems confused
Suddenly forgetful

BIZARRE BEHAVIOR
Runs the wrong way
Talks nonsense
Blank stare
Laughs or cries at the wrong time
Yells in rage at coach or peers
Wants to fight for no good reason

PHYSICAL DECLINE
Begins to lose coordination
Sudden or unusual fatigue
Nausea and vomiting
Chills and goose bumps
Overbreathing, tingly fingers
Wobbles or staggers, collapses
Seizure or coma

unevaporated sweat. The rash is generally localized to areas of the body covered with clothing. Massage is regionally contraindicated.

HEAT SYNCOPE (HEAT COLLAPSE)

Heat syncope, or **heat collapse,** is associated with rapid physical fatigue during overexposure to heat. It usually occurs after standing in heat for long periods or in persons not accustomed to exercising in the heat. It is caused by peripheral vasodilation of superficial vessels, hypotension, and/or pooling of blood in the extremities, which result in dizziness, fainting, and nausea. Heat syncope is quickly relieved by laying the individual down in a cool environment and replacing fluids.

HEAT CRAMPS

Heat cramps are extremely painful muscle spasms that occur most commonly in the calf and abdomen, although any muscle can be involved. The occurrence of heat cramps is related to electrolyte balance. Profuse sweating results in loss of water and small quantities of electrolytes; this upsets the balance in concentration of these elements in the body. This imbalance will ultimately result in painful muscle contractions and cramps.

The person most likely to get heat cramps is someone in fairly good condition who simply overexerts in the heat. An athlete who experiences heat cramps generally will not be able to return to practice or competition that day because cramping is likely to recur.

Although muscle cramps have many causes, large losses of sodium and fluid can be key factors that predispose athletes to run-of-the-mill muscle cramps. Sodium is an important mineral in initiating signals from nerves and actions that lead to movement in the muscles, so a deficit of this element and of fluid may make muscles "irritable." Under such conditions, a slight stress such as a tensing movement may cause the muscle to contract and twitch uncontrollably. Massage does not help these cramps and may actually cause them. Only fluids and electrolytes will stop the cramping.

Diabetes, neurologic disorders, or vascular problems may be a factor in cramping episodes. Also, anecdotal reports indicate that the use of certain dietary supplements such as creatine may increase the risk of muscle cramps. If cramps suddenly occur in a client without a prior history, referral to a physician should be made to rule out more serious causes.

Preventing and Managing Cramping

1. Drink plenty of fluids to stay hydrated during exercise.
2. Replenish sodium levels during times of heavy exercise and profuse sweating with a diluted sports drink or other electrolyte solutions. Dilute 50% sports drink to 50% water.
3. Ensure adequate nutritional recovery (particularly for salt) and rest of muscles after hard training. Salt pills are not necessary; eating salty pickles is a good alternative.

When cramps strike an athlete during a workout or competition, take immediate action with the following:

1. Stretch. Because cramps are often related to a change in weight bearing, stretching and non–weight-bearing exercises are effective treatments.
2. Massage the area. Rubbing the cramped muscle may help alleviate pain and stimulate blood flow and fluid movement into the area. Ice massage can also be used.
3. Stimulate recovery. Rest and adequate rehydration with fluids containing electrolytes, particularly sodium, will bring quick improvement.

HEAT EXHAUSTION

Heat exhaustion results from inadequate replacement of fluids lost through sweating. Clinical symptoms include collapse, profuse sweating, pale skin, mildly elevated temperature (102°F [39°C]), dizziness, hyperventilation, and rapid pulse.

It is sometimes possible to spot athletes who are having problems with heat exhaustion. They may begin to develop heat cramps and become disoriented and lightheaded; their physical performance will not be up to their usual standards. In general, persons in poor physical condition who attempt to exercise in the heat are most likely to suffer from heat exhaustion.

Immediate treatment of heat exhaustion requires ingestion or intravenous replacement of large quantities of water.

HEATSTROKE

Unlike heat cramps and heat exhaustion, **heatstroke** is a serious, life-threatening medical emergency. The specific cause of heatstroke is unknown. Heatstroke can occur when there is a combination of hot environment, strenuous exercise, clothing that limits evaporation of sweat, inadequate adaptation to the heat, too much body fat, and/or lack of fitness.

During exercise, body heat is generated primarily in the active muscles. Transport mechanisms, which include the circulating blood and conduction between body tissues, bring heat to the skin. At the skin, evaporation, convection, radiation, and—far less important—conduction can transfer heat from the skin to the environment. Certain situations can impede heat release. For example, when the air temperature is higher than the skin temperature, convection, radiation, and conduction will result in transfer of heat from the air to the body.

Evaporation of sweat is decreased when the humidity of the air is high. To maintain a body temperature that is within a safe range, the following factors are important:

1. The intensity and duration of exercise and the body's efficiency for the effort being performed—this ratio establishes the amount of heat released by the body.
2. Blood circulation and blood volume—these determine the transport of heat from muscles to skin.

3. The amount of sweat produced and the temperature and humidity of the environment—these factors determine how much heat can be given off to the environment.
4. The capability of the body to make other physiologic adjustments to continue regulating the temperature.

Heatstroke is always a risk in summer sports. Victims of heatstroke are described as "the hardest worker" or "determined to prove himself." During hard practice on a hot day, the never-quit mentality can work against a player.

In summer sports, it is not the heat but the combination of heat and humidity that predisposes to heat illness. Getting heat-fit takes time. Lack of acclimation is a predictor of heatstroke in football. Triathletes unacclimated to tropical heat also suffer. Acclimation, much of which occurs in a week or two, leads to drinking more fluids; also, the body holds onto water and salt, increasing blood volume so the heart pumps more blood at a lower rate. Heat-fit athletes sweat sooner, in greater volume, and over a wider body area, so they stay cooler.

During physical training, the athlete who is disabled with a spinal cord injury faces the same risks of heat stress as the able-bodied athlete. However, the spinal cord injury also affects the disabled athlete's circulating blood volume, sweat production, and temperature regulation, and therefore can adversely influence thermoregulatory capabilities.

Opportunities to compete in the Paralympics, advances in medical treatment and therapies for functional recovery of the disabled, and the recognition that physical activity is beneficial for the health of everyone, abled or disabled, have contributed to increased participation of disabled individuals in regular physical exercise. As with able-bodied athletes, disabled athletes face limitations to performance—fatigue, nutrition and fluid needs, and the possibility of heat exhaustion. The greatest risk for heat stress is seen in individuals with spinal cord injury above the sixth thoracic vertebra because they are unable to increase heart rate to sustain cardiac output when blood must flow to both the muscle and the skin, and because they have a reduced sweating capacity.

Preventing heatstroke hinges on heat acclimation, hydration, pacing, cooling, and vigilance. Physical fitness, especially aerobic fitness, provides some of the same physiologic benefits as heat acclimation. Fitness also makes workouts less taxing. In contrast, lack of fitness increases risk of heat illness.

The prime time for heatstroke is the day after an exhausting and dehydrating day in the heat. The misconception is that hydration prevents heatstroke. The truth is that hydration is critical but is not sufficient to prevent heatstroke.

Heatstroke symptoms include the following:

- Sudden collapse with loss of consciousness
- Flushed, hot skin with less sweating than would be seen with heat exhaustion
- Shallow breathing
- A rapid, strong pulse and a core temperature of 106°F (41°C) or higher

The heatstroke victim experiences a breakdown of the thermoregulatory mechanism caused by excessively high body temperature, and the body loses its ability to dissipate heat through sweating.

Stimulants speed heat buildup, so products that speed players up heat them up. Amphetamine and cocaine are the most dangerous, but ephedra is the most prevalent. Many dietary supplements claim ephedra benefits of weight loss or quick energy. However, ephedra poses many health risks, including heatstroke, and should not be used. Excessive caffeine use can also pose a problem. Heatstroke risk is compounded by drugs that impair sweating, such as some antihistamines, antispasmodics, and certain medications for depression.

Heatstroke is often slow to evolve, and the vigilant observer can detect early warning signs. Heatstroke is always a threat during hard drills on hot days, especially in hefty players in full gear. Heatstroke can occur suddenly and without warning. The athlete usually will not experience signs of heat cramps or heat exhaustion. Athletes who sleep poorly and those who are ill, especially with vomiting, diarrhea, or fever, are more prone to heatstroke. The same applies to athletes taking diuretics or drinking alcohol.

Early warning signs of impending heatstroke may include irritability, confusion, apathy, belligerence, emotional instability, and irrational behavior. The coach may be the first to notice a player who is heating up and can no longer think clearly. Giddiness, undue fatigue, and vomiting can be early signs. Paradoxical chills and goose bumps signal shutdown of skin circulation, resulting in a faster rise in temperature. The player may hyperventilate—just as a dog pants—to shed heat; this can cause tingling fingers and face before collapse. Lack of coordination and staggering—"running like a puppet on a string"—are late signs, followed by collapse with seizure and/or coma. At this stage, core body temperature can be 108°F (42.2°C) or higher.

The possibility of death from heatstroke can be significantly reduced if body temperature is lowered to normal within 45 minutes. The longer the body temperature is elevated to 106°F (41°C) or higher, the higher is the mortality rate.

DEHYDRATION

Athletes in the heat can lose 1 to 2 liters of water in an hour through sweating, and most athletes drink less fluid than they lose in sweat. The result is dehydration. Dehydrating only 2% of body weight—that's just 5 pounds in a 250-pound athlete—can impair physical performance. **Dehydration** increases heart rate and decreases cardiac output. Dehydration drains mental sharpness and willpower along with muscle power and endurance, so that the same level of activity seems as if it requires more effort.

Hydration helps prevent heatstroke, but consuming fluid in excess of sweat loss provides no advantage. Likewise, it is not necessary to overhydrate the night before or during the hours before a long run or practice. During training, the athlete should weigh in before and after a workout and should learn to adjust fluid intake to minimize weight loss. If weight loss does occur, rehydration after activity is critical. The athlete should drink 20 to 24 ounces of fluid for every pound of weight loss and should eat foods with high water content (fruits and vegetables).

TREATMENT

Cool First

No faster way to cool is known than placing the athlete in an ice-water tub. Submerge the trunk—shoulders to hip joints. Research suggests that ice-water immersion cools runners twice as fast as air exposure with the runner wrapped in wet towels. The U.S. Marines use ice-water cooling, and recent field research with volunteer runners suggests that cold water may cool as fast as ice water.

Transport Second

This is a medical emergency.

Some research suggests that heatstroke patients may have brief or lasting heat intolerance, but whether this is innate or is a result of the heatstroke is unclear. Most heatstroke sufferers have normal heat tolerance within 2 months. It seems likely that most athletes treated early for heatstroke and educated about prevention can return safely to their sport within weeks (see Box 19-2).

After an episode of major heat exhaustion, an athlete is allowed to return to play when his or her weight has normalized and symptoms are gone—usually within 48 hours.

Massage Implications

Massage is not applicable for heat-related illnesses except for temporary management of muscle cramps. Refer all clients with suspected heat-related illness to the trainer or to appropriate medical personnel.

COLD-RELATED ILLNESS

Cold weather is a frequent adjunct to many outdoor sports in which the sport itself does not require heavy protective clothing; consequently, the weather becomes a pertinent factor in injury susceptibility. In most instances, the activity itself enables the athlete to increase the metabolic rate sufficiently to function normally and dissipate resulting heat and perspiration through usual physiologic mechanisms. If an athlete fails to warm up sufficiently or becomes chilled because of relative inactivity for varying lengths of time, he or she is more prone to injury.

Dampness or wetness further increases the risk of hypothermia. Air at a temperature of 50° F (10° C) is relatively comfortable, but water at the same temperature is intolerable. The combination of cold, wind, and dampness creates an environment that easily predisposes the athlete to hypothermia.

A relatively small drop in body core temperature can induce shivering sufficient to materially affect an athlete's neuromuscular coordination and performance. Shivering ceases when the body temperature is 85° F to 90° F (29.4° C to 32.2° C). Death is imminent if the core temperature rises to 107° F (41.6° C) or falls to between 77° F and 85° F (25° C and 29° C).

Treatment consists of warming and drying the athlete.

Frostbite

Frostbite is local tissue destruction resulting from exposure to extreme cold; in mild cases, it results in superficial, reversible freezing, followed by erythema and slight pain. In severe cases, it can be painless or paresthetic and may result in blistering, persistent edema, and gangrene.

Do not massage any areas with frostbite.

IN MY EXPERIENCE

BREATHING

Breathing pattern disorder is extremely common in competing athletes. This tendency occurs because of extremes in activity level. Running around while breathing heavily is perfectly normal during many sports activities. Yet this same breathing pattern at home with the family can lead to disrupted interaction.

I recall an athlete with multiple stressors as the result of a nagging injury that was compromising performance, who would go home to a young family with a 3-year-old son and 1-year-old twin girls. His breathing was just stuck in the upper chest, perpetuating sympathetic arousal patterns. On the playing field, the result was too much "fight." At home, it seemed that everything irritated him. Obviously, this athlete needed help that went beyond massage strategies and that targeted normal relaxed breathing. As is often the case, the massage therapist may be the first to notice the cumulative strain. Sensitivity to noise is a common symptom of sympathetic dominance that is caused by, or perpetuated by, upper chest breathing.

I asked this client if he was having trouble with the "kid" noise. He looked at me and began to tear up. Then I asked if he was yelling at the kids, and he just hung his head and began to sob. The head coach, a great guy, was able to intervene, and the athlete was given help on multiple levels. Both massage to manage breathing dysfunction and help for the nagging injury were included in the intervention plan. I often wonder what might have happened to this young family if the coach had not been so supportive.

BREATHING PATTERN DISORDERS

Objective

1. Apply appropriate massage interventions for clients with breathing pattern disorder.

The massage therapist working with athletes as well as with other clients involved in physical exercise needs to

BOX 19-3 Signs and Symptoms of Breathing Pattern Disorder

Increased ventilation is a common component of fight-or-flight responses, but when our breathing increases and our actions and movements are restricted or do not increase accordingly, we are breathing in excess of our metabolic requirements. Blood levels of carbon dioxide fall, and many of the following signs and symptoms can occur.

CARDIOVASCULAR

Cardiovascular symptoms include palpitations, missed beats, tachycardia, sharp or dull atypical chest pain, "angina," vasomotor instability, and cold extremities. Raynaud's phenomenon, blotchy flushing of the blush area, and capillary vasoconstriction (face, arms, hands) may also be seen.

NEUROLOGIC

Neurologic symptoms include dizziness, unsteadiness or instability, sensation of giddiness, feelings of faintness (rarely actual fainting), visual disturbances (blurred or tunnel vision), headache (muscle tension and vascular migraine), and paresthesias (numbness, uselessness, heaviness, pins and needles, burning), commonly of hands, feet, or face, but sometimes of the scalp or whole body. Limbs may feel "out of proportion," or as if they "don't belong." Hypersensitivity to noise or light may be noted, and the pupils may be dilated (wearing dark glasses on a dull day).

RESPIRATORY

Respiratory symptoms include shortness of breath (typically after exertion), irritable cough, tightness or oppression of chest, difficulty breathing, "asthma," air hunger (inability to take a satisfying breath), and excessive sighing, yawning, and sniffing.

GASTROINTESTINAL

Gastrointestinal symptoms include difficulty in swallowing, dry mouth and throat, acid reflux (heartburn), exaggeration of symptoms of hiatal hernia due to aerophagia (air swallowing), nausea, flatulence, belching, abdominal discomfort, and bloating.

MUSCULAR

Muscular symptoms include cramps and pain, particularly in the occipitals, neck, and shoulders, and between the scapulae, and less commonly in the lower back and limbs. Tremors, twitching, weakness, stiffness, or tetany (seizing up) may also occur.

PSYCHOLOGICAL

Individuals with breathing pattern disorder may complain of tension, anxiety, "unreal feelings," and "out of body" feelings. Other psychic symptoms include depersonalization, panic, phobias, and agoraphobia (fear of being in open spaces).

GENERAL

Other symptoms include feelings of weakness; exhaustion; impaired concentration, memory, and performance; disturbed sleep, including nightmares; emotional sweating (axillae, palms, sometimes whole body); and a "thick-headed" sensation.

Cerebrovascular constriction, a primary response to disordered breathing, can reduce by about one half the amount of oxygen available to the brain. Among resulting symptoms are dizziness, blurring of consciousness, and possibly, because of a decrease in cortical inhibition, tearfulness and emotional instability.

Other effects that therapists should watch for include generalized body tension and chronic inability to relax. Persons with breathing pattern disorder are particularly prone to spasm (tetany) of muscles involved in the "attack posture"—they hunch the shoulders, thrust the head and neck forward, scowl, and clench the teeth.

be able to address the mechanism of breathing both to help correct dysfunction and to support optimal function. Persons in pain, including athletes, are prone to breathing pattern disorder (Box 19-3). Those with any sort of respiratory disease are especially susceptible to breathing dysfunction. Increased upper chest breathing results in biochemical changes that may temporarily reduce pain but in the long run may make the situation worse. Respiratory illness such as a cold can shift the breathing function to an upper chest pattern, and then it may not reverse. Chronic respiratory disease such as asthma perpetuates breathing dysfunction. Persons with anxiety and depression often display breathing difficulties.

Athletes can get "stuck" in the breathing rate required for practice and competition and may not be able to reverse the breathing to a resting phase. This interferes with mood, recovery, and further performance.

Breathing pattern disorder consists of a complex set of behaviors that lead to overbreathing without evident pathology. Because no specific pathology is known and anatomy and physiology are normal, it is considered a functional syndrome. The breathing pattern is inappropriate–a situation resulting in confused signals to the central nervous system, which sets up a whole chain of events.

SLEEP-DISORDERED BREATHING

Obstructive sleep apnea is the most common disorder of breathing. During sleep, breathing efforts persist, but the upper airway is obstructed. Symptoms include excessive snoring, daytime sleepiness, headache, impaired thinking and irritability.

Continuous positive applied pressure (CPAP) prevents airway collapse and is effective in long-term treatment.

THERAPEUTIC MASSAGE FOR BREATHING DISORDERS

If accessory muscles of respiration, such as the scalenes, sternocleidomastoid, serratus posterior superior, pectoralis

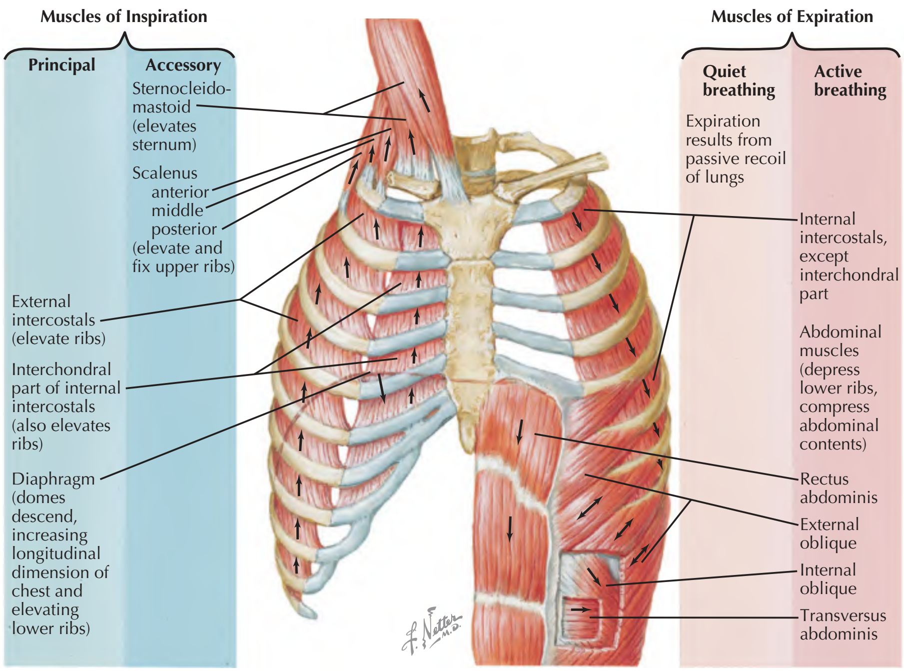

FIGURE 19-1 Muscles used during breathing. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

minor, levator scapulae, rhomboids, abdominals, and quadratus lumborum, are constantly being activated for breathing when forced inhalation and expiration are not called for, dysfunctional muscle patterns will result (Figure 19-1).

Therapeutic massage can assist in normalizing these conditions and supporting more effective breathing. It is very difficult to breathe well if the mechanical mechanisms are not working efficiently. Many who have attempted breathing retraining have become frustrated with their inability to accomplish the change in breathing pattern because these muscle patterns are not changed. They may find more success once the muscles of the body and the mechanism of breathing are normalized.

The massage therapist influences breathing in two distinct ways:

1. Supporting balance between sympathetic and parasympathetic autonomic nervous system function. (This is generally accomplished with a relaxation focus in the general protocol.)
2. Normalizing and then maintaining effective thoracic and respiratory muscle function.

The following assessment and treatment procedures specifically target these areas. The applications should be integrated into the general protocol to work more specifically with breathing function if assessment indicates a tendency toward breathing pattern dysfunction. Again, it is strongly recommended that the reader study *Multidisciplinary Approaches to Breathing Pattern Disorders* (Chaitow et al., 2002).

ASSESSMENT PROCEDURES

During each massage session, the client should be monitored continually for symptoms related to breathing pattern disorder.

Observe and palpate for overuse of upper chest breathing muscles during normal relaxed breathing.

Stand behind the client and place your hands or the client's hands over the upper trapezius area, so that the tips of the fingers rest on top of the clavicles. As the client breathes, determine whether he or she is using accessory muscles during relaxed breathing.

If the shoulders move up and down as the client breathes, it is likely that accessory muscles are being recruited. In normal relaxed breathing, the shoulders should not move up and down. The client is using accessory muscles to breathe if the chest movement is concentrated in the upper chest instead of in the lower ribs and abdomen. Use of any of the accessory muscles for breathing causes increased tension and a greater tendency toward the development of trigger points. These situations can be identified by palpation. Connective tissue changes are common because this condition is often chronic. The connective tissues are palpated as thick, dense, and shortened in this area.

Have the client naturally inhale and exhale, and observe for a consistent exhale that is longer than the inhale. Normal relaxed breathing consists of an inhalation phase that is shorter than the exhalation phase. The ratio of inhalation time to exhalation time is 1 count inhale to 4 counts exhale. The reverse of this pattern serves as the basis for breathing pattern disorder.

The ideal pattern ranges from 2 to 4 counts during the inhale, and from 8 to 16 counts for the exhale. Targeted massage and breathing retraining methods can be used to restore normal relaxed breathing.

Have the client hold the breath without strain, to assess for tolerance to carbon dioxide levels. The client should be able to comfortably hold the breath for at least 15 seconds; 30 seconds is much better.

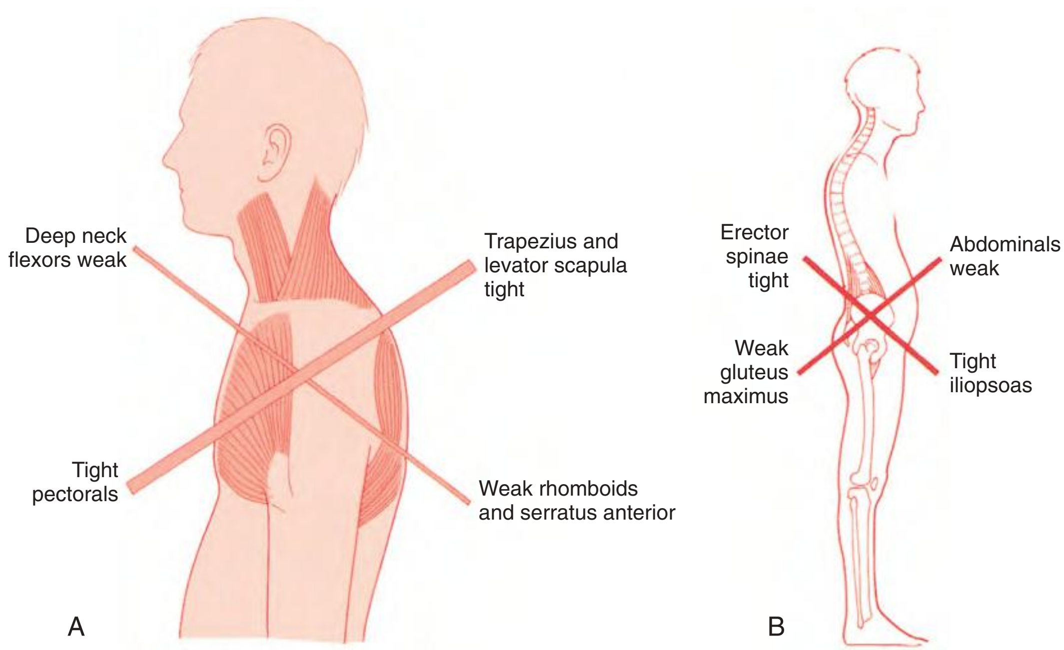

FIGURE 19-2 **A,** Upper crossed syndrome (after Janda). **B,** Lower crossed syndrome (after Janda). (From Chaitow L, DeLany J: *Clinical applications of neuromuscular techniques, vol 1, The upper body,* Edinburgh, 2001, Churchill Livingstone.)

Palpate and gently mobilize the thorax to assess for rib mobility. This is done with the client in the supine, prone, side-lying, and seated positions. The ribs should have a springy feel and should be a bit more mobile from the 6th to the 10th rib.

TREATMENT PROCEDURES

The following muscles are specifically targeted by massage because they tend to shorten during breathing dysfunction (see Chapter 13):

- Scalenes
- Sternocleidomastoid
- Serratus anterior
- Serratus posterior superior and inferior
- Levator scapulae
- Rhomboids
- Upper trapezius
- Pectoralis major and minor
- Latissimus dorsi
- Psoas
- Quadratus lumborum
- All abdominals
- Pelvic floor muscles
- Calf muscles

The intercostals and the diaphragm, which are the main breathing muscles, also will be addressed.

All of these muscles should be assessed for shortening, weakness, and agonist/antagonist interaction. Muscles that orient mostly transverse, such as serratus anterior and serratus posterior, superior, and inferior, are rhomboids and are difficult to assess with movement and strength testing. Palpation will be more accurate. Typical patterns of the upper and lower crossed syndromes are often involved (Figure 19-2).

Muscles assessed as short need to be lengthened. If the primary cause of the shortening is neuromuscular, then inhibitory pressure should be used at the muscle belly and lengthening should be performed by moving adjacent joints or, more likely, by introducing tension, bend, or torsion force directly on the muscle tissues. For scalenes and for sternocleidomastoid, serratus anterior, pectoralis minor, latissimus dorsi, psoas, quadratus lumborum, diaphragm, rectus abdominis, and pelvic floor muscles, follow recommendations in the specific release section of Chapter 13.

Work with each area as needed, as it becomes convenient during the general massage session. Use the least invasive measure possible to restore a more normal muscle resting length.

If breathing has been dysfunctional for an extended period (longer than 3 months), connective tissue changes are common. Focused connective tissue massage application is effective (see Unit Two).

Once the soft tissue is more normal, gentle mobilization of the thorax is appropriate. If the thoracic vertebrae and ribs are restricted, chiropractic or other joint manipulation methods may be appropriate and referral is indicated. The massage therapist can use indirect functional techniques to increase the mobility of the area as well. These methods are described in Unit Two.

Methods and sequences used to address the breathing function need to be integrated into a full-body approach because breathing is a whole body function (Figure 19-3).

A possible protocol to add to the general massage session would consist of the following:

- Give increased attention to general massage of the thorax; posterior, anterior, and lateral access to the thorax is used to primarily address general tension or dysfunctional patterns in the respiratory muscles of this area. Address scalenes, psoas, quadratus lumborum, and legs, especially the calves.

FIGURE 19-3 Assessment and treatment of breathing function. **A,** Assess shoulder movement. Shoulders should not move up and down in normal relaxed breathing. **B,** Assess rib mobility. Lower ribs should move out not up during normal relaxed breathing. **C,** Watch client breathe. Hand on abdomen should move out. Hand on chest should not move during normal relaxed breathing. **D,** Assess rib mobility, anterior. Gentle compression on the ribs should feel springy with slightly more movement on ribs lower than 1 through 4. **E,** General massage accesses the posterior thorax. **F,** General massage accesses the lateral thorax.

FIGURE 19-3, cont'd **G,** General massage accesses the shoulder and pectoral muscles. **H,** Compression/kneading/mobilization treatment, rib mobility, anterior. **I,** Identify trigger/tender point (drag palpation). Then use positional release. **J,** Stretch tissues directly and with movement. **K,** Relief position 1: lifts lower ribs to support diaphragm function. **L,** Relief position 2: opens chest and fixes shoulders so the accessory muscles cannot be used for breathing. **M,** Self-help 1: breathing retraining. Have client loosely interlace fingers. **N,** Then have client press fingers tightly together as when making a fist with both hands. Client breathes normally while fingers are pressing. This method makes breathing with accessory muscles more difficult and supports more normal breathing function. Maintain position as long as is comfortable. Relax and repeat. **O,** Self-help 2: instruct client to bend elbows to 90 degrees, and hold against lateral side of the body. Then have client press forearms down into the therapist's hands. This method is practiced by pushing into the arms of a chair or simply down toward the floor. This maneuver does not allow shoulders to move during breathing.

- Use appropriate muscle energy techniques to lengthen and stretch shortened muscles of the cervical, thoracic, and lumbar regions, as well as the legs.
- Gently move the rib cage with broad-based compression. Assess for areas that move easily and those that are restricted. Assess the anterior, lateral, and posterior areas.
- Identify the amount of rigidity in the ribs with the client supine by applying bilateral compression to the thorax, beginning near the clavicles and moving down toward the lower ribs, while maintaining compressive force near the costal cartilage.
- Identify rigidity in the ribs with the client prone bilaterally (on both sides of the spine) at the facet joints, beginning near the 7th cervical vertebrae and moving down toward the lower ribs, while maintaining compressive force near the facet joints.
- Use compression against the lateral aspect of the thorax with the client in a side-lying position to assess rib mobility in both facet and costal joints. Begin by applying compression near the axilla and then moving down toward the lower ribs. Sufficient force needs to be used while applying compression to feel the ribs spring, but not so much as to cause discomfort. Normal response is a feeling of equal mobility bilaterally. A feeling of stiffness or rigidity indicates immobility.
- Identify the area of greatest mobility and the area of greatest restriction.
- Position the client so that a broad-based compressive force can be applied to areas of ease–the most mobile.
- Gently and slowly apply compression until the area begins to bind. Hold this position and have the client cough. Coughing will act as a muscle energy method and will support mobility of the joint through activation of the muscles. Repeat 3 or 4 times.
- If areas of rigidity remain, the following intervention may be useful.
  - Apply broad-based compression to the area of immobility, using the whole hand or forearm.
  - Have the client exhale, and then increase the intensity of the compressive force while following the exhale.
  - Hold the ribs in this position.
  - Have the client push out against the compressive pressure.
  - Instruct the client to inhale while continuing to hold the compressive focus against the ribs.
  - Have the client exhale while following the action of the ribs. Mobility should be increased.
  - Gently mobilize the entire thorax with rhythmic compression.
  - Reassess the area of greatest bind/restriction. If the treated area has improved, locate a different area and repeat the sequence. It is appropriate to do three or four areas in a session.
  - Next, palpate for tender points in the intercostals, pectoralis minor, and anterior serratus. (Clients are not very tolerant of this, so be direct and precise.) Use positional release to treat these points by moving the client or having the client move into various positions until pain in the tender point decreases.
- As a reminder, the procedure for positional release is as follows.
  - Locate the tender point.
  - Gently initiate the pain response with direct pressure. (Remember that the sensation of pain is a guide only.) The pain point is not the point of intervention.
  - Slowly position the client's body, actively or passively, until the pain subsides. This position can be focal and can be accomplished by moving the client's ribs, arm, or head, or it can be a whole body process involving many different areas to achieve the position in which pain is decreased.
  - Have the client maintain the position for up to 30 seconds, or until the client feels the release; while encouraging the client to breathe from the diaphragm, lightly monitoring the tender point with palpation.
  - Slowly reposition the client to neutral, and then into a stretch position for the tender point. Direct tissue stretching is usually most effective.

BREATHING RETRAINING PROGRAM

Once the thorax and breathing function begin to normalize–usually after four to six focused sessions–a breathing retraining program can be taught to clients. The main focus of a breathing retraining program is the exhale process. Do not even address the inhale. When the exhale pattern normalizes, the inhale pattern will normalize as well. Three common activities can normalize a breathing pattern: yelling, crying, and laughing. Each of these activities sustained for 3 to 5 minutes can be valuable in any breathing retraining program.

Pursed lip exhale is helpful. The client inhales normally, holds the breath for 1 or 2 seconds, and then slowly exhales (as if gently trying to make a candle flame flicker about 1 foot away) by blowing the air through pursed lips.

Blowing up balloons can be a good exercise for supporting exhale function, as is playing a horn, a flute, or a similar musical instrument. Singing or chanting and simply toning the vowel sounds (a, e, i, o, u) are variations that support exhale function.

It is helpful for the client to combine a slow breathing pattern with a stretching/flexibility program that targets the short muscle areas. The client can practice breath holding until the breath can be held comfortably for 30 seconds. Relief positions place the thorax in such a way as to support normal, relaxed breathing or inhibit muscle function (see Figure 19-3).

SUMMARY

Illnesses and disorders are typically systemic and affect multiple body systems. Injury is more local. Injury, illness, and disorders interact. Clients who are injured are more apt to become ill. Those who have been or are ill are more susceptible to injury and to thermoregulation problems. Those with disordered breathing are more prone to both injury and illness. Strain on adaptive capacity is the common thread here, and effective massage can at least temporarily reduce adaptive strain. Caution is necessary, however. Massage that is excessive for an individual client with a specific condition can add to adaptive strain. The skilled massage therapist should be able to balance the dynamics of appropriate and inappropriate massage application.

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evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1. Describe a massage treatment plan that would be appropriate if the client had a viral respiratory infection.
2. Describe a massage treatment plan that would NOT be appropriate if a client had suppressed immunity.
3. Write a treatment plan for each of the following clients:
   a. A 23-year-old basketball player with a sinus infection
   b. A 67-year-old male who has recently had a mild heart attack
   c. A 19-year-old cheerleader with mononucleosis
   d. A 27-year-old marathon runner, 24 hours post event
   e. A 38-year-old deconditioned client playing tennis in heat and humidity
   f. A 44-year-old client with generalized anxiety and disrupted breathing, who is using exercise for both weight management and anxiety management.

CHAPTER

20 Injury by Area

OBJECTIVES

After completing this chapter, the student will be able to perform the following:

1 Identify specific injuries based on location.

2 Develop and implement appropriate treatment plans for massage application for a specific injury.

KEY TERMS

Achilles Bursitis
Achilles Tendinopathy (Tendonitis, Tendonosis)
Achilles Tendon Rupture
Arthritis of the Shoulder
Baker's Cyst (Popliteal Cyst)
Biceps Tendonitis
Black Toenails
Blisters
Blowout Fracture
Bo Jackson Injury (Avascular Necrosis)
Bone Chips
Boxer's Wrist
Broken Ankle
Broken Cheekbone
Broken Collarbone
Broken Finger
Broken Hand
Broken Hip
Broken Jaw
Broken Neck
Broken Nose
Broken Patella
Broken Rib
Broken Toe
Bruised Collarbone
Bruised Quadriceps
Bruised Ribs
Bulging Disk
Bunion/Hallux Valgus
"Burner" ("Stinger")
Bursitis
Buttock Pull
Calf Cramps
Calluses
Carpal Tunnel Syndrome
Cauliflower Ear
Cervical Stenosis
Cluster Headaches
Compartment Syndrome
Concussion
Cracked Back
Cracked Wing
Cruciate Ligament Injury
Dislocated Finger
Dislocated Knee
Dislocated Patella
Dislocated Shoulder
Dislocation of the Fibularis
Femur Fracture
Fracture of the Shoulder
Frozen Shoulder (Adhesive Capsulitis)
"Funny Bone" Syndrome
Ganglion
Golfer's Wrist
Groin Pull
Hamstring Pull
Headache
Heel Spur
Heel Stress Syndrome
Hip Pointer
Hyperextended Elbow
Iliotibial Band Syndrome
Impingement Syndrome
Jammed Finger
Jumper's Knee
Leg Muscle Pulls and Tears
Little League Elbow
Loose Body
Lumbar Pain
Mass Reflex
Metatarsal Stress Fracture
Metatarsalgia
Mid-Back Pain
Migraine Headache
Morton's Foot
Morton's Syndrome
Osgood-Schlatter Disease
Osteitis Pubis
Osteoarthritis/Arthrosis
Pain on the Outside of the Leg
Partial Dislocation of the Shoulder
Patellofemoral Syndrome
Pes Cavus (Claw Foot)
Pinched Nerve
Pitcher's Elbow
Plantar Fasciitis
Prepatellar Bursitis
Pro's Rotator Cuff Injury
Pronating Foot
Psoas Low Back Pain
Quadratus Lumborum Pain
Quadriceps Pull or Tear
Quadriplegia
Racquet Wrist
Rib Muscle Pull or Tear
Rib Separation

OUTLINE

KEY TERMS—continued

Rotator Cuff Tear
Ruptured Disk
Scaphoid Fracture
Sciatica
Scratched Cornea
Shin Splints
Short-Leg Syndrome
Shoulder Muscle Pulls (Strains)
Shoulder Separation
Shoulder Sprains
Ski Pole Thumb
Skull Fractures
Spastic Torticollis
Spinal Cord Injuries
Spondylolysis
Sports Hernia/Athletic Pubalgia
Sprained Finger
Sprained Knee
Sprained Neck
Sprained Thumb
Sprained Wrist
"Stinger" ("Burner")
Stress Fracture
Stretched Nerve
Supinating Foot
Tarsal Tunnel Syndrome
Tendonitis of the Shoulder
Tennis Elbow
Tennis Leg
Tension Headache
Terrible Triad of O'Donohue
Tibial Stress Syndrome
Tibialis Anterior Tendon Sheath Inflammation
Tibialis Posterior Syndrome
TMJ Injury
Toe Tendinopathy (Tendonitis, Tendonosis)
Torn Biceps
Torn Cartilage (in the Knee)
Torn Tendon
Trapezium Fracture
Trapezius Triggers
Triceps Tendinopathy (Tendonitis, Tendonosis)
Trigger Finger
Turf Toe
Weight Lifter's Shoulder
Whiplash
Wryneck

The previous chapters have prepared the reader to assess the indication (or contraindication) for massage therapy in cases of injury, illness, and disorders, and to provide appropriate intervention. Typically, the client will come to the massage therapist with an injury diagnosis. A massage treatment plan is then developed as part of a multidisciplinary care approach. This chapter enables the massage therapist to understand the physician's diagnosis, provides guidance for effective treatment, and discusses the injury in relation to its body region.

If massage therapy is appropriate as treatment or as an adjunct to treatment, the reader is referred to a section in a previous chapter outlining appropriate procedures. Occasionally, a more expansive discussion is presented here, along with specific strategies for the particular injury.

It is the responsibility of the massage therapist who is treating a client with an injury to thoroughly research the specific injury, understand the treatments being used by the medical team, and provide appropriate supportive care during the healing and rehabilitation process. How injuries cluster in relation to common sports is found in Table 20-1.

Massage applications recommended for a specific condition can be incorporated into the general massage session protocol.

THE HEAD

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

Because the head houses all of the body's vital control centers, any injury to the head other than a mild bump or scrape should be seen by a physician. Head injuries should be monitored for at least 2 weeks because some conditions worsen slowly. Consider ALL head injuries to be serious until proven otherwise because they can be life-threatening.

CONCUSSION

A **concussion** is any disorientation or loss of consciousness, even for a moment, after a blow to the head. The brain floats within the skull surrounded by cerebrospinal fluid, which cushions it from the light bounces of everyday movement. However, the fluid is not able to absorb the force of a sudden blow or a quick stop, and the brain slides forcefully against the inner wall of the skull and becomes bruised. This can result in bleeding in or around the brain and tearing of nerve fibers. It is common for a person who suffered a concussion to not remember events just before, during, and immediately after the injury. Memory of these events may return. After recovery, cognitive function almost always returns to normal, although repeated concussions (even if mild) can result in minimal brain damage.

A serious aftermath of a concussion is a condition known as *second impact syndrome.* This can occur when a person who is still recovering from a concussion returns to a contact sport or activity or has recurrent head trauma. A seemingly minor trauma or bump on the head in these individuals can lead to devastating swelling of the brain, which may prove fatal.

Head trauma can result in various types of closed head injuries. Impaired functions depend on the area of brain injury. Any change in typical behavior or ability in a person who has suffered head trauma should be closely monitored.

More than 300,000 athletes suffer concussions each year. There is no way to predict which athletes are likely to suffer concussions. The severity of a concussion depends on how much force is applied to the head and whether the blow is head-on or glancing.

People who wear helmets, which absorb shock, probably will have milder concussions than those who do not. Advances in the design of protective headgear are helping to prevent head trauma and reduce the severity of a concussion. Although protective equipment continues to improve in quality, many athletes participate in high-impact sports activities, such as soccer, or sports in which head trauma can result from falling, such as gymnastics, or the many other sports in which head protection is not required. Therefore, concussions are an ongoing concern, and repeated head trauma can have cumulative effects. Previous head trauma seems to make a person more predisposed to future problems.

Signs and symptoms of concussions can be subtle and may not appear immediately. Once present, symptoms can last for days, weeks, or longer. The severity and side effects of a head injury depend greatly on which area of the brain was most affected.

Immediate signs and symptoms of a concussion may include the following:

- Confusion
- Amnesia
- Headache
- Loss of consciousness after injury
- Ringing in the ears (tinnitus)
- Drowsiness
- Nausea
- Vomiting
- Unequal pupil size
- Unusual eye movements
- Convulsions
- Slurred speech

Delayed signs and symptoms may include those listed here:

- Irritability
- Headaches
- Depression
- Sleep disturbances

TABLE 20-1 Common Injuries by Sport

Athletic Sport	Definition	Common Injuries
Baseball/Softball	Bat and ball game: A game played with a bat and ball by two teams of nine players on a field with four bases marking the course the batters must take to score runs.	Shoulder tendinopathy (tendonitis, tendonosis), bursitis, impingement syndrome, muscle sprains and strains, rotator cuff, frozen shoulder, wrist sprains, tennis elbow, anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) injuries, medial collateral ligament (MCL) and lateral collateral ligament injuries.
Basketball	Ball game played on a court: A game played by two teams of five players, who score points by throwing a ball through a basket mounted at the opponent's end of a rectangular court.	ACL and PCL injuries, ankle sprain, Achilles tendinopathy (tendonitis, tendonosis), rotator cuff tendinopathy (tendonitis, tendonosis), injuries to the meniscus, wrist sprain, finger fractures, Achilles tendon rupture, hamstring pull or tear, muscle sprains and strains.
Bicycling	The act or sport of riding or traveling by bicycle or motorcycle.	Neck pain, neck strain, knee pain, patellofemoral pain, chondromalacia, osteoarthritis of the knee, Achilles tendinopathy (tendonitis, tendonosis), plantar fasciitis.
Boxing	Sport of fighting with fists: The sport of fighting with the fists with the objective of knocking out the opposing boxer, or inflicting enough punishment to cause the other boxer to quit or be judged defeated.	Facial lesions, rotator cuff injury, inflammation, impingement syndrome.
Canoe/Kayaking	Sports canoe: A lightweight plastic- or fiberglass-covered canoe propelled by a double-bladed paddle, used for leisure and in competitive sport.	Shoulder strain, wrist/hand and elbow/forearm sprains.
Football	Game played with an oval ball: A game in which two teams of 11 players score points by carrying an oval ball across their opponents' goal line, or by kicking the ball through the opponents' goal posts.	Anterior and posterior cruciate ligament injuries, meniscus injury, groin pull; hamstring pull, tear, sprain, or strain; iliotibial band syndrome, shin splints, concussion, shoulder fracture, torn rotator cuff, shoulder separation, shoulder dislocation, whiplash, neck strain, Achilles tendinopathy (tendonitis, tendonosis), turf toe, back muscle strains, low back pain, herniated disks.
Gymnastics	A competitive sport in which individuals perform optional and prescribed acrobatic feats mostly on special apparatuses to demonstrate strength, balance, and body control.	Muscle back strain, spondylolysis, bruises, contusions, muscle soreness, overtraining syndrome, ankle sprains.
Hockey	Team sport played on ice: A game played on ice between two teams of six, using long sticks with curved ends. The objective is to hit a small hard rubber disk into the opposing goal.	Lacerations, knee sprains, medial collateral and capsular ligaments, acromioclavicular joint separation, shoulder dislocation, gamekeeper's thumb, fracture of the hand and wrist, bruises and contusions, muscle cramps, lumbosacral pain.
Golf	Game with ball and clubs: An outdoor game in which an array of special clubs with long shafts are used to hit a small ball from a prescribed starting point into a series of holes.	Muscle back strain, low back pain, herniated disks, shouder tendinopathy (tendonitis, tendonosis), bursitis, impingement syndrome, torn rotator cuff, frozen shoulder, rotator cuff tendonitis, shoulder instability, golfer's elbow, bursitis of the elbow, tennis elbow.
Ice skating	Skating on ice as a sport or pastime.	Sprained wrist, plantar fasciitis, MCL injury, low back injury.
Running	The exercise or sport of someone who runs.	Shin splints, runner's knee, ankle sprain, foot arch pain and strain, Achilles tendinopathy (tendonitis, tendonosis), blisters, delayed-onset muscle soreness, groin pull, heel spur; hamstring pull, tear, or strain; iliotibial band syndrome, muscle cramps.

Continued

TABLE 20-1 Common Injuries by Sport—cont'd

Athletic Sport	Definition	Common Injuries
Snow skiing/Snowboarding	Activity of gliding over snow using skis or a flat board (originally wooden planks, now usually made from fiberglass or related composites) strapped to the feet.	Anterior and posterior cruciate ligament injuries, meniscus injury, concussion, knee pain, low back pain, skier's thumb, wrist arthritis pain, shoulder fracture, torn rotator cuff, shoulder separation or dislocation, neck strain, shoulder fracture.
Soccer	Ball game using no hands: A game in which two teams of 11 players try to score by kicking or butting a round ball into the net goals on either end of a rectangular field.	Hamstring pull, ankle sprain, Achilles tendinopathy (tendonitis, tendonosis), cruciate ligament tears, concussion, groin pull, iliotibial band syndrome, ACL and MCL injuries, meniscus injuries.
Swimming	Moving through water: The action or activity of making progress unsupported through water using the arms and legs, whether for pleasure, exercise, or sport.	Swimmer's shoulder (shoulder joint pain), inflammation, impingement, rotator cuff pain, eye irritation.
Tennis	Game with ball, racquets, and net: A game played on a rectangular court by two players or two pairs of players, who use racquets to hit a ball back and forth over a net stretched across a marked-out court.	Tennis elbow, bursitis of the elbow, rotator cuff tendonitis, shoulder tendinopathy (tendonitis, tendonosis), frozen shoulder, shoulder joint pain, inflammation, ankle sprain, torn rotator cuff, wrist tendinopathy (tendonitis, tendonosis), Achilles tendinopathy (tendonitis, tendonosis), iliotibial band syndrome, osteoarthritis.
Triathlon	Athletic contest with three events: An athletic competition in which the contestants compete in three different events and are awarded points for each to find the best all-around athlete.	Shin splints, runner's knee, shoulder inflammation and pain, Achilles tendinopathy (tendonitis, tendonosis), plantar fasciitis.
Volleyball	A sport in which two teams hit a large ball over a high net using their hands, played on a rectangular court.	Shoulder joint pain, inflammation, impingement syndrome, rotator cuff pain, tendinopathy (tendonitis, tendonosis), tennis elbow, bursitis of the elbow, glenohumeral arthritis, wrist tendinopathy (tendonitis, tendonosis), Achilles tendinopathy (tendonitis, tendonosis), osteoarthritis of the knee, low back pain, ankle sprain.
Weight training	Training using weights: Physical training using weights to strengthen the muscles.	Strained lower back injury, shoulder joint inflammation, tendinopathy (tendonitis, tendonosis).

- Fatigue
- Personality changes
- Poor concentration
- Trouble with memory
- Getting lost or becoming easily confused
- Increased sensitivity to sounds, lights, and distractions
- Loss of sense of taste or smell
- Difficulty with gait or in coordination of the limbs

When diagnosing a concussion, the doctor may ask questions about the accident and may conduct a neurologic examination to assess memory, concentration, vision, hearing, balance, coordination, and reflexes. Depending on the results of the neurologic examination, the doctor may request a computed tomography (CT) scan or a magnetic resonance imaging (MRI) scan.

Rest is the best recovery technique. Some over-the-counter and prescription drugs may be taken for headache pain. Aspirin and other nonsteroidal antiinflammatory drugs (NSAIDs) usually are not recommended because they could contribute to bleeding. The healing process takes time–sometimes several months–and includes the following:

- Plenty of sleep at night, and rest during the day
- Gradual return to normal activities
- Avoiding activities that could result in a second head injury

After a concussion, some symptoms may persist, including headache, dizziness, loss of memory of the event, fatigue, and general weakness. This is called *postconcussion syndrome.* In some people, these symptoms clear up and they feel fine, but the symptoms recur when they become active again. If these symptoms persist, the athlete should be reevaluated by the physician. No athlete should return to heavy physical activity until the symptoms clear completely.

Returning to athletic activity depends on the cumulative effects of the concussions. The following time frames are typical:

First concussion—7 days or until all postconcussion symptoms clear, whichever is longer.
Second concussion—3 weeks or until symptoms cease.
Third concussion—up to 6 months.

The effect of multiple concussions can result in long-term neurologic and functional deficits, including changes in emotional behavior.

Massage Strategies

Massage, if approved by the physician, should be general and nonspecific. Avoid any abrupt movements of the head. The focus of the massage should be sleep support and recovery (parasympathetic dominance). Once the athlete is allowed to practice, gait patterns and ocular reflexes need to be reset. The massage therapist should maintain vigilant observation for any postconcussion symptoms and should urge the athlete to see the physician for even minor symptoms.

SKULL FRACTURE

A hard blow to the head can fracture the bones of the skull (Figure 20-1). Although not common, **skull fractures** occur, and a severe blow to the head can cause a fracture. Blood or clear fluid leaking from the ear or nose may be a sign of a skull fracture. This is a medical emergency—refer the client to a physician immediately.

A depressed skull bone from a fracture may put pressure on the brain or tear blood vessels in the lining of the skull, causing bleeding on the brain. Pressure and bleeding can cause coma and even death if not relieved.

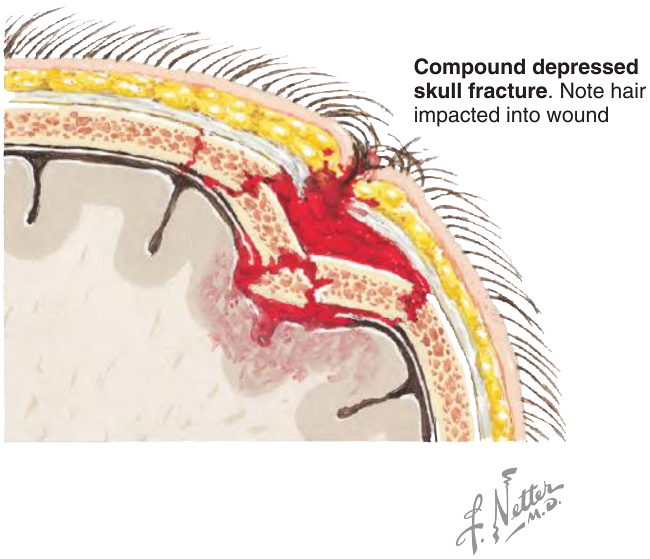


FIGURE 20-1 Skull fractures. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

Massage Strategies

Massage is contraindicated in these cases.

BROKEN NOSE

A blow to the nose can fracture the nasal bones or the cartilage of the septum. A **broken nose** appears flattened or crooked; there is copious bleeding from the nose, and breathing is difficult.

If a broken nose is suspected, it should be iced down to limit swelling and bruising. The nose needs to be examined and x-rayed by a physician. If the broken bone has been displaced, this can cause later breathing problems if not repaired. After treatment, the nose should be protected with a splint and/or a face guard until it heals completely, which can take 4 to 6 weeks.

Massage Strategies

Massage is general and nonspecific, avoids injured areas, manages pain, and promotes healing. The prone position may need to be avoided. Because of disrupted breathing, auxiliary breathing muscles may become strained. Include focus on normalized breathing in the general massage protocol. Use general procedures for fractures, broken bones, breathing support, and pain management.

BROKEN CHEEKBONE

A hard blow to the cheek can fracture the bone. The same athletes who are prone to a broken nose may also be prone to a **broken cheekbone** (Figure 20-2). Treatment includes icing the cheek and possibly surgery. Healing may take several weeks.

Massage Strategies

Do NOT massage the area. Focus on pain management and support healing by encouraging parasympathetic dominance. The prone position should be avoided. See general procedures for fractures (page 309).

BLOWOUT FRACTURE

A blow to the eye or cheek can fracture the bones surrounding the eyeball. A **blowout fracture** is easy to spot because the orbit connects to one of the sinuses. When the client blows hard through the nose, the eye will suddenly swell shut as air gets into the tissues right under the eye. As with any fracture, the victim of a blowout fracture must see a doctor for treatment, which may include surgery. If the fractured orbit is displaced, as often happens, one of the eye muscles may be trapped, and the eye will not move properly, causing double vision, unless surgically corrected.

Massage Strategies

Massage avoids the area, and the prone position is not used. See general procedure for broken bones and pain

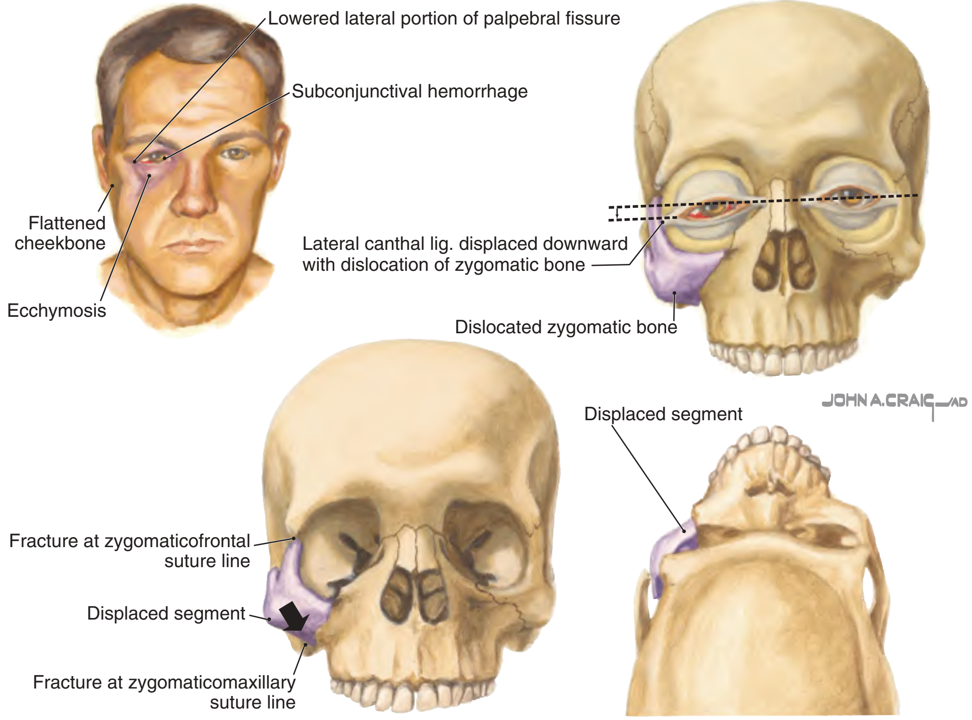


FIGURE 20-2 Zygomatic fractures. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

management. Once the athlete has recovered, eye reflexes may need to be addressed.

SCRATCHED CORNEA

A **scratched cornea** commonly occurs when a person gets poked in the eye. Direct blows to the eye from a ball in sports such as racquetball can cause a scratched cornea, as well as a variety of other injuries. This is an extremely painful injury. If severe, it can lead to loss of vision. Every eye injury must be considered serious. Treatment includes covering the eye with a patch and examination by a physician as soon as possible.

To guard their eyes, many athletes now wear protective gear, especially if they have already had an eye injury.

Massage Strategies

Massage supports pain management and healing by encouraging parasympathetic dominance.

CAULIFLOWER EAR

If an unprotected ear is bent over, punched, or caught in a wrestling hold, the cartilage in the ear can break. Bleeding occurs under the skin, and if the blood is not drained, scar tissue will form and the ear will look somewhat like a cauliflower—hence the name **cauliflower ear**.

Medical treatment includes ice and compression to the ear to limit bleeding, and drainage of excess blood from the ear by a physician.

Massage Strategies

General massage that supports healing mechanisms and avoids the area is indicated. Once healing is in the subacute phase, scar tissue management can begin.

BROKEN JAW

Symptoms of a **broken jaw** include pain on one side of the jaw and pain inhibiting the ability to clench the jaw. If the jaw can be closed, the teeth will not meet properly.

A broken jaw must be wired shut by a dental surgeon to allow it to heal, which typically takes about 6 weeks. Many athletes can compete with their jaws wired shut, but their diet is limited to liquids taken through a straw, which can result in weight and strength loss.

Massage Strategies

Use massage strategies for fractures.

TMJ INJURY AND PAIN

A blow to the jaw can injure the temporomandibular joint (TMJ). The ligaments may become torn, causing the joint to slide into and out of place. The jaw may become stuck in an open position, requiring manipulation by an oral surgeon to close it. This injury usually heals within 6 to 8 weeks, but a mouthpiece may be necessary to hold the jaw in position until the ligaments heal.

Preventing **TMJ injury** is one of the reasons athletes wear mouthpieces. The mouthpiece protects the jaw and teeth and disperses the shock from a blow. However, sustained biting down on the mouthpiece can cause pain and shortening in the muscles of mastication, resulting in TMJ pain.

Massage Strategies

Massage for TMJ pain targets the muscles of mastication. The muscles most effectively massaged for TMJ pain are the masseter, temporalis, and sternocleidomastoid. Muscle shortening, trigger point activity, and connective tissue bind can all occur. Intraoral muscles are not easily accessed for massage application but can be worked if necessary.

While wearing a glove, access the pterygoids and masseter by using a pinching technique. Instruct the client to exhale slowly through the open mouth immediately beforehand, which can reduce the gag reflex. Referral to a TMJ specialist may be required.

The general protocol used on the head, neck, and face is usually effective for addressing simple TMJ pain.

HEADACHE

Headache is a common symptom with a multitude of causes. Headaches can be caused by stress, muscle tension, biochemical imbalance, circulatory and sinus disorders, and tumor. Because the brain has no sensory innervation, headaches do not originate in the brain. The pain of a headache is produced by pressure on the sensory nerves, vessels, meninges, or muscle-tendon-bone unit. All headaches should be evaluated by a physician to rule out serious underlying conditions.

Migraine headache is believed to be caused by dilation of the cranial vessels. The pain is knife-like, throbbing, and unilateral. Any visual distortion (e.g., flashing lights) is believed to be caused by vasoconstriction preceding the vasodilation and pain.

Medications used to treat headaches are usually NSAIDs such as aspirin, but migraines may not respond to medication after the headache begins. Migraines sometimes may be prevented by the medication ergotamine (a vasoconstrictor) or another vasoconstricting medication. The judicious use of caffeine may reduce migraine symptoms. On the other hand, caffeine withdrawal also causes a vascular-type headache.

Cluster headaches occur on one side of the head, with remissions and recurrence lasting for long periods. They usually occur at night and are associated with other symptoms, such as red eyes and sinus drainage.

A tension or muscle contraction headache is the most common headache type. **Tension headache** is believed to be caused by a muscle-tendon strain at the origin of the trapezius and deep neck muscles at the occipital bone, or at the origin of the frontalis muscle on the frontal bone *(occipital* or *frontal headache).* Tension headache also can originate in the TMJ muscle complex. Connective tissue structures that support the head may be implicated in headache if they are shortened and pull the head or scalp into the nerves, creating pain. Conversely, if connective tissue support structures are lax and fail to support the neck and head, nerve structures may be compressed as well.

Treatment for most headaches consists of NSAIDs such as aspirin and ibuprofen. Frequent use of headache medications can cause a rebound headache pattern; these agents should be used only if other methods fail.

Headaches are common in all people; however, predisposing factors for headaches in athletes include the following:

- Head gear that puts pressure on pain-sensitive structures
- Squinting under bright lights or in the sun
- Dehydration
- Blood flow changes
- Competition stress and let-down
- Overbreathing tendency
- Blood sugar changes
- Impact trauma that increases neck muscle tension

Symptoms of Vascular or Fluid Pressure Headache

This headache type includes sinus, migraine, cluster, caffeine withdrawal, and toxic headaches. Pain is experienced as ache/pressure from the inside of the head pushing out. The head may feel like it will blow up. This headache type is difficult to manage with massage.

Symptoms of Muscle/Connective Tissue/Tension Headache

This headache type includes referred pain headache from trigger point activity or nerve impingement, muscle tension, and muscle guarding. Pain is experienced as pressure from the outside of the head pushing in and may feel like a tight band around the head. This headache type is effectively managed with massage.

Massage Strategies

Log on to your Evolve website to watch Video 20-1: Headache.

Massage and other forms of soft tissue therapy are effective in treating muscle tension headaches but are much less effective for migraine headaches and cluster headaches. Soft tissue therapy can relieve secondary muscle tension headache caused by the pain of the primary headache. Headache is often stress-induced. Stress management in all forms usually is indicated for chronic headache conditions. Massage and other forms of soft tissue therapy are effective in treating muscle tension headaches (Figure 20-3).

Log on to your Evolve website to view expanded examples of massage for headache.

The following two massage strategies are effective for headaches.

Vascular/Fluid Pressure Headache. Approach the massage as if there is excessive fluid in the skull and the goal of the massage is to help get the fluid out of the skull. Rhythmic

FIGURE 20-3 Examples of massage for headache.

1. In prone position, target fascia tissues of the scalp and posterior neck, moving tissues into and out of bind—direct and indirect methods.
2. Grasp and lift fascia and muscles of the posterior neck. Passively or actively move the head in circles.
3. Apply forearm compression against muscle attachments at the occipital ridge.
4. Side-lying position supports massage application to mobilize tissues of the scalp and address any tender points identified.
5. Forearm compression into upper trapezius. Treat any trigger points referring pain into a headache pattern.
6. Apply rhythmic compression to the sides of the head, and use the ear to mobilize the scalp. Gently pull the ears and have the client swallow to equalize pressure.

FIGURE 20-3, cont'd
7. Massage into tissues surrounding the TMJ.
8. Cupped hands over the eyes and finger pressure around the bones of the face may provide relief of sinus pressure.

compression on the head and face can act as a pump to move the fluid.

- Use broad-based compressive force on the head. The sensation felt by the client should be pleasant relief from pressure inside the head.
- Place your flat hands or forearm on the occipital bone/frontal bone and press firmly together. Then release. Rhythmically and slowly perform up to 50 repetitions.
- Repeat again, but with pressure applied at the temporal bones.

If the pain is more in the face, as in a sinus headache, rhythmic compression is also applied at the temples (sphenoid), cheeks (zygomatic), and side of the nose, and over the eyes.

- Use the palm of the hand or pads of the fingers.
- When applying pressure over the eyes, do not actually press the eyeball, but cup it in the palm and apply pressure around it.

Often a tension headache accompanies a vascular headache.

Muscle/Connective Tissue/Tension Headache. To treat tension headache, use inhibitory pressure on the muscles of the scalp–occipital/frontalis, temporalis, and auricular (ear) muscles. Muscle energy and positional release methods are effective.

- Instruct the client to move the eyebrows, clench the teeth, and move the ears.
- Massage the entire muscle area, with special attention to both the belly and attachments. Pressure levels should be intense enough to re-create headache symptoms. This is significantly more pressure than is typically used during general relaxation massage. The intensity should not cause guarding, and, although painful, this should be a "good" hurt, meaning that the intervention is perceived as addressing the issue rather than simply causing pain.
- Nerve impingement by the suboccipital, scalene, sternocleidomastoid, and trapezius muscles can cause referred pain. Use inhibiting pressure with muscle energy and lengthening procedures on the muscles that create headache symptoms.

Headaches more in the area of the face can arise from the muscles of mastication or those that control eyebrow movement. They are addressed as previously described.

The scalp has a significant quantity of connective tissue structures. The tendons and the fascial anchoring bands of the scalp can shorten. Usually, forces applied to these structures during massage are shear and bend with localized tension force. As in any connective tissue application, the forces are applied slowly and rhythmically, into and out of bind. Again, this level of intensity is greater than that typically used during general massage, and both pressure and location should feel "right" to the client.

If possible, stretch muscles and connective tissue by pulling the hair:

- Grasp a large bundle of hair near the scalp, and exert an even, firm pull.
- At the point of resistance, shift the direction into and out of bind.
- Repeat the process sequentially all over the scalp. This should feel intense but good to the client.
- If the client has no hair or very short hair, roll and twist the scalp around the skull, into and out of bind. Next, firmly massage along all cranial sutures with circular-type friction.

Eye muscles can be a factor in headache pain:

- Have the client place his or her finger pads over the closed eyelids, and with the massage therapist's fingers

on top of the client's fingers, exert gentle pressure on the eyeballs.
- While maintaining the compression, the client moves the eyes in alternating circles and in a figure-eight pattern.

Thoroughly massage the neck and shoulder muscles, addressing any areas responsible for the headache symptoms.

The connective tissue structures from the skull to the sacrum, if short, can create headache. These structures need to be addressed to increase tissue pliability and reduce bind. Connective tissue methods generating mechanical forces and skin rolling approaches with sufficient drag from the scalp down the midline of the back to the sacrum are effective. Begin at the head and end at the sacrum, then reverse direction and begin at the sacrum and end at the head.

Headaches may be caused by constipation. Abdominal massage is an option. A toxic headache from chemicals such as monosodium glutamate (MSG) or from excessive alcohol consumption will often respond to hydration and the strategy for vascular headache. However, until the liver detoxifies the substance and it is cleared from the body, the headache will persist.

A menthol- or peppermint-based cooling counterirritant ointment applied to the base of the neck and temples and forehead is effective for all headache types. Remember to dilute all essential oils in carrier oil before application, and be aware of client scent sensitivities before uncapping because some clients are so sensitive that *any* scent may cause severe headache.

Essential oils can be placed on cotton balls and put in plastic bags for the client to smell. Sinus headaches tend to respond to eucalyptus. Tension headaches respond to peppermint and lavender, and toxic headaches to citrus (lemons, oranges, limes). If the headache is a migraine type, using various aromas may make the headache better or may make it worse. Use should be guided by the client's reaction.

The massage therapist needs to know whether the client has been taking medications for headache and must adjust massage accordingly.

Self-Help for Headaches

Vascular (inside the head)-type headache responds to external compression, such as wrapping a towel or Ace bandage tightly around the head, wearing a tight hat, or placing a weight such as a rice bag on the top of the head.

Muscle tension headache responds to compression of the muscles. As silly as this may sound and look, putting a plastic clothes hanger over the head on the muscles that are creating the symptoms relieves the pain somewhat. Areas of the hanger that poke should be padded. It should not be left on for longer than a minute at a time and can be repeated as necessary. A 3- to 5-pound rice bag on the top of the head may also reduce pain.

THE NECK

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

Neck injuries are serious. The neck is much less stable and much more prone to injury than the rest of the spine. Because the neck must be tremendously mobile to allow the head to swivel, the range of motion between vertebrae in the neck is much greater than in the lower spine. Also, neck muscles are smaller and weaker than those in the lower back, where the strongest muscles in the body support the spine.

Do NOT move a person with a neck injury. An injury can turn into a disaster if the neck is not properly stabilized. Moving a fractured neck can cut the spinal cord. Call emergency medical personnel immediately for help.

SPRAINED NECK

Ligaments hold the vertebrae together, and ligaments can be stretched or ruptured, often by the head snapping backward. The result is a **sprained neck**. If the injury is severe, a vertebra may slide forward out of place and compress the spinal cord–the same injury as is seen with a fracture. If the sprain is mild, there will be pain and stiffness in the neck area. Any injury more severe than a mild sprain should be seen by a physician.

Massage Strategies

Massage procedures for sprains and strains are applicable (see page 299).

WHIPLASH

A combination of muscle and ligament strains on the neck due to a sudden, violent movement is called **whiplash**. The neck muscles, as well as the ligaments that hold the bones of the neck, can become severely strained and sprained.

This can be a severe injury that takes up to 6 months to heal. It should be seen by a physician and x-rayed to ensure that the vertebrae in the neck have not slipped out of alignment or become fractured.

Treatment for whiplash is rest for 2 or 3 days, followed by physical rehabilitation. Antiinflammatory drugs can help to ease the discomfort. The client may need to wear a cervical collar, which supports the weight of the head and takes the strain off the ligaments.

Massage Strategies

Massage therapy after acute, subacute, and remodeling healing stages is beneficial. Common errors when these cases are treated include (1) being overly aggressive with the neck during the acute/subacute healing phase, and (2) failing to realize that this phase may last for up to 2 weeks.

In addition to general massage application during subacute and remodeling stages, it is appropriate to work with oculopelvic reflexes, firing patterns, and gait reflexes. During whiplash, as with concussion, the eye muscles are affected during impact.

Pain management is an important goal, and energy-based applications are very comforting. Cradling the neck in the hands and applying gentle compression with the intention of supporting circulation and healing feels very good to the client. Gentle rhythmic rocking can soothe the muscle spasms.

PINCHED NERVE

An injury that seems like a sprain but is more complex is a **pinched nerve**. This can happen when a cervical disk ruptures or degenerates. Often, when a disk ruptures, gel-like material from inside the disk presses on a nearby nerve, causing sharp pain that extends down into the arm. Onset of severe pain in the neck may be sudden, or the pain may develop gradually.

Any athlete who makes fairly violent neck motions is prone to this injury.

A pinched nerve usually responds to cervical traction for 2 to 6 weeks, with accompanying physical therapy to reduce muscle spasm.

Massage Strategies

Gentle massage, especially rhythmic rocking, can help reduce muscle spasm. However, if severe symptoms persist, particularly in the arm and in the hand, surgery may be required to repair damage to the disk. See massage for entrapment on page 312.

BROKEN NECK

The most serious neck injury is damage to the cervical vertebrae in the neck; this is commonly called a **broken neck**. Each year, a few football players, from the high school level on up to the professionals, suffer spinal cord injuries, such as a broken neck, that leave them quadriplegics. However, the most common cause of a broken neck is diving. Skiers, gymnasts, and skaters are also prone to this type of neck injury.

A head-on blow may cause a compression fracture of the neck, in which the force to the top of the head compresses and shatters some of the cervical vertebrae. This injury may be as mild as a simple chipping of the vertebrae, or it may cause compression or severing of the spinal cord.

An equally severe injury can occur from a blow when the neck is bent down. This is more common in football, when a tackler ducks his head as he makes contact.

Massage Strategies

See the section entitled "Spinal Cord Injuries" for massage strategies applicable to treatment of a broken neck.

CERVICAL STENOSIS

Athletes who have recurrent, short episodes of numbness or weakness in the arms and hands may have a narrowed spinal canal. This condition is called **cervical stenosis**. An MRI scan will show narrowing of the cervical canal, which is the area from the base of the skull to the shoulder. Symptoms of numbness or weakness may occur after relatively mild trauma to the neck because the spinal cord does not have adequate room in the canal to begin with.

Massage Strategies

Focus massage on maintaining as much soft tissue pliability as possible without reducing stability. Do not move the neck to the ends of range of motion. Stay in mid-range.

"BURNER," "STINGER," AND STRETCHED NERVES

Two nerve injuries to the neck feel the same at first. Both are caused by a blow to the head or neck, and both cause burning pain down the arm and weakness in the arm and hand. One, a "**burner**" or "**stinger**," is a simple injury, but the other, a **stretched nerve**, is a serious injury that requires rehabilitation.

A "burner," or "stinger," is characterized by sudden burning pain down one arm, which feels weak. This is due to a pinched nerve in the neck. Usually, the pain disappears and full strength in the arm returns within 5 minutes. It is very important to know which side of the head was hit and on which side the pain is felt. If a blow is received to the left side of the head, the head will be knocked toward the right shoulder (and vice versa), and a burning pain will be felt down the right arm. The pain results from the nerve being pinched as vertebrae in the neck flex sharply to the right. When the athlete's arm strength recovers, he or she can return to full activity. Muscle guarding will usually be noted in the area, which presents as a stiff neck. Massage should be cautious, allowing the guarding to reduce slowly over a few days.

A similar but more dangerous injury, a stretched nerve in the brachial plexus, has almost the same symptoms. If the blow is to the left side of the head, the head is knocked toward the right shoulder, and pain is felt down the left arm. This occurs because the nerve is being stretched on the left side of the neck as the head is pushed to the right. With this injury, pain and weakness persist. This is a serious injury that must be treated by the medical team. Recovery of full strength may take weeks.

Strong neck muscles may help to prevent these types of injuries. Protective equipment is sometimes used to prevent excessive neck motion.

The athlete should not return to action without the doctor's approval. Early return may lead to reinjury of the nerves and possibly permanent damage.

Massage Strategies

Be cautious when applying massage around the injured area. Pressure on nerves, especially injured nerves, is contraindicated and tends to further irritate the area. Do not use any methods that increase pain. Massage is focused on assisting return to normal of protective muscle guarding while avoiding injured nerves.

SPASTIC TORTICOLLIS

Wryneck, or **spastic torticollis**, is caused by a pulled muscle or a muscle spasm. The neck will not turn equally in both directions (left and right). When the neck is turned in one direction, movement is restricted and painful. Pain occurs on one side of the neck, and the neck may be pulled over slightly to that side. It is particularly painful to turn the head in the direction of the pain, that is, if the pain is on the left side of the neck, the client can turn to the right but not to the left. This type of injury can happen in sports such as tennis, when the player looks up while serving the ball or hits an overhead smash.

Treatment consists of ice application for 20 minutes at a time, with gentle stretching of the neck. If the pain is severe, medications such as a muscle relaxer or an NSAID may be prescribed.

Massage Strategies

Massage application, in addition to the general protocol, typically focuses on the sternocleidomastoid muscle that is spasmodic, with one overpowering the other (the one that is shorter is stronger). Treat as for spasm. If the condition persists longer than 2 to 4 days, more aggressive work is appropriate. See sternocleidomastoid release in Unit Two.

TRAPEZIUS TRIGGERS

Severe muscle spasm in a localized area of the neck can cause **trapezius triggers**. Symptoms include a very painful area at the base of the neck or extending out above the collarbone. Any athlete can suffer this injury by pulling fibers in the trapezius muscle, or as the result of a direct blow to muscle fibers in the neck.

Muscle spasm sets up the pain-spasm-pain cycle: the spasm causes nerves to fire and gives the sensation of pain; this electrical impulse causes other nerve fibers to fire and the muscle to contract further.

Very severe pain may require injection of cortisone and Novocain into the area.

Massage Strategies

Treatment includes icing the neck for 20 minutes, followed by massage and gentle stretching. Use the muscle spasm procedure beginning on page 291.

SPINAL CORD INJURIES

Spinal cord injuries can result in a number of neurologic problems. Studies of blood flow and metabolism indicate that spinal cord injury involves not only direct neuronal trauma but also direct and delayed vascular trauma. The most frequently injured sites are at the most mobile segments of the spine, such as the cervicothoracic (C7 to T1) and thoracolumbar (T12 to L1-4) junctions. About 40% of spinal cord injuries result in complete interruption of function. The remaining 60% result in impairment or destruction of certain sensory and motor functions.

Injury to the spinal cord is followed by a 2- to 3-week period of spinal shock, during which all spinal reflex responses are depressed. Spinal reflexes below the cut become exaggerated and hyperactive. Neurons become hypersensitive to excitatory neurotransmitters, and spinal neurons may grow collaterals that synapse with excitatory input. Stretch reflexes are exaggerated and the tone of the muscle is increased.

If spinal cord injury occurs above the third cervical spinal nerve, loss of voluntary movement in all four limbs occurs. This is known as **quadriplegia**. If the lesion is lower, and only the lower limbs are affected, the condition is called *paraplegia*. Should the nerves to only one limb be affected, the condition is referred to as *monoplegia*.

Respiratory movements are affected if the phrenic nerve arising from the 3rd, 4th, or 5th cervical nerve to supply the diaphragm is affected.

One of the complications common among persons with spinal cord injury is decubitus ulcer. Because voluntary shifting of weight does not occur, the weight of the body compresses the circulation to the skin over bony prominences, producing ulcers.

Fluctuations in blood pressure can occur. Because of disuse, calcium from bones is reabsorbed and excreted in the urine, increasing the incidence of calcium stones in the urinary tract.

Paralysis of muscles of the urinary bladder results in stagnation of urine and urinary tract infection.

Connective tissue changes occur in muscles and joints. The function of the autonomic nervous system below the level of the lesion is affected. Voluntary control of the bladder and rectum is lost if the lesion is above the sacral segments; reflex contractions of the bladder and rectum occur as soon as they become full, resulting in incontinence.

In the **mass reflex**, which occurs with severe spinal cord injury, a slight stimulus to the skin triggers emptying of the bladder and rectum, sweating below the level of the lesion, and blood pressure changes. Persons with chronic spinal injury can be trained to initiate these reflexes by stroking or pinching the thigh to trigger the mass reflex, thereby giving them some control over urination and defecation.

Circulating blood volume, sweat production, and skin surface area—all factors necessary for effective heat transfer to the environment—are affected in spinal cord injury, and this can impair the ability to stay cool during sustained exercise training. Physiologic responses to exercise, especially in the heat, of people with spinal cord injury differ from normal responses and depend on the level and completeness of the lesion.

The extent to which the circulation is affected depends on the level and severity (incomplete or complete) of the spinal cord lesion. Figure 20-4 identifies the levels of spinal cord injury. In a complete lesion above the 6th thoracic vertebra (T6), sympathetic regulation of the heart is affected; the heart rate remains low, and the myocardial contractile force is impaired. Distribution of blood below

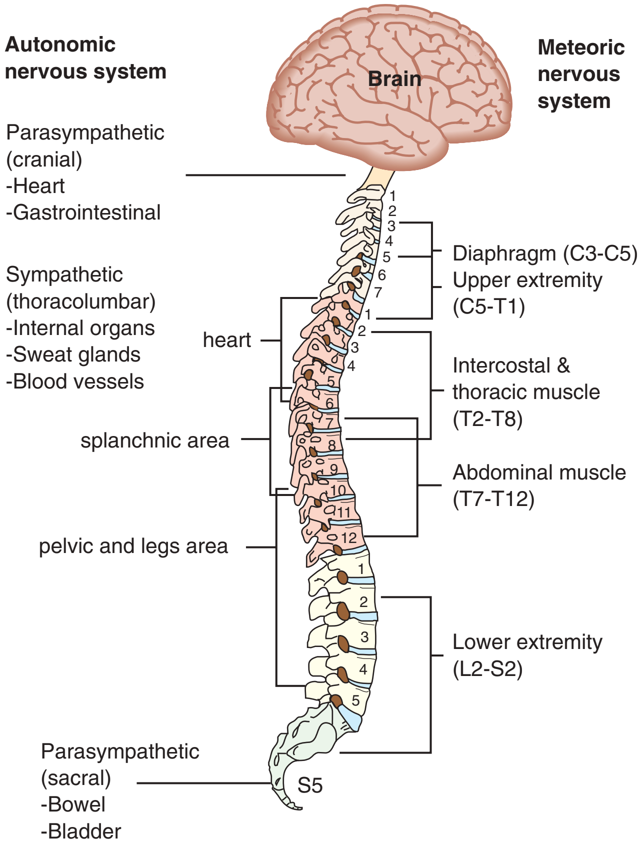


FIGURE 20-4 Levels of possible injury to the spinal cord.

the level of the lesion is impaired because of lack of vasoconstriction in the internal organs of the abdomen and the pelvis; this diminishes the redistribution of blood during exercise. In addition, blood flow in muscles and skin below the lesion, as well as sweat gland activity in the affected skin, is impaired.

A complete lesion between T6 and T10 will not affect cardiac function. However, sympathetic vasoconstriction in the abdominal and pelvic organs is absent below such a lesion. Regulation of the sweat glands and blood flow to muscles and skin below the lesion are impaired.

With a complete lesion at or below T10, loss of central regulation of vasoconstriction is noted in the pelvic area, as are diminished blood flow in the legs (muscles and skin) and reduced activity of sweat glands below the lesion.

Massage Strategies

Therapy after spinal cord injury is managed by the medical team. If massage is used, the massage for fractures sequence is appropriate, combined with general full-body massage. However, caution regarding pressure levels and intensity is advisable.

Massage is an effective part of a comprehensive, supervised rehabilitation and long-term care program. Massage can help manage secondary muscle tension resulting from alterations in posture and the use of equipment such as wheelchairs, braces, and crutches. Massage that is specifically focused on the abdomen can help manage difficulties with bowel paralysis. Circulation enhancement by massage can assist in management of a decubitus ulcer.

Functioning areas of the body can become stressed by compensating for areas that have reduced function. Do NOT assume that paralysis equals no feeling in the area. This totally depends on the area of the break, the type of break, the extent of damage to the spinal cord, and the body's adaptive capacity, as well as the types of medical treatment and rehabilitation received after injury. Because so many variables are involved, frequent reassessment is necessary.

It is imperative for the massage therapist to communicate effectively with the client and the medical team to gain an understanding of the effects of the injury, allowing adjustment of the general protocol to meet client needs.

THE ANTERIOR TORSO

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

The thorax, or chest, includes the area between the neck and the thoracic diaphragm. The primary function is breathing and protection of vital organs. Core stability influences torso stability and protects abdominal contents.

The ribs act like the bars of a cage to protect the lungs and the heart from blows; they also help the chest wall to expand and collapse, so that air can move through the lungs.

The ribs do not attach directly to the breastbone in the front. If they did, the rib cage would be so rigid that breathing would be restricted. Flexible cartilage connects the end of each rib to the breastbone.

BRUISED RIBS

A blow to an unprotected rib cage can bruise the ribs. Treatment for **bruised ribs** consists of resting them and applying ice until the pain is gone. Athletes can wear a protective pad made of strong plastic with an absorbent material underneath. It hangs on the shoulders and wraps around the rib cage.

Massage Strategies

Massage is contraindicated in the area of the bruise. Lymphatic drain methods are appropriate. See massage strategies for separated ribs in the following section.

SEPARATED RIBS

A severe blow can cause a **rib separation**, in which the rib tears loose from the cartilage.

Pain is severe, usually toward the front of the rib cage, and it "hurts to breathe." When the person bends over or rotates the body, there may be the feeling of a "pop." It is particularly painful to go from a lying to a sitting position, as when getting out of bed in the morning. If you place one hand on the back and the other on the breastbone, and then squeeze, the client will feel tremendous pain.

The treatment is to use a rib belt. This strap of elastic about 8 inches wide goes around the rib cage. It stretches tight and closes in front with Velcro. This compresses the rib cage so it cannot overexpand. The belt holds the rib ends in place until the separation heals and the pain of everyday movements is lessened.

Participating in sports activity usually is not feasible because of extreme pain; however, some athletes manage.

Massage Strategies

These methods are suitable for treating bruised and separated ribs.

Full-body massage is applied. The goal is pain management, incorporating counterirritation and hyperstimulation analgesia with support of parasympathetic dominance. Various essential oils that are relaxing and have analgesic action may be incorporated into the massage.

Because it is painful for the client to contract the muscles, direct work on the ribs is limited to positional release. Positioning the client is very difficult and requires creative bolstering until a comfortable position with reduced pain is found. In effect, the bolstered position becomes a treatment using positional release concepts. Direct manipulation of spindle cells and the Golgi tendon apparatus may work with gentle passive lengthening to reduce muscle spasms.

The breathing pattern is disturbed, and muscles used during upper chest breathing can become short and tense. Massage can reduce the shortening somewhat, but it will return until the ribs are healed.

Application of positional release is somewhat different from the typical method (use of a painful point). Because movement is so painful,

- Instruct the client to locate the painful area with the fingers.
- Place one hand above or below the painful point and the other hand on the opposite side. Then gently move the hands toward each other, slowly applying gentle compression to the rib cage in various directions, until the client indicates that the pain is reduced.
- Hold this position for as long as the client indicates that it is comfortable.

This procedure is highly experimental, and it may be necessary to keep changing the hand position until the correct position is found. If no relief is obtained, or if pain is increased after three or four attempts, stop.

The pain is caused primarily by protective spasm *(guarding)* of the intercostals, as well as of anterior serratus, transversus thoracis, pectoralis minor, and other muscles that can stabilize rib movement. Guarding muscle spasms is a resourceful function, and response to the positional release method may not occur. Even if the method is successful, use no more than two or three positions to protect rib stability. The goal is to achieve pain reduction and easier breathing without interfering with the body's protective mechanisms.

Gentle repetitive stroking and slow rhythmic rocking over the injured area can be soothing. However, these methods may cause irritation. Avoid any procedure that increases the client's pain or discomfort.

BROKEN RIBS

A blow to the rib cage may cause a **broken rib**. The resulting pain may occur anywhere in the rib cage, depending on where the rib or ribs are broken.

Pain from broken ribs is similar to that from bruised or separated ribs, only more severe. Any excessive strain or movement, or another blow, can cause the sharp ends of broken ribs to puncture a lung. This is a medical emergency.

Treatment includes rest (for about 6 weeks) and use of a rib belt until the pain is gone. An x-ray must show that the ribs have healed before the athlete can return to activity (Figure 20-5).

Massage Strategies

Apply full-body massage for pain management and healing. Do not massage the thorax until the ribs are stable; then use the procedure given for bruised and separated ribs.

RIB MUSCLE PULLS AND TEARS

The muscle between each pair of ribs, the intercostal muscle, which is the muscle used in respiration, may pull or tear as a result of overstress. A **rib muscle pull or tear** can happen when a tennis or football player makes a sudden, violent lateral motion or suddenly rotates the trunk.

Tenderness is felt in the area between the ribs, not in the ribs themselves. Treatment consists of rest and ice application until the pain disappears. A rib belt provides stability and eases pain.

Massage Strategies

It is difficult to use the massage strategies for muscle tears in this area.

See suggestions for separated ribs.

THE BACK

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

General massage protocols for back dysfunction and pain are discussed beginning on page 353. See also massage strategies for individual back disorders in the following sections.

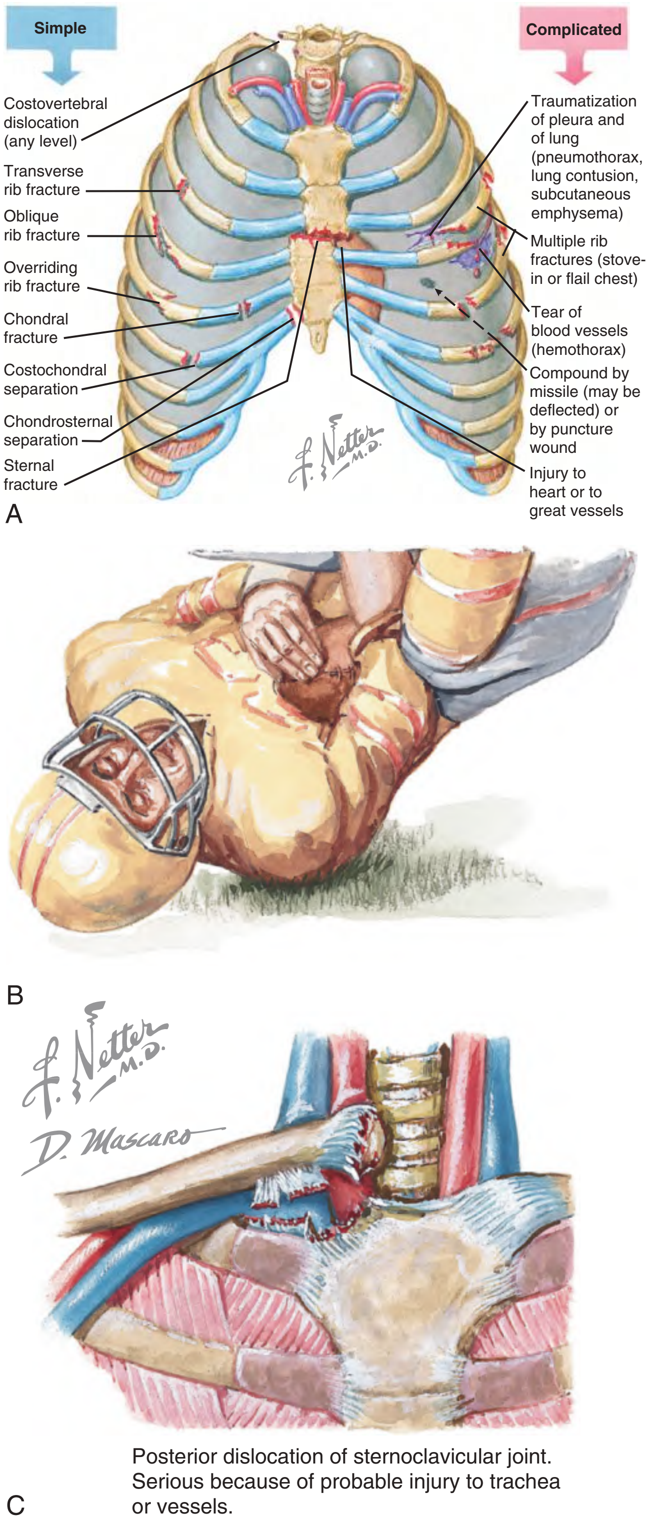


FIGURE 20-5 **A,** Thoracic cage injuries. **B,** For posterior dislocation, force is applied to the posterolateral aspect of the shoulder when the arm is adducted and flexed. **C,** Posterior dislocation of the sternoclavicular joint is serious because of probable injury to the trachea or vessels. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

BACK PAIN

The best way to prevent back problems is to develop a strong back. Because most muscle injuries are due to muscle weakness, increased strength can correct almost every back problem. Strengthening the core is essential.

Nearly all injuries to the back are muscular in nature. About 95% of cases of low back pain are the result of muscular problems caused by lack of exercise, weak muscles, or overweight. Back problems can also be caused by tense muscles or strain from suddenly overloading muscles during activity. Muscle fibers may pull or tear, sending back muscles into spasm and causing pain.

Fortunately, most simple backaches go away within a few days or weeks, with or without treatment, and 90% disappear within 2 months. A workout that strengthens the back muscles and the abdominal muscles (the core) and stretches the pectoralis major and other anterior thorax muscles can prevent back pain, provide relief, and help prevent pain from recurring.

Bed rest for longer than a couple of days only weakens muscles and can be disabling. The client needs to get out of bed as soon as possible. Alternating applications of heat and cold (ice) may be helpful. Surgery should be considered only as a last resort.

Orthopedists often advise people with back pain to avoid sports that put stress on the back. Recommended activities include swimming, walking, cross-country skiing, and stationary cycling. These can all be done without sharp, sudden movements such as severe arching of the back and twisting or rotating of the trunk. Low-impact, not high-impact, aerobics, and water aerobics are appropriate activities for those with back pain.

Sports that require arching and twisting of the body and sudden starts and stops can strain the back. Examples are basketball, volleyball, downhill skiing, dancing, bowling, football, and baseball. Sports-related back pain is common in football players, wrestlers, ice hockey players, gymnasts, figure skaters, and skateboarders. Bike riders, including motorcyclists, and horseback riders can experience compression of the sacroiliac (SI) joint and lower lumbar vertebrae, as well as muscle strain. Gymnasts and divers tend to experience sprains and strains during athletic activity.

The incidence of low back pain in collegiate athletes is increasing, mostly as the result of improper form and overtraining in strength development and conditioning activities.

Improper posture and overstressing of the immature spine may also cause low back pain Back pain often results from an excessive load on the normal back or a normal load on a weak or unprepared back.

Golfers should beware of the torsion placed on the back during the swing. Tennis and golf, with their twisting, flexing, and extending motions, can be challenging for anyone with back pain.

Golfing, baseball, and bowling are the three activities most likely to cause lumbar disk problems, including herniation.

Running can lead to back problems because of the impact of the foot strike, abnormal foot mechanics, the necessity for imbalanced muscles to work harder, and running too fast, or if one leg is slightly longer than the other.

Back pain is a common symptom and cause of injury, regardless of an individual's health or fitness status. Almost everyone will complain at some time of back pain, and 50% of working-age adults experience back pain symptoms.

Common causes of back pain in athletes include spondylolysis, stress fractures, discogenic defects in intervertebral disks, strains of the musculature of the back, hyperlordotic mechanical back pain, and back pain from other causes, including infection and tumor that become symptomatic in the course of sports participation.

The causes of back pain are different in young versus older athletes. The young athlete generally does not have degenerative changes in the spine, and back pain is usually the result of a specific injury or event. The incidence of spondylolysis is statistically higher in the young athlete than in the older athlete. The older athlete often has back pain related to disk degeneration, other pathology, and weight control problems.

Most back pain in athletes is the result of a combination of mechanical factors, including improper weight-lifting techniques, overstretching, torsion, impact trauma, static positioning, repetitive loading, hard repetitive contact, sudden violent muscle contraction, musculotendinous strains, ligament-vertebrae sprains, irregular anatomic positioning, and spondylolysis or spondylolisthesis (Figure 20-6). Impact trauma is caused by contact with hard or nonmovable objects such as playing surfaces, walls, and other people.

The possibility of a disk condition and related nerve irritation must be considered in any long-lasting episode of back discomfort, especially if any pain is radiating into the leg.

Diagnostic testing includes a thorough physical examination with attention to range-of-motion/flexibility testing and neurologic testing for motor, sensory, and deep tendon reflex loss, straight leg raising, and other signs of disk disease. X-rays, MRI and CT scans, electromyography (EMG), myelography, fluoroscopy, and bone scan are all viable diagnostic tests. Blood work can help to identify Paget's disease, tuberculosis, cancer, and infection. Urinalysis can aid in the diagnosis of kidney or other urologic involvement.

A quick assessment for serious back injury consists of forward trunk flexion and backward trunk extension. Increased pain during flexion indicates possible disk involvement. If extension increases pain, a stress fracture of a vertebra or vertebrae may be present (Figure 20-7).

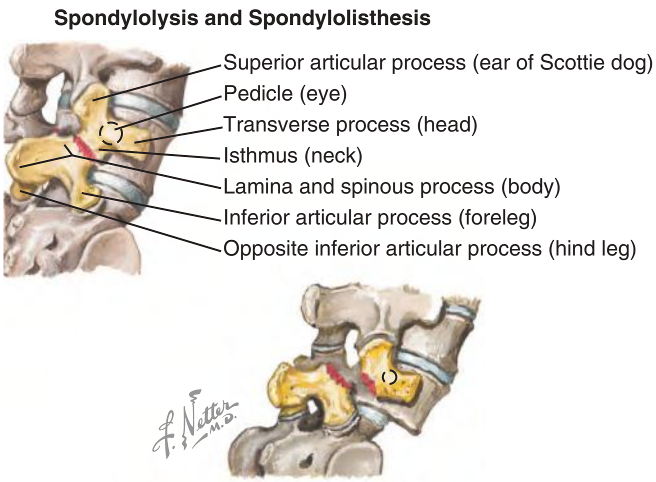


FIGURE 20-6 Spondylolysis and spondylolisthesis. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

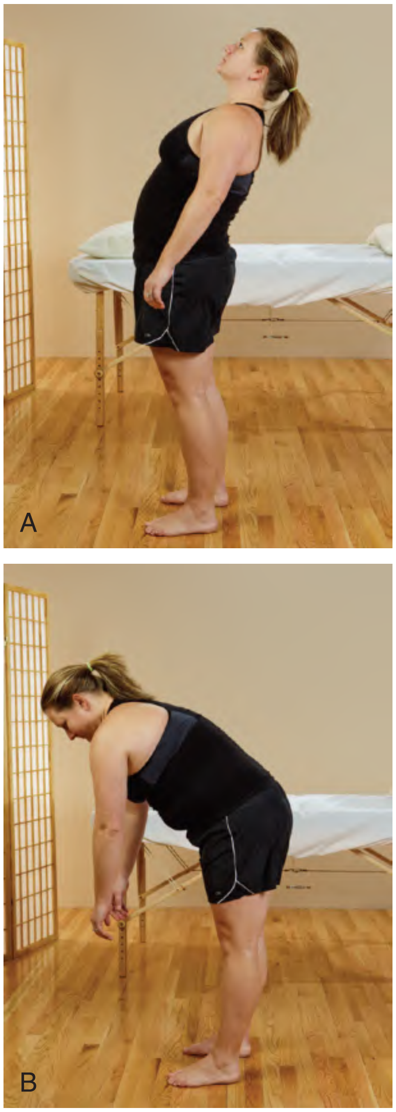


FIGURE 20-7 Assessing for causes of back pain. **A,** Pain that increases during extension indicates a possible bone fracture. **B,** Pain that increases during flexion may indicate a disk injury.

The success rate for surgical treatment of low back pain is questionable, and it is the final option only after more conservative treatment has failed. However, new microscopic surgical procedures are less invasive and show promising results.

The treatment plan for back pain often varies among health care professional groups. It is important to realize that neurosurgeons, orthopedists, osteopaths, chiropractors, and massage therapists bring different approaches, training, and philosophies to the treatment of back pain.

Back pain is usually muscular in origin (Figure 20-8). Once a thorough assessment has ruled out all other possible causes, use ice for inflammation, massage for muscle spasm, and pain control measures and counterirritants such as heat, ice, and ointments for pain. Electrical stimulation modalities for pain and spasm are helpful. A comprehensive rehabilitation program is necessary and should include core stability training and a flexibility program especially for the pectoralis major, latissimus dorsi, hamstrings, piriformis, external rotators of the hip, and hip flexors, including psoas and gluteal muscles. Patients in rehabilitation programs should progress from single-plane to multi-plane exercises, and dynamic stabilization should be emphasized. Chiropractic or osteopathic mobilization can be helpful for abnormal facet function. Muscle activator sequences for the trunk, hip extension, and knee flexion are usually dysfunctional and require treatment (Figure 20-9).

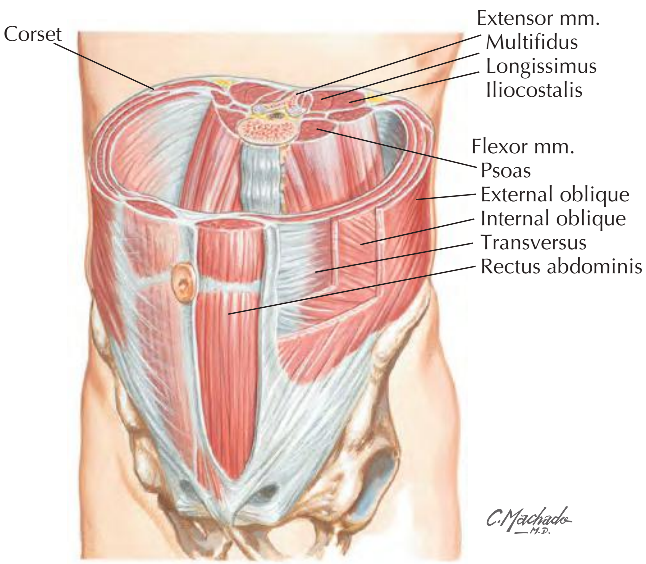


FIGURE 20-8 Muscles of the core. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

BULGING DISK

One of the most common back problems is a **bulging disk**. The wall of the disk bulges out into the spinal column. The disk, however, is not ruptured completely. The disk bulge can impinge on a nerve, resulting in pain and muscle spasm. A bulging disk cannot be seen on x-ray but can be seen on CT or MRI scan.

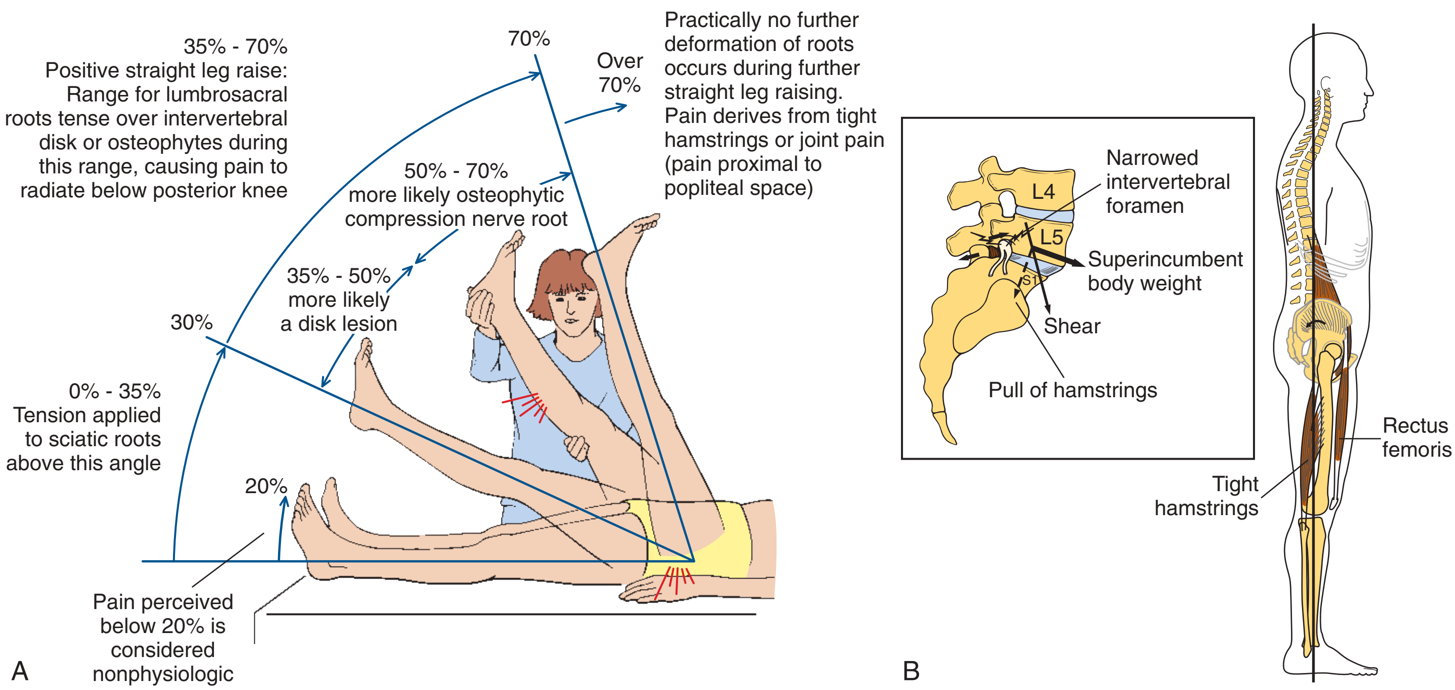


FIGURE 20-9 Assessment for back pain. **A,** Hamstring test. **B,** Tight hamstrings cause a pull on the pelvis that rotates it backward about the common hip axis as a posterior pelvic tilt and therefore increases shear of L5 on S1 and predisposes to accelerated disk and facet degeneration. (From Saidoff DC, McDonough A: *Critical pathways in therapeutic intervention—extremities and spine*, St Louis, 2002, Mosby.)

Massage Strategies

Conservative treatment is used, and massage is appropriate with caution.

RUPTURED DISK

A **ruptured disk** usually occurs in the lower (lumbar) spine—the area that receives the brunt of twisting and turning. Poor posture, lifting of heavy objects, or repetitive twisting motions in sports can weaken the disks, eventually causing a rupture.

A ruptured disk, also called a *herniated* or a *slipped disk*, occurs when the disk capsule breaks open and protrudes into the spinal canal, pressing on nerve roots. Gel oozes out of the disk, causing increased pressure on the spinal cord or the nerve roots. Over time, the gel usually disintegrates, and symptoms may be relieved.

When a disk ruptures, however, the pad between the two vertebrae is gone, and gradual wearing of bone on bone leads to arthritis. This can cause serious pain if the arthritic spurs of the vertebrae press on the nerve root.

The pain of a ruptured disk is usually sharp and sudden. Commonly, pain will be passed along the course of the nerve impinged by the ruptured disk. A disk pressing on the sciatic nerve root causes sciatica, sending pain from the buttock down the leg and into the foot.

Only when the disk has completely disintegrated can the narrowed space between two vertebrae be seen on radiography.

If symptoms do not subside, surgery may be needed to remove some or all of the disk. What used to be a crude, major operation requiring a long recuperation time has become a much more sophisticated endoscopic and microscopic surgical procedure. The classic back operation, called a *diskectomy*, involves an incision in the back and removal of a small piece of the vertebra to expose the injured disk. The damaged part of the disk is then cut out. Surgery now usually involves insertion of an arthroscope into the ruptured disk to suck out the gel and relieve pressure on the nerve.

A nonsurgical procedure popular in Europe is the injection of a papaya derivative called *chymopapain* into the center of the ruptured disk. This natural enzyme dissolves the gel to relieve the pain. However, this treatment has hazards and is not widely used in the United States.

Most people, even those with acutely ruptured disks, get better without surgery. Surgery is prescribed for the 10% to 15% of patients who fail to respond to conservative treatment, or who develop weakness or numbness in the limbs, which is a sign of neurologic problems. The problem for competing athletes is the time needed for the condition to heal without surgical intervention. Athletes must compete or lose their jobs. Therefore, many more athletes opt for surgery compared with the general population.

Massage Strategies

If conservative therapy is the option, massage is an important component of the treatment plan. Massage targets muscle spasm and manages pain. If the condition is surgically corrected, often preoperative and postoperative massage strategies are used.

CRACKED BACK

Abnormal separation of a vertebra into front and rear portions is called **spondylolysis**. It is also known as **cracked back**. Originally, this was thought to result from congenital failure of the two halves of the vertebra to fuse, but it is now believed that this condition is due to acute fracture caused by back trauma. A quick assessment for a cracked back is to compare lumbar flexion and extension. If extension increases the pain, especially in an isolated area, a small fracture may be present.

Spondylolysis is most common in young people who have chronic back pain with no obvious cause. Often, they have taken a fall before feeling any pain.

If the fracture is old or congenital, the treatment of choice is a strengthening program with reduced physical activity until symptoms cease. If the fracture is fresh, all sports and similar athletic activities should be avoided for about 6 months to allow the fracture to heal. Usually, rest alone is not enough to relieve all symptoms, and a program to strengthen the back muscles is required.

A back brace may be helpful during this time. However, a brace should be used only in the presence of acute pain. Back braces are not useful in the long run because they further weaken the back muscles.

If a fracture fails to heal, this may lead to another condition called *spondylolisthesis*, in which the front portion of a vertebra slips forward out of line with the other vertebrae. Most of the stabilizing ligaments of the spinal column are located on the anterior surface of the vertebral column. If the connecting bone does not heal, then almost any activity can cause the front part of the vertebra to slip forward.

Normal activity can be resumed after an initial period of rest and when the bone heals. If the vertebra remains unstable, activities such as diving and gymnastics, which require arching of the back, and contact sports such as soccer, football, and basketball, in which a person might take a heavy blow to the back, need to be avoided. If a slipped vertebra progresses despite conservative treatment, the vertebra will have to be fused surgically.

Massage Strategies

Massage is focused on management of protective muscle guarding that develops to stabilize the back. This muscle guarding is persistent, and best results are achieved when the goal is to reduce but not eliminate muscle tightening in the area. Trigger points should not be treated. Instead, broad-based compression should be applied, with gliding in the general area to gently inhibit some of the muscle tension (see page 333 for specific procedure).

CRACKED WING

A **cracked wing** is a fracture of the protuberance at the lower side of each vertebra, known as a *wing* but properly called the *transverse process.* It can be cracked from a blow to the back. The back muscles and ligaments attach to the spine at the wing. In football, a wing fracture commonly occurs in running backs hit from behind with a helmet.

Although very painful, this is not a serious injury. Once the pain disappears, extra padding around the wing protects it.

Massage Strategies

Do NOT reduce muscle guarding in the area of the fracture. Avoid the area and any positioning that causes the back to be extended. Follow bone fracture strategies.

SHORT-LEG SYNDROME

A common cause of lower back pain is a difference in the lengths of the legs, or **short-leg syndrome**. A difference of one-fourth of an inch can be significant in an athlete, whereas a nonathlete may get away with a difference of up to half an inch. The back pain is usually felt on the side of the longer leg. This leg pounds into the ground during walking, running, jumping, and so forth, throwing that side of the body out of alignment. The stress works its way all the way up to the back.

Short-leg syndrome may be caused by displacement of the pelvis and muscle imbalance. Usually the condition is functional and can be corrected by mobilization of the pelvis and targeted lengthening and strengthening exercises.

Massage Strategies

Massage is supportive. Use the indirect function technique for the pelvis, along with quadratus lumborum and psoas release if indicated. Treatment is focused on lengthening the soft tissue of the *short leg* (see Unit Two).

SCIATICA

Sciatica is not a true back problem; it refers to pain along the course of the sciatic nerve. This nerve runs from the buttock down the back of the leg to the foot. Pressure on the sciatic nerve root at the spine causes pain. It is necessary to determine the cause of the pressure and then treat the cause. Possible causes include nerve impingement from a disk, an arthritic spur of a vertebra, a muscle spasm, and neurologic problems in the spinal cord. Treatment for sciatica itself is not the answer because sciatica is only a symptom of an underlying problem.

Sciatica may be very easy or very difficult to diagnose. If pain occurs only in the posterior thigh, it can be easily confused with a hamstring pull. If pain is noted more in the lateral thigh, the lumbar plexus may be the issue. If the pain goes all the way down the leg to the foot, this is more likely sciatica.

Increased pain when bending over or while doing a straight leg raise indicates possible sciatica. Other indications of sciatica include a weak big toe, trouble in raising the front of the foot, and a diminished ankle reflex. Entrapment of the sciatic nerve by the piriformis muscle is called *piriformis syndrome.* Lengthening this muscle may help to decrease symptoms.

MASSAGE PROTOCOLS FOR TREATMENT OF PAIN ASSOCIATED WITH BACK DISORDERS

The massage therapist targeting the athletic population must be able to effectively work with back pain because it is so common. Athletes are prone to this condition at the beginning of a training period, when fatigued, and when compensating for an existing injury.

Therapeutic massage best addresses back pain of muscular origin such as simple back strain and overuse without joint or disk involvement. Low back pain is the most common complaint (Figure 20-10).

Massage is useful as part of a comprehensive treatment program for more complicated conditions such as disk dysfunction. Joint dysfunction usually requires manipulation by a physician, physical therapist, chiropractor, or trainer. Massage is preadjustment and postadjustment adjunct treatment. More complex back pain often results in muscle tension and spasm that is guarding and therefore stabilizing. If the muscles are excessively tense, stiffness, pain, and possible increased irritation of the joint structure may occur, because the muscles pull on the structure, causing compression. Unequal forces are being applied to the joint structure because flexors, adductors, and internal rotators exert more pull than extensors, abductors, and external rotators.

Massage can reduce muscle tension from guarding but should not seek to eliminate it. The guarding response is appropriate. Pain control methods are appropriate as well. These two strategies combined should support more normal movement and allow other treatments to be more effective. Manipulation of joints is easier if massage is applied to surrounding soft tissue. Massage after joint manipulation can reduce any spasm that may result. Complex back pain that is more than muscle-related needs multidisciplinary treatment, with massage in the supporting role.

Massage for simple back pain is best combined with hot and cold hydrotherapy and counterirritant ointment. Rest with ongoing gentle range of motion with stretching activities is recommended. It is not advisable to rest without movement because this can make the situation worse.

Massage is targeted at the following muscles: abdominals, psoas, quadratus lumborum, hamstrings, and gluteal group. Firing pattern dysfunction is almost always present. Gait reflexes are usually disrupted.

Mid-Back Pain

The cause of **mid-back pain** is usually short anterior serratus, pectoralis minor, and pectoralis major muscles and weak core muscles. The rhomboids and the trapezius are usually long, with protective spasms and trigger point activity at the attachments. The biggest massage error is to massage the long areas in the area of the pain; this only makes them longer. Massage targeted at the long structures

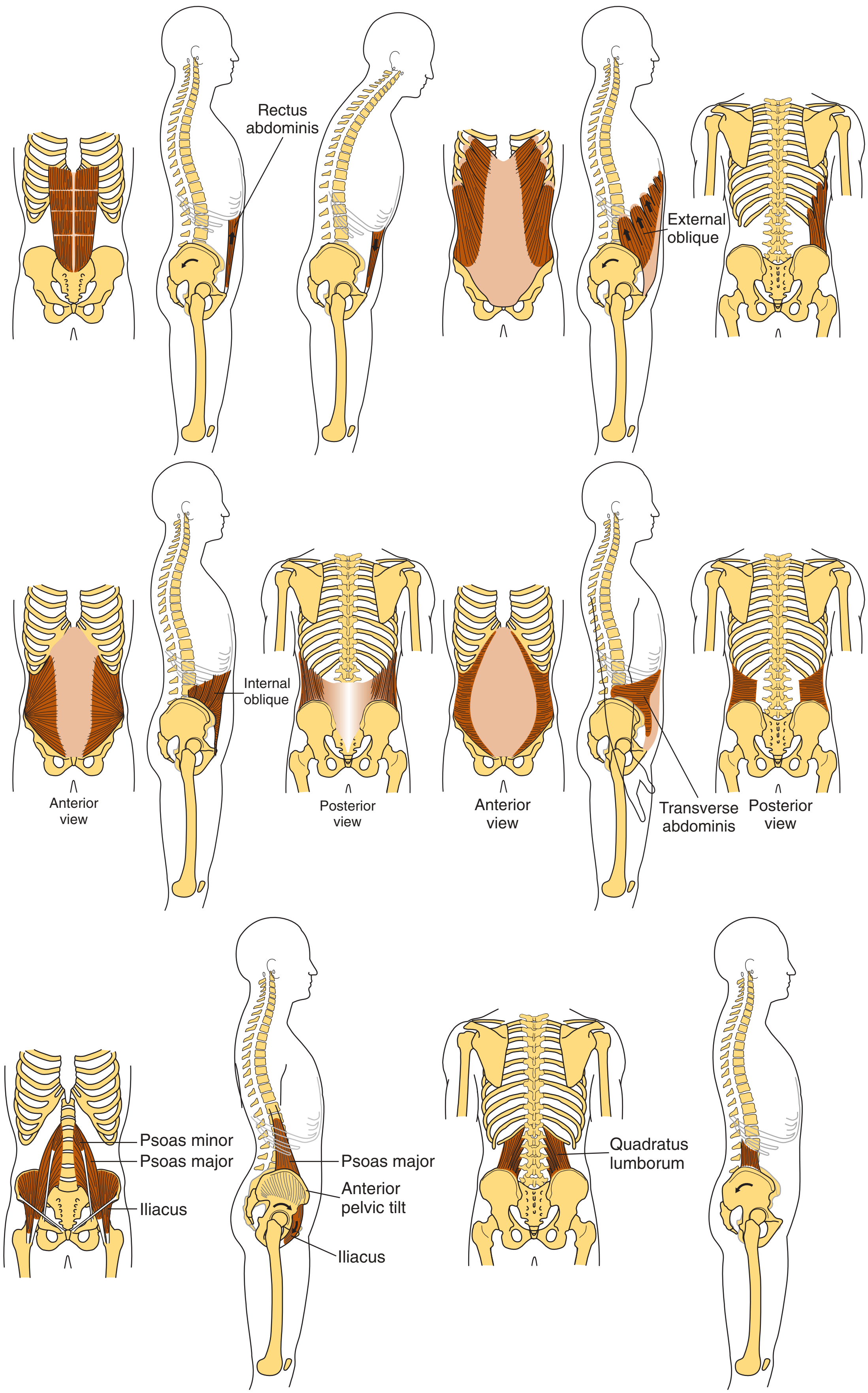


FIGURE 20-10 Major muscles involved in low back pain. (From Saidoff DC, McDonough A: *Critical pathways in therapeutic intervention—extremities and spine*, St Louis, 2002, Mosby.)

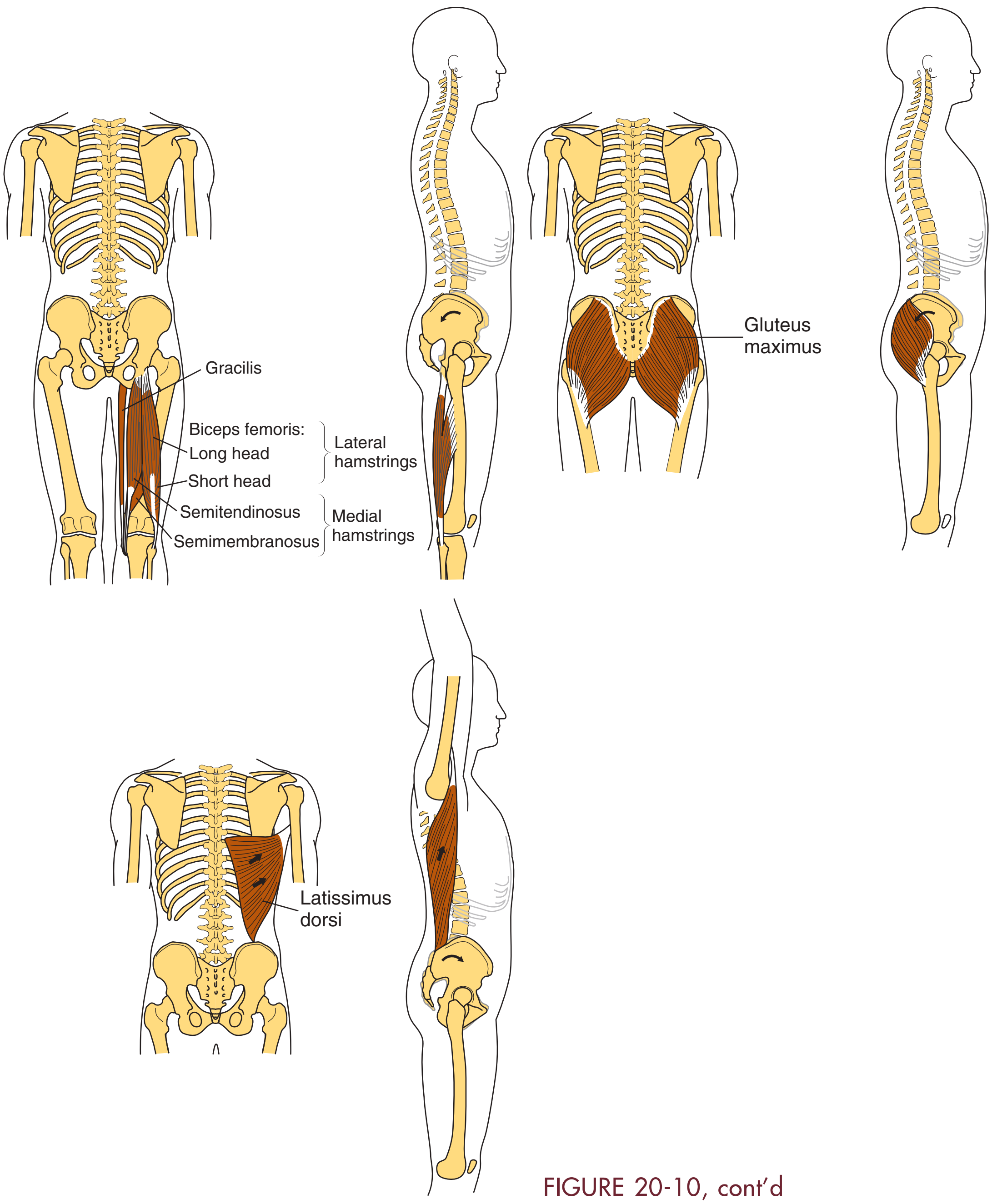


FIGURE 20-10, cont'd

consists of local pain control only, using surface rubbing with a counterirritant ointment and hyperstimulation analgesia. Use all muscle energy methods and inhibitory pressure on the muscle belly, and lengthen the short tissues in the anterior chest. See anterior serratus and pectoralis minor release in Unit Two.

If connective tissue bind exists in the pectoralis region, use appropriate mechanical forces by kneading, compressing, or stretching the tissues. Therapeutic exercise can strengthen inhibited muscles, such as the rhomboids. The scalene muscles can impinge on a portion of the brachial plexus, resulting in a pain pattern to the mid-scapular region. Massage addresses the impinging tissue in the neck that re-creates the symptoms.

If the client feels as if he or she wants to "crack" the back, the paraspinal muscles are usually the problem. See release of paraspinal muscles, multifidi, and rotators in Unit Two.

If the client is sniffling, coughing, or sneezing, or has been laughing excessively, the posterior serratus inferior is often the cause. This muscle can shorten and because of its fiber direction is very difficult to stretch. Symptoms include an aching sensation just below the scapula at the location of the muscle. Compression into the muscle belly with local tissue stretching usually relieves the symptoms.

Lumbar Pain

Various types of **lumbar pain** are known. The most serious is referred pain from kidney or bladder injury or infection or a ruptured disk. These conditions require medical treatment.

SI joint dysfunction is a major cause of pain that requires a multidisciplinary approach. The joint can be jammed or fused, interfering with movement of the pelvis during gait. Restricted pelvic movement creates increased movement at L4-5 to the SI area, at the hip, or in both places. Pain occurs in the hip abductors and around the coccyx/sacrum area on the affected side. Proper mobilization of the joint by the trainer, physical therapist, physician, or chiropractor is necessary. Massage supports the mobilization process by reducing muscle guarding and increasing tissue pliability. Once the joint is adjusted, the mobilization sequence for the SI joint (see Unit Two) can be incorporated into the general massage. The latissimus dorsi muscle opposite the symptomatic SI joint is part of the force couple that stabilizes the SI joint. The lumbar dorsal fascia needs to be pliable but not so loose that stability is affected.

Usually the symphysis pubis is somewhat displaced in conjunction with SI joint dysfunction. A simple resistance method can address this condition. The client is supine, the knees are bent, and the massage therapist provides resistance against the action of the client's attempt to push the knees together. This action activates the adductors, which then can pull the symphysis pubis into better alignment. Sometimes a popping sound is heard when the symphysis resets, but this is not necessary or desirable for effective results.

Reflexively and functionally, the sternoclavicular (SC) joint is a factor in SI joint pain. Assess for corresponding pain in the SC joint, apply massage to inhibit muscle tension, increase tissue pliability, and use the SC joint technique shown in Unit Two.

Often the sacrotuberous and sacrospinous ligaments are short, or the hamstring and gluteus maximus attachments near these ligaments are binding. These ligament structures are difficult to reach, and, when located, a compressive force is applied to the ligament while the client activates the hamstrings and the gluteus maximus. Results should include increased pliability of the ligament, permitting the muscles to move more freely without bind.

If a functional long leg is present, the SI joint can become jammed on the long leg side. Typically, the pelvis is anteriorly rotated on the symptomatic affected side and posteriorly rotated on the nonsymptomatic side, with the quadratus lumborum short on that side. Indirect function techniques for anterior rotation combined with quadratus lumborum release are effective (see Unit Two). The physical trainer or chiropractor rotates the pelvis, and the massage therapist deals with the soft tissue compensation. Gait patterns and firing patterns need to be assessed and normalized.

Quadratus Lumborum Pain

Quadratus lumborum pain is felt in the lumbar region just above the iliac crest. Usually pain is felt more on one side than the other, and this is combined with a rotated pelvis and functionally uneven legs. Coughing and sneezing increase pain. SI joint pain is a common aspect of quadratus lumborum pain. The history often includes short-leg syndrome, stepping in a hole, or one leg coming down hard on an uneven surface during running, any of which can cause the leg to be driven up into the joint, resulting in muscle spasms as the SI joint jams. The paired muscle group consists of the scalenes, which need to be addressed in conjunction with the quadratus lumborum. Apply both scalene and quadratus lumborum releases (see Unit Two) during the general massage.

Psoas Low Back Pain

The main symptoms of low back pain related to psoas dysfunction are a deep aching in the lumbar area, difficulty moving from a seated to a standing position and vice versa, and difficulty rolling over when lying down. **Psoas low back pain** is often the end result of a series of events that begin at the core muscles. The most common pattern is that the transverse abdominis and oblique muscles are weak, and therefore trunk muscle activation patterns are ineffective. The rectus abdominis becomes dominant and the psoas shortens. The gluteus maximus muscle becomes inhibited, and hip extension function is assumed by the erector spinae and hamstrings. As a result, hip extension firing patterns are abnormal. Hamstrings shorten and become prone to injury. The gastrocnemius begins to function as a knee flexor and shortens. This interferes with ankle mobility. Uneven forces are placed on the knees, and the calf muscles usually stick together and pull at the Achilles tendon. Eventually, Achilles tendon and plantar fascia problems can occur.

The massage strategy is to normalize muscle activation firing pattern sequences and reduce tone in the shortened muscles (i.e., the psoas, hamstrings, and calves) (see psoas and hamstring treatment in Unit Two). However, this sequence only treats the symptom. The problem is core instability. A proper strength and conditioning sequence must deal with core strength. However, the target muscles of the strengthening program will be inhibited by the short tense erector spinae, psoas, hamstring, and calves, and a vicious cycle is created. The short muscles need to be treated and normal resting length restored as much as possible before core training takes place. This can take up to a month of concentrated effort with massage 2 to 3 times a week, combined with a sequential stretching program. Then core training begins. Massage sessions are reduced to twice a week, and daily stretching continues.

The full-body protocol is necessary, with attention to reflex paired body areas–hamstrings/biceps, quadriceps/triceps, calf/forearm, quadratus lumborum/scalenes, psoas/sternocleidomastoid and longus colli. The rectus abdominis needs to be inhibited, and the psoas released. Also thorough massage of the feet and connective tissue strategies on binding structures should be applied.

Assess and address breathing dysfunction, using the strategies shown in Chapter 19.

Connective tissue muscle-stabilizing patterns become strained. The latissimus dorsi lumbar dorsal fascia, with the gluteus maximus and the iliotibial (IT) band on the opposite side, is a common pattern. Massage inhibits the latissimus dorsi and gluteus maximus and increases pliability in the lumbar fascia and IT band.

To further complicate treatment of back pain, underlying joint instability may be noted in the lumbar and SI joints. If too much mobility is restored, joint pain may result. Slowly introducing change allows the body to adapt. If symptoms are improving and then suddenly return, too much soft tissue stability was released, and joint stability is compromised. Back off and return to general massage until the condition improves (Box 20-1).

BOX 20-1 Treating Back Pain

ACUTE TREATMENT USING MASSAGE

The side-lying position is recommended.

- If the client is prone, support with pillows under the abdomen and ankles. Do NOT keep client in the prone position for an extended time—15 minutes is maximum.
- When moving the client from the prone to the side-lying position, have the client slowly assume a position on the hands and knees, and then slowly arch and hunch the back (cat/camel move, valley/hill). Next, have the client stretch back toward the heels with the arms extended.
- Have the client slowly move to the side position; bolster for stability. Target pain control mechanisms:
- Do NOT do deep work or any method that causes guarding, flinching, or breath-holding. Use rocking and gentle shaking combined with gliding and kneading of the area of the most severe pain and symptomatic muscle tension. This will most likely be on the back, even though the causal muscle tension and soft tissue problem are usually in the anterior torso.
- Massage the hamstrings, adductors, gluteals, and calves. These muscles are usually short and tight, and the firing is out of sequence.
- Do not attempt to reset firing patterns during acute symptoms. Include massage of the reflex points of the feet related to the back.
- Turn client supine after working with both left and right sides; bolster the knees.
- The rectus abdominis and pectoralis muscles are likely short and tense. Massage as indicated in the general protocol. Psoas muscles and adductors are likely short and spasmodic, but it is best to wait 24 to 48 hours before addressing these muscles. Continue rocking and shaking.

SUBACUTE TREATMENT USING MASSAGE

24 to 48 Hours after Onset

- In the context of the general massage protocol, repeat acute massage application, but begin to address second- and third-layer muscle shortening, connective tissue pliability, and firing patterns.
- Use direct inhibition pressure on the psoas, quadratus lumborum, and paraspinalis, especially the multifidi, always monitoring for guarding response. Do NOT cause guarding or changes in breathing.
- It is likely that the hip abductors will have tender areas of shortening, but lengthen the adductors first.
- Gently begin to correct the trunk, gluteal, hamstring, and calf firing patterns. Include massage application for breathing dysfunction because it is commonly associated with low back problems. Do not overdo.

3 to 7 Days after Onset

- Continue with subacute massage application in the context of the general massage protocol, increasing the intensity of the massage as tolerated.
- In addition, normalize the gait and eye reflexes.
- Gently mobilize the pelvis for low back pain and the ribs for upper back pain. No pain should be felt during any active or passive movements.
- Positional release methods and specific inhibiting pressure can be applied to tender points. Pressure re-creates the symptoms but does not increase the symptoms. Work with trigger points that are most medial, proximal, and painful. Do not address latent trigger points or work with more than three to five areas at a time.
- Continue to address breathing function.
- The client should be doing gentle stretches and appropriate therapeutic exercises.

POST-SUBACUTE TREATMENT USING MASSAGE

- Continue with general massage, and address muscles that remain symptomatic.
- Assess for body-wide instability and compensation patterns that are commonly associated with an acute back pain event. Usually, the core muscle firing is weak, with synergistic dominance of the rectus abdominis and psoas.
- If breathing is dysfunctional, there can be mid-back pain as well. Continue to normalize breathing muscles.
- If the client has chronic back pain, continue with post-subacute treatment, and encourage rehabilitative exercises, including breathing retraining.

THE SHOULDER

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

The shoulder is prone to a number of sports injuries. It is a very shallow ball-and-socket joint, which means that it is not very stable.

The shoulder is the only joint in the body that is not really held together by ligaments. The few ligaments in the shoulder serve only to keep the shoulder from moving too far in any one direction. The ligaments have little to do with holding the joint in place. Muscles provide most of the joint stability.

The shoulder socket contains the tendons of the long and short heads of the biceps muscle and the supraspinatus tendon. Directly below the socket is the brachial plexus, which contains all of the nerves that supply the arm.

The shoulder bones are held together by the rotator cuff muscles. These muscles are also responsible for the shoulder's fine movements, such as throwing a ball. Because of the shoulder's shallow socket and lack of ligaments, any weakness of the small rotator cuff muscles makes it easy for the head of the shoulder to slide part way out of the socket, which is a partial dislocation, or subluxation. Or it may slide all the way out, which is a full dislocation.

The shoulder joint is composed of three bones: the clavicle, the scapula, and the humerus. Three joints facilitate shoulder movement. The acromioclavicular (AC) joint is located between the acromion and the clavicle. The sternoclavicular (SC) joint formed by the clavicle and the sternum must function to allow proper range of motion in the AC joint. The glenohumeral joint, commonly called the *shoulder joint*, is a ball-and-socket–type joint that helps move the shoulder forward and backward and allows the arm to rotate in a circular fashion or hinge out and up away from the body. The capsule is a soft tissue envelope that encircles the glenohumeral joint and is lined by a thin, smooth synovial membrane.

The front of the joint capsule is anchored by three glenohumeral ligaments.

The rotator cuff is composed of tendons that, with associated muscles, hold the ball at the top of the humerus in the glenoid socket and provide mobility and strength to the shoulder joint. Bursae permit smooth gliding between bone, muscles, and tendons and cushion and protect the rotator cuff from the bony arch of the acromion.

Some shoulder problems develop from the disturbance of soft tissues as a result of injury to or overuse or underuse of the shoulder. Other problems arise from a degenerative process in which tissues break down and no longer function well.

Shoulder pain may be localized or may be referred to areas around the shoulder or down the arm. Diseases within the body (such as gallbladder, liver, and heart disease, and disease of the cervical spine of the neck) may generate pain that travels along nerves to the shoulder. Referral is necessary for proper diagnosis.

DISLOCATED SHOULDER

The shoulder is the most frequently dislocated joint of the body. A dislocation may stretch or tear the rotator cuff muscles. Usually these muscles are only stretched, particularly in younger athletes. In older athletes, who have more brittle rotator cuffs, the muscles are more likely to be torn.

In a typical case of a **dislocated shoulder**, a strong force that pulls the shoulder outward (abduction) or extreme rotation of the joint pops the ball of the humerus out of the shoulder socket. The shoulder can dislocate forward, backward, or downward. Dislocation commonly occurs when there is an intense unexpected backward pull on the arm. A partial dislocation, in which the upper arm bone is partially in and partially out of the socket, is called a *subluxation*.

Shoulder instability occurs when a shoulder dislocates frequently. The arm appears out of position when the shoulder dislocates, and there is pain. Muscle spasms may increase the intensity of pain. Swelling, numbness, weakness, and bruising are likely to develop. Problems seen with a dislocated shoulder include tearing of the ligaments or tendons reinforcing the joint capsule and, less commonly, nerve damage.

Diagnosis of a dislocation is made by physical examination. X-rays may be taken to confirm the diagnosis and to rule out a related fracture.

Medical treatment for dislocation consists of putting the ball of the humerus back into the joint socket—a procedure called *reduction*. The arm is then immobilized for several weeks in a sling or in a device called a *shoulder immobilizer*. The shoulder is rested and iced 3 or 4 times a day. After pain and swelling have been controlled, a rehabilitation program that includes exercises to restore range of motion of the shoulder and to strengthen the muscles to prevent future dislocations begins. These exercises progress from simple movements to the use of weights.

After treatment and recovery, a previously dislocated shoulder may remain more susceptible to reinjury, especially in young, active individuals. A shoulder that dislocates severely or often, injuring surrounding tissues or nerves, usually requires surgical repair to tighten stretched ligaments or to reattach torn ones.

If surgery is necessary, arthroscopic surgery is performed if possible. After surgery, the shoulder generally is immobilized for about 6 weeks, and full recovery takes several months. Many surgeons prefer to repair a recurring dislocated shoulder by performing an open surgery procedure. Repeat dislocations are usually fewer and movement is improved after open surgery, but it may take a little longer to regain motion.

Massage Strategies

Massage is focused on managing pain, reducing edema, and supporting rehabilitation. The muscles of the shoulder need to be somewhat short for stability. Do not overmassage. If massage is required after surgery, use the postsurgery sequence in Chapter 18.

SPRAINS

As with all sprains, three degrees of severity of **shoulder sprains** have been identified. A mild, or first-degree, shoulder sprain causes minimal stretching of the ligaments without much tearing of fibers, and the joint remains stable. Pain and swelling will be noted around the joint.

In a moderate, or second-degree, sprain, the ligaments are stretched farther and are partially torn, and the outer end of the collarbone partially snaps into and out of the joint.

It is much easier to diagnose a severe, or third-degree, sprain. Complete disruption of all ligaments around the joint causes the collarbone to displace.

Treatment for first- and second-degree shoulder sprains is rest. The shoulder is placed in a sling to bring damaged tissues together and encourage healing. The sling is worn for 1 to 3 weeks, depending on the severity of the injury. In addition to resting the shoulder, ice is applied for 20 to 30 minutes a few times each day to ease the pain. These injuries are particularly frustrating because they can take 6 to 8 weeks to heal.

For a third-degree shoulder sprain, surgical repair of the ligaments is necessary to stabilize the joint. Up to 6 weeks of recovery from surgery is necessary before a rehabilitation program begins. This program consists of range-of-motion and strengthening exercises.

Massage Strategies

Use the strategies for sprains and strains shown on page 299.

SHOULDER SEPARATION

A **shoulder separation**, which technically is a sprain, occurs where the clavicle meets the scapula. When ligaments that hold the joint together are partially or completely torn, the outer end of the clavicle may slip out of place, preventing it from properly meeting the scapula. Most often, the injury is caused by a blow to the shoulder or by falling on an outstretched hand.

Shoulder pain and/or tenderness and, occasionally, a bump over the AC joint are signs that a separation may have occurred previously. Sometimes the severity of a separation can be detected on x-rays taken while the athlete holds a light weight that pulls on the muscles, making a separation more pronounced.

Risk factors for shoulder separation include athletic activities, especially

- Baseball (pitching)
- Football (blocking, throwing)
- Gymnastics
- Weight lifting
- Tennis
- Volleyball
- Swimming (especially backstroke and butterfly swimming techniques)

Congenital collagen disorders, including Marfan syndrome and Ehlers-Danlos syndrome, may also play a role. Marfan syndrome is a connective tissue multisystemic disorder affecting the skeleton and ligaments (joint laxity) and producing substantial cardiovascular defects. People with Ehlers-Danlos syndrome have fragile skin and loose (hypermobile and frequently dislocated) joints as the result of faulty collagen synthesis.

Another risk factor for shoulder dislocation is a history of family members with shoulder instability.

Shoulder separations are classified according to the severity of the injury as follows:

Type (grade) I: A sprain (without a complete tear) of the ligaments holding the joint together.

Type (grade) II: A tear of the acromioclavicular ligament.

Type (grade) III: A tear of the acromioclavicular and coracoclavicular ligaments.

Type (grade) IV: Both ligaments are torn, and the clavicle is pushed forward and sideways into soft tissue.

With proper treatment of a type I separation, the client should be pain-free with full range of motion in about 2 to 3 weeks. It may take 3 to 5 weeks for type II separations to reach this stage of recovery. Complete healing of type III separations, when surgery is not necessary, may take 6 weeks to 2 months. Should a type III acromioclavicular separation need surgery, full recovery may take 3 to 6 months.

Type IV separations are surgically treated. Even with proper rehabilitation, full recovery may not be achieved for 6 months to a year, and recurrence is common.

Type I, II, and III shoulder separations usually are treated conservatively with rest, and the affected shoulder/arm is placed in a sling. Soon after injury, an ice bag may be applied to relieve pain and swelling. After a period of rest, treatment consists of exercises that put the shoulder through a range of motion and increase muscle strength. Most shoulder separations heal within 2 or 3 months without further intervention. However, if ligaments are severely torn, as in type IV separations, surgical repair may be required to hold the clavicle in place. The physician may wait to see if conservative treatment works before deciding whether surgery is required.

Massage Strategies

It is important that the stability of the shoulder not be compromised. Most of the pain is caused by protective guarding by surrounding muscles. Guarding should not be eliminated because to do so would destabilize the shoulder and interfere with the progressive healing process.

The following sequence is appropriate for nonsurgical treatment of shoulder separation, especially types I and II. It should be added to a general massage session with outcome goals of parasympathetic dominance, hyperstimulation analgesia, and increased pain-modulating neurochemicals for pain management and support of restorative sleep.

- Place the injured shoulder in the loose-packed position and in the direction of ease to avoid any strain on healing tissue and to reduce the tendency for increased muscle guarding. The client's arm should be resting by the side with the shoulder abducted approximately 50 degrees and horizontally adducted 30 degrees.
- With the client in the prone position, place a pillow under the chest with additional bolsters in the axillary area if necessary. The side-lying position is best avoided on the injured side but can be effective if the client is placed on the noninjured side with a pillow supporting the head and another pillow placed on the chest for the client to "hug." It is difficult to achieve abduction in this position.
- With the client in the supine position, place bolsters under the knees and head, with an additional pillow under the scapula and arm on the injured side. Place an additional small pillow or folded towel under the elbow, with the arm bent over the chest.
- The shoulder itself is not massaged in the area of the injury, but the muscles of scapular stabilization need to have tension reduced by approximately 50%. These include the trapezius, rhomboids, levator scapulae, pectoralis minor, and anterior serratus. Also address the latissimus dorsi, pectoralis major, and deltoids. Do not work with the rotator cuff muscles because these are a major source of stability. Do not work specifically around the AC joint.
- Use gliding and broad-based compression with some kneading. Avoid ischemic compression and trigger point methods. Methods used should not cause flinching or exert pain, but they do need to be applied with enough depth of pressure and drag to affect the spindle cell and the Golgi tendon mechanism so that tension in the muscles is reduced. *Do not stretch the area.*
- Work on the opposite hip and adductors because reflexive muscle tightness will tend to occur in these areas, and massage in this area can reflexively reduce muscle tension in the injured shoulder.
- With the client in the supine position, apply gentle oscillation to reduce pain and tension in the area. Gently place one hand under the shoulder so that the scapula lies in the palm of the hand. Place the other hand gently on top of the cap of the shoulder so that the injured area is in the center of your palm. Then gently compress the two hands together to cradle the injured area. Begin moving the hands together in small, rocking, circular movements. There should be no pain or guarding. Sustain this action for as long as it feels comfortable to the client.
- During subacute healing, do NOT reduce the increased tone in the rotator cuff muscles. This is a resourceful compensation pattern that creates some joint stability. Massage needs to support strengthening exercises for the shoulder.

SHOULDER "POPS": PARTIAL DISLOCATION

Partial dislocation of the shoulder can occur when sudden force is exerted against the shoulder, causing the head of the humerus to "pop," or slip momentarily out of the socket—that is, become partially dislocated, or subluxated. Shoulder structures and the shallow socket may allow the head to slip part way up onto the rim of the socket; then the shoulder snaps back into place spontaneously. It feels as if the shoulder has popped out and then popped back in. If the shoulder were truly dislocated, this would not occur.

When the head of the humerus slides partially out and then snaps back in, the rotator cuff muscles are stretched, creating an overuse injury. The shoulder begins to slide around, causing impingement and tendonitis. Because the rotator cuff muscles are stretched, the next time the shoulder takes a blow, the head of the humerus is likely to slide out again. With each blow, the rotator cuff gets looser, until finally the shoulder is in danger of truly dislocating.

Standard treatment for a subluxated shoulder consists of rest and an exercise program to strengthen the rotator cuff muscles to prevent future slipping.

These muscles are slow healers. The strengthening program usually takes 6 to 12 weeks, and the shoulder may not be back to full strength for 6 months or longer.

Massage Strategies

Massage must not destabilize the area. Use strategies for dislocation provided on page 307.

TENDONITIS, BURSITIS, AND IMPINGEMENT SYNDROME

Tendonitis of the shoulder is different from bursitis, although both can be very painful. Usually, the pain of tendonitis does not occur unless the tender body part is used. With **bursitis**, the body part is constantly painful. The tenderness of tendonitis occurs all along the length of the tendon, but pain is felt in one specific spot with bursitis.

With tendonitis of the shoulder, the rotator cuff and/or the biceps tendon becomes inflamed from repetitive strain, or as a result of being pinched by surrounding structures. The injury may vary from mild inflammation to involvement of most of the rotator cuff. When a rotator cuff tendon becomes inflamed and thickened, it may get trapped under the acromion. Squeezing of the rotator cuff is called **impingement syndrome**.

Tendonitis and impingement syndrome are often accompanied by inflammation of the bursal sacs (bursitis) that protect the shoulder.

Signs of these conditions include slow onset of discomfort and pain in the upper shoulder or upper third of the arm and/or difficulty sleeping on the shoulder. Tendonitis and bursitis also cause pain when the arm is lifted away from the body or is raised overhead. If tendonitis involves the biceps tendon, pain will occur in the front or side of the shoulder and may travel down to the elbow and forearm.

Diagnosis of tendonitis and bursitis begins with a medical history and physical assessment. X-rays do not show the tendons or bursae, but they may be helpful in ruling out bony abnormalities and arthritis. The doctor may remove and test fluid from the inflamed area to rule out infection. Impingement syndrome may be confirmed if injection of a small amount of anesthetic (lidocaine hydrochloride) into the space under the acromion relieves pain.

The first step in treating these conditions is to reduce pain and inflammation with rest, ice pack applications, lymphatic drain massage, and NSAIDs. In some cases, ultrasound (noninvasive sound wave vibrations) may be used to warm deep tissues and improve blood flow. Gentle stretching and strengthening exercises are added gradually. These may be preceded or followed by the use of an ice pack. If no improvement is noted, the doctor may inject a corticosteroid medicine into the space under the acromion. Steroid injections are a common treatment, but they should be used with caution because their use may lead to tendon rupture. If no improvement is noted after 6 to 12 months, arthroscopic or open surgery may be necessary to repair damage and relieve pressure on the tendons and bursae.

Rotator cuff muscles are not meant to function under stress with the arm raised above a line parallel to the ground. If the shoulder joint is continually stressed with the arm in this overhead position, the rotator cuff muscles begin to stretch out. This allows the head of the joint to become loose within the shoulder socket. Extension of the arm backward over the shoulder will cause the head of the humerus to slide forward, catching the tendon of the short head of the biceps between the ball and the socket. The head of the humerus will drop in the socket, so that it impinges on the tendon of the long head of the biceps and, in some cases, on the supraspinatus muscle as well. Sports that require repeatedly raising the arm up over the head, such as baseball, tennis, volleyball, and swimming, are the main contributors to shoulder impingement injuries.

This impingement causes the tendons to become inflamed and painful. Baseball pitchers tend to feel the pain in both the long and short heads of the biceps, and tennis players feel the pain particularly in the long head of the biceps. Athletes such as freestyle and butterfly swimmers may feel pain deep in the shoulder because of impingement on the supraspinatus tendon.

Tennis players may state that they can hit ground strokes without pain, but when they hit an overhead stroke or serve, the shoulder hurts. The same thing can happen to golfers in both the backswing and the follow-through, when the arms are higher than parallel to the ground.

The proper way to treat a shoulder impingement is through an exercise program that strengthens the rotator cuff muscles sufficiently that the head of the humerus is held firmly in place and will not slip out of the socket. With no slipping, the tendons will no longer be inflamed or irritated.

Some people do not respond to rehabilitation, even with physical therapy, and surgery will be required to repair the shoulder joint.

Massage Strategies

Massage must not destabilize the joint. See the sequence for tendonitis and bursitis provided on page 306.

THE PRO'S ROTATOR CUFF INJURY

In professional athletes, the rotator cuff muscles can become so overdeveloped that they no longer fit into the shoulder socket. As a consequence, they rub along the outside of the socket, and eventually some of the muscle fibers are sawed through as they ride back and forth against the rim of the socket. This condition is known as the **pro's rotator cuff injury**. The only way to correct this is by performing surgery to enlarge the socket and repair the damaged muscle fibers.

ROTATOR CUFF TEAR

One or more rotator cuff tendons may become inflamed as a result of overuse, aging, a fall on an outstretched hand, or a collision. Sports that require repeated overhead arm motion and occupations that require heavy lifting place a strain on rotator cuff tendons and muscles. Normally, the tendons are strong, but continued strain of this type may lead to a tear.

Typically, a person with a **rotator cuff tear** feels pain over the deltoid muscle at the top and outer side of the shoulder, especially when the arm is raised or extended out from the side of the body. Motions such as those involved in getting dressed can be painful. The shoulder may feel weak, especially when one is trying to lift the arm into a horizontal position. A person may also feel or hear a click or pop when the shoulder is moved (Figure 20-11).

Pain or weakness on outward or inward rotation of the arm may indicate a tear in a rotator cuff tendon. There is pain when lowering the arm to the side after the shoulder is moved backward and the arm is raised. A doctor may detect weakness but may not be able to determine from a physical examination the location of the tear. X-rays may appear normal. An MRI scan can help detect a full tendon tear, but not partial tears. If the pain disappears after a small amount of anesthetic is injected into the area, impingement is likely to be present. If there is no response to treatment, arthrography may be used to inspect the injured area and confirm the diagnosis.

A torn rotator cuff receives the same initial treatment as a stretched one–a comprehensive rehabilitation program. Some tears will heal without surgery. The surgery is difficult and should be avoided if at all possible. Arthroscopic surgery is coming into more widespread use for the shoulder and is a less invasive approach to treat the injury.

Massage Strategies

Use strategies for a muscle strain described on page 297.

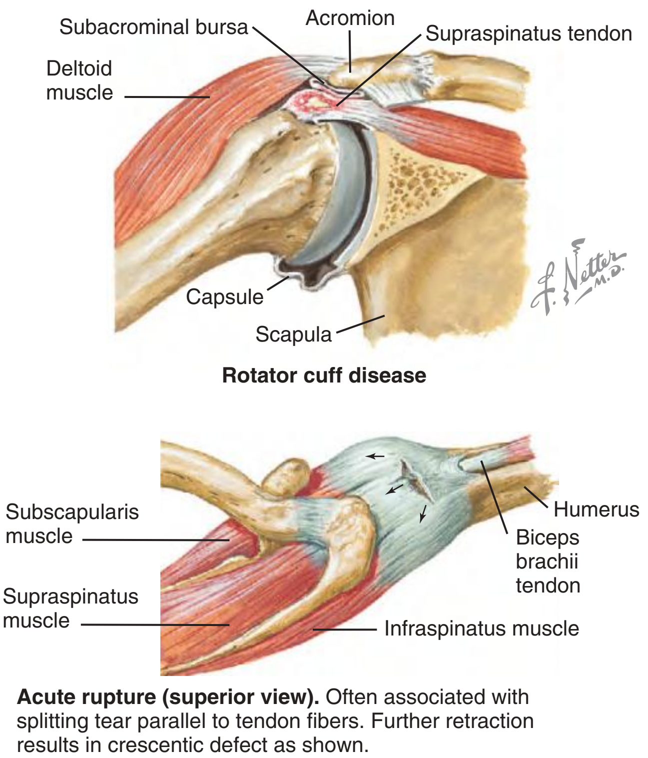


FIGURE 20-11 Rotator cuff injury. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

FROZEN SHOULDER (ADHESIVE CAPSULITIS)

In cases of **frozen shoulder (adhesive capsulitis)**, movement of the shoulder is severely restricted. This condition, also called *adhesive capsulitis*, is frequently caused by injury that leads to lack of use due to pain. Intermittent periods of use may cause inflammation. Adhesions grow between the joint surfaces, restricting motion. There is also a lack of synovial fluid, which normally lubricates the gap between the humerus and the socket to help the shoulder joint move. It is this restricted space between the capsule and the head of the humerus that distinguishes adhesive capsulitis from a less complicated painful, stiff shoulder.

A number of risk factors for frozen shoulder have been identified, including rotator cuff injury, diabetes, stroke, accidents, lung disease, and heart disease. The condition seldom occurs in people younger than 40 years of age.

With a frozen shoulder, the joint becomes so tight and stiff that it is nearly impossible to carry out simple movements, such as raising the arm. People complain that stiffness and discomfort worsen at night. A doctor may suspect a frozen shoulder if a physical examination reveals limited shoulder movement. An arthrogram may confirm the diagnosis.

Treatment of this disorder focuses on restoring joint movement and reducing shoulder pain. Usually, treatment begins with NSAIDs and application of heat, followed by gentle stretching exercises and massage. In some cases, transcutaneous electrical nerve stimulation (TENS) may be used to reduce pain by blocking nerve impulses. If these measures are unsuccessful, the doctor may recommend manipulation of the shoulder under general anesthesia. Surgery to release the adhesions is necessary only in severe cases.

Massage Strategies

Massage cannot access adhesions inside the joint capsule. Instead, massage is focused on increasing range of motion and pliability of the muscles related to shoulder mobility. Often the latissimus dorsi is short and is a major source of symptoms. The pectoralis major and minor fascial coverings can be stuck together, and this needs to be corrected. Massage applied to the hip opposite the affected shoulder while the client actively moves the frozen shoulder may stimulate reflex responses supporting mobility.

The sequence for subscapularis release is often helpful. All rotator cuff muscles need to be thoroughly massaged, lengthened, and stretched.

FRACTURE

Fracture of the shoulder usually occurs as a result of an impact injury such as a fall or a blow to the shoulder. The fracture, which can occur as a partial or total crack of the bone, usually involves the clavicle or the neck of the humerus.

A shoulder fracture that occurs after a major injury is usually accompanied by severe pain. Within a short time, redness and bruising may be evident around the area. Sometimes a fracture is obvious because the bones appear out of position. Both diagnosis and severity can be confirmed by x-rays.

Initially, the doctor attempts to bring the affected parts into a position that will promote healing and restore arm movement *(reduction)*. If the bones are out of position, surgery may be necessary to reset them.

Fracture of the clavicle or neck of the humerus usually is treated with a sling or shoulder immobilizer. Exercise restores shoulder strength and motion.

Massage Strategies

See massage for fractures on page 310.

ARTHRITIS

Arthritis/arthrosis is a degenerative joint disease caused by wear and tear. Arthritis not only affects joints; it may secondarily affect supporting structures such as muscles, tendons, and ligaments.

The usual signs of **arthritis of the shoulder** are pain, particularly over the AC joint, and a decrease in shoulder motion. Arthritis is suspected when both pain and swelling are noted in the joint. The diagnosis is confirmed by a physical examination and x-rays. Analysis of synovial fluid from the shoulder joint may be helpful in diagnosing some types of arthritis. Although arthroscopy permits direct visualization of damage to cartilage, tendons, and ligaments, and may confirm a diagnosis, this is usually done only if a repair procedure is to be performed.

Athletes are particularly prone to developing arthritis if they have repeatedly damaged the shoulder joints.

Usually, osteoarthritis of the shoulder is treated with NSAIDs. When conservative treatment fails to relieve pain or improve function, or when severe deterioration of the joint is evident, shoulder joint replacement *(arthroplasty)* may provide better results. The success of this procedure requires participation in a physical rehabilitation program. In this operation, an artificial ball replaces the humerus, and a cap replaces the scapula. Passive shoulder range of motion is started soon after surgery. Eventually, stretching and strengthening exercises become a major part of the rehabilitation program.

The success of the operation often depends on the condition of rotator cuff muscles before surgery and the degree to which the person follows the rehabilitation program.

Massage Strategies

Treatment that incorporates the strategies for arthritis is found on page 307. If surgery is necessary, see the procedures shown in Chapter 18.

WEIGHT LIFTER'S SHOULDER

Weight lifting can cause overuse injuries of the shoulder. In particular, bench press exercises often lead to shoulder pain in the AC joint. The small amount of cartilage between the two bones of this joint—the acromion and the clavicle—can tear or degenerate from the stress of weight lifting. When the cartilage is damaged, bone rubs on bone, causing pain.

This injury, known as "**weight lifter's shoulder**," is not common among well-trained or world-class weight lifters; people who work out on their own are most likely to develop weight lifter's shoulder.

Usually, rest for a few weeks and an injection of cortisone provide relief. If the pain becomes chronic, a small piece of the outer end (acromion process) of the collarbone can be surgically removed. This widens the space between the two bones and relieves pressure in the joint, enabling return to full, pain-free weight lifting.

Massage Strategies

Use the same strategies as for arthritis, shown on page 307.

SHOULDER MUSCLE PULLS (STRAINS)

Shoulder muscle pulls (strains) occur when the muscles contract excessively or are overstretched, causing muscle fibers to tear. This is seen commonly in wrestling and in sports requiring throwing, such as basketball and baseball.

Treatment includes rest for 3 to 7 days, followed by stretching and then strengthening exercises.

Because of the complexity and the number of muscles around the shoulder that can be injured, the diagnosis should determine the particular muscles involved, and a program specifically focusing on those muscles is necessary.

Massage Strategies

Use strategies for strains and sprains on page 299.

THE COLLARBONE (CLAVICLE)

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

BRUISED COLLARBONE

A blow on the head of the collarbone can cause a painful bone bruise or contusion but will not actually sprain the AC joint. This injury usually heals without difficulty but may lead to a condition called *osteolysis*.

Osteolysis causes the bone to dissolve and deteriorate because of loss of calcium. On an x-ray, the collarbone has a mossy appearance, and bone loss is evident at the outer end of the bone.

Although a **bruised collarbone** can be quite painful, the bone usually heals and becomes healthy again in 6 to 12 months, and the pain is decreased. If pain persists, the outer edge of the collarbone can be shaved in a surgical procedure performed to relieve the pain.

Massage Strategies

Apply lymphatic drain massage over the bruised area.

BROKEN COLLARBONE

The collarbone heals easily. A **broken collarbone** does not need to be set perfectly. However, in severe cases, sharp fragments can cause damage to surrounding tissue. As long as the pieces of the bone are in close proximity, they will bridge any gaps, heal, and form a new collarbone even stronger than the old one (Figure 20-12).

A broken collarbone is usually a matter of concern only because it prevents the client from functioning. Proper treatment for a broken collarbone is immobilization to allow it to heal. A brace is used to pull the shoulders back and to hold the ends of the bone in line. This injury takes 6 to 8 weeks to heal completely, but early healing is usually sufficient that the brace can be removed in about 3 weeks. Because the shoulder joints are not involved in bracing, the patient retains full use of the arms and shoulders.

Massage Strategies

See procedures for fractures on page 319.

THE ELBOW

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

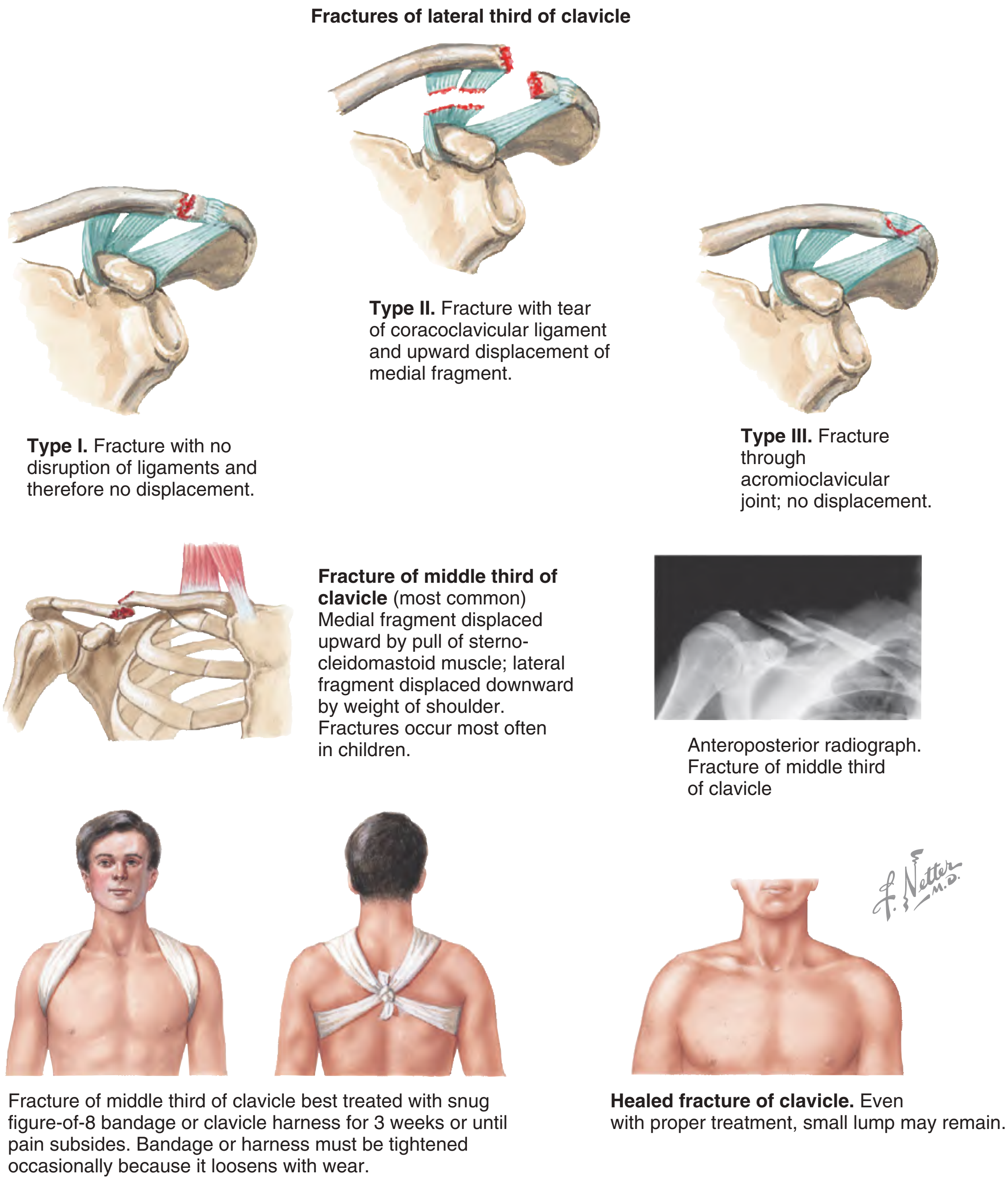


FIGURE 20-12 Clavicular fractures. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

The elbow has three separate joints, consisting of the junction of the two bones of the forearm—the radius and the ulna—and the junction of each of these bones with the humerus. These three joints allow the elbow to flex and extend and also to rotate, allowing *supination* and *pronation.* The elbow is a common source of injury, particularly in racquet and throwing sports.

Elbow pain can be caused by wrist problems. The muscles that control the wrist originate from the bones of the elbow, and many problems caused by excessive wrist strain cause pain in the elbow rather than in the wrist.

TENNIS ELBOW

Tennis elbow, a common elbow injury, is an inflammation of the muscles of the forearm and the tendon that connects the muscles to the bones in the elbow. These muscles are used in wrist extension and supination. When muscles and tendons become inflamed from overuse, pain occurs on the outside of the elbow (lateral epicondyle). The pain is worse during lifting with the palm facing down (e.g., when picking up a cup).

Tennis elbow also causes pain during rotation of the hand in a clockwise direction (the direction used to screw in a light bulb). During clenching or squeezing, pain will be felt, as when shaking hands or holding a racquet or a golf club.

Golfers also suffer from tennis elbow, but on the nondominant side: a right-handed golfer will feel the pain in the left elbow. Pulling the club through the swing with the left wrist causes irritation in the left elbow.

Tennis players most often aggravate the elbow by hitting the ball late on a backhand swing, straining the forearm muscles and tendon.

Once the elbow becomes inflamed, everyday activities are enough to keep it irritated. Treatment includes rest and an exercise program to increase the strength and flexibility of the forearm muscles and tendons. Massage is very helpful in increasing flexibility and pliability in these muscles.

One treatment for tennis elbow is cortisone injections; however, this is not the best long-term strategy. Injecting an antiinflammatory agent such as cortisone around an inflamed tendon will reduce inflammation and ease pain, but this does not address the cause of the problem, which is overstressing of the forearm tendons. When the cortisone begins to wear off (in 4 to 6 weeks), the forces that caused the tendonitis in the first place remain, causing pain and stress to recur. Repeated cortisone injections can irreparably damage tendons.

In deep friction massage, pressure is applied back and forth across the tendon. This irritation increases blood flow to the tendon and promotes healing. Another way of increasing blood flow is electrotherapy, in which an electrical current is passed through the tendon. Other modalities include iontophoresis, in which a cortisone solution is painted on the skin and then is driven through the tendon using an electrical current. This concentrates cortisone around the tendon without subjecting it to damage from an injection.

Persons with a history of tennis elbow and those who feel twinges of pain after playing tennis should ice the elbow down. Icing is more effective once the elbow has returned to normal body temperature.

Another type of tennis elbow is characterized by pain on the inner side of the elbow at the medial epicondyle. This pain involves inflammation of the muscles and tendons that allow pronation of the wrist.

Other sports that require a snap of the wrist, such as throwing sports, can also lead to this type of elbow pain. Prevention and treatment are the same as for tennis elbow.

Massage Strategies

Use massage strategies for tendonitis/tendonosis as shown on page 306. Deep friction massage does increase circulation, but it also creates inflammation. The benefit of friction massage needs to be evaluated on a case-by-case basis.

PITCHER'S ELBOW

Baseball pitchers may develop elbow pain that occurs on the inner (medial) side of the elbow or on both inner and outer (lateral) sides. This is called "**pitcher's elbow**." Pitching requires a tremendous external rotational force on the elbow that stretches the ligaments that hold the inner bones together, causing pain; it also compresses the outer side, causing the head of the radius to jam against the humerus.

The repeated trauma of this compression can cause an area of bone in the humerus to die. This disorder is called *osteochondritis dissecans*. The dead piece of bone can actually fall into the joint, leaving a crater. This causes continued pain and clicking in the elbow. If a fragment gets caught in the joint, it becomes a **loose body** and may cause the elbow to lock.

Treatment for this condition is rest, which allows the elbow ligament and bone to heal. It may take a full year for the bone to heal. If loose pieces of bone are found inside the elbow, arthroscopic surgery will be required to remove them.

Massage Strategies

Use the strategies for tendonitis shown on page 306. Apply lymphatic drain massage if edema is present. If friction massage is used, its location at the specific area of pain in the tendons must be precise.

LITTLE LEAGUE ELBOW

A young baseball player who throws too often or too hard can irritate the growing part of the elbow bone, and the medial epicondyle enlarges. In the act of throwing, the flexor muscles of the wrist contract to propel the ball. These muscles are connected to the medial epicondyle, and the constant yanking pulls the soft growth center (epiphysis) apart, causing pain. Also, irritation of the growth center stimulates it, causing excessive growth of the medial epicondyle.

Treatment for this condition, called **Little League elbow**, is rest until the condition subsides. This usually takes from 6 weeks to 6 months, depending on the severity of the injury.

In severe cases, the medial epicondyle may be torn completely off the bone through the soft growth center. This injury is an emergency situation, and the epicondyle will have to be surgically reimplanted.

Rehabilitation, which includes immobilization followed by gradual range-of-motion exercises with an experienced physical therapist, may take 6 months or longer after surgery.

Sanctioned Little Leagues now restrict the number of innings that a pitcher can pitch in a week.

Massage Strategies

No specific massage is used. If the client has surgery, massage should follow the recommendations of the physical therapist or physician for presurgery and postsurgery care.

"FUNNY BONE" (CUBITAL TUNNEL) SYNDROME

Hitting the elbow in a certain way stimulates the ulnar nerve and causes the numbness, tingling, and pain characteristic of the "**funny bone**" **syndrome**, or cubital tunnel syndrome. The ulnar nerve traverses the back of the elbow in a groove behind the medial epicondyle.

Some athletes may feel as if they have hit their funny bone as a result of repeated trauma to the elbow. Scar tissue may form over the nerve and may compress it into the canal, resulting in severe pain in the elbow. Numbness and tingling radiate down into the fourth and fifth fingers, with loss of strength in these fingers. This syndrome is similar to carpal tunnel syndrome in the wrist.

Treatment consists of surgery to remove the scar tissue formed over the nerve. The nerve may have to be transplanted outside of the canal to prevent scar tissue from building up around it again.

Massage Strategies

Massage is not appropriate to reduce the scar tissue because of close proximity to the nerve and the potential for nerve damage. A skin rolling application over the adhered area may increase tissue pliability. Restoring normal resting length to all muscles in the area may reduce symptoms. Postsurgery massage can encourage more appropriate scar formation. See postsurgery strategies in Chapter 18.

HYPEREXTENDED ELBOW

When force applied to the elbow extends farther than normal, the result is hyperextension. This tears the fibers that hold the front of the elbow joint together and overextends the biceps muscle, which attaches just below the elbow.

A **hyperextended elbow** causes pain and swelling. Treatment consists of rest, ice application, and possibly splinting to keep the elbow bent until the pain subsides. Stretching is slowly introduced until pain-free range of motion returns. Total recovery time is usually 3 to 6 weeks, depending on the severity of the injury.

Massage Strategies

Agonist/antagonist balance is altered by hyperextension injury. The biceps muscles are pulled into a forced eccentric pattern and may spasm in an attempt to decelerate movement. Triceps shorten concentrically and can develop trigger points. Co-contraction of both muscles stabilizes the joint, but the joint can become jammed, interfering with range of motion. Massage targets all of these issues from the subacute phase onward, into the remodeling phase of healing. Follow strategies for strains and sprains—acute, subacute, and remodeling.

BONE CHIPS

Bone chips are the result of many years of overuse of the elbow and usually afflict an older pitcher or tennis player. Football players, especially linemen, are also prone to this condition. Little pieces of bone break off the elbow as the result of long and repeated stress. Arthroscopic surgery is the usual treatment option if the pain cannot be tolerated.

Massage Strategies

Massage can reduce symptoms of compensatory muscle tension. All massage methods aimed at muscle length and connective tissue pliability are appropriate. If surgery is performed, follow presurgical and postsurgical massage protocols provided in Chapter 18.

TRICEPS TENDINOPATHY (TENDONITIS, TENDONOSIS)

Throwing sports can cause pain in the back of the elbow at the olecranon process. **Triceps tendinopathy (tendonitis, tendonosis)** may also occur in basketball players, as the result of dribbling and throwing motions. The triceps muscle and the tendon combine to straighten out the elbow. In the throwing motion, the elbow begins at a flexed position as the arm is cocked and extends as the throw is delivered, causing stress where the triceps tendon attaches to the elbow. The pain of triceps tendonitis can be severe, primarily for baseball pitchers.

Treatment includes rest, ice application, and a structured rehabilitation exercise program.

Massage Strategies

See general treatment for tendinopathy (tendonitis, tendonosis) on page 306.

BICEPS TENDINOPATHY (TENDONITIS, TENDONOSIS)

Biceps tendonitis, or inflammation, is characterized by pain in the lower portion of the biceps muscle where it attaches to the elbow. It is a common phenomenon in beginning weight lifters who overstress themselves, and among veteran weight lifters who make too big a step up in the weights that they are lifting. The pain usually occurs the day after lifting. A limitation in the range of motion occurs as the result of inflammation and spasm in the muscle fibers that have been overstressed.

Treatment consists of icing and rest in the acute phase. Adjustment in training intensity and form is necessary, as is rehabilitation exercise.

Massage Strategies

See massage treatment for tendinopathy (tendonitis, tendonosis) on page 306.

TORN BICEPS

A sudden, severe movement of the arm can tear the biceps muscle, as when a golfer unexpectedly hits the ground hard with a club, a tennis player hits a hard forehand smash, or a weight lifter makes a clean-and-jerk motion. The **torn biceps** results in pain, bleeding, loss of function, and muscle deformity. The biceps muscle may contract and ball up, creating a defect the size of a small orange on top of the muscle.

Cosmetic surgery can correct the muscle defect, but it cannot restore the strength of the muscle. The buildup of scar tissue weakens the muscle, and a torn biceps that has been repaired will likely tear again.

Medical treatment consists of rest for 2 or 3 weeks while the torn muscle heals, followed by a training program to strengthen the other head of the biceps so it can compensate for the loss of strength and function.

Massage Strategies

Use the muscle strain strategies shown on page 297. Scar tissue management is also appropriate.

THE WRIST

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

The wrist is one of the most complex structures in the body. Ten bones are involved in moving the wrist joint in various directions. These small bones are extremely sensitive to excessive force or trauma, which commonly occurs in racquet and throwing sports. In addition, tremendous head-on forces on the wrist are generated in boxing, football, and wrestling. Because of all of these forces, the wrist is one of the more frequently injured parts of the body.

Any severe wrist pain after a fall or a blow should be seen by a physician and x-rayed because of the possibility of a fracture. The wrist is usually fractured as the result of a fall. However, a wrist can also be fractured by being hit. A wrist fracture can be misdiagnosed as a sprain or a bruise.

SPRAINS

The most common injury to the wrist is a sprain.

All but the most minor wrist sprains should be x-rayed because a sprained ligament may pull off a little piece of bone, which changes the injury to an avulsion fracture. A sprained wrist may not need anything more than a soft splint. A fractured wrist, however, requires casting.

Treatment for a **sprained wrist**, as for any sprain, is PRICE (*p*rotection, *r*est, *i*ce, *c*ompression, and *e*levation) therapy, followed by range-of-motion exercises and then by strengthening exercises.

Subluxation of the wrist bones is a serious sprain. This is seen when the ligaments connecting two or more of the small bones are torn completely, and the bones slide out of place. This injury is common among boxers and usually results from hitting the heavy bag in training.

Massage Strategies

Use the sequences for sprains (see page 299).

TRAPEZIUM FRACTURE

The trapezium bone is the small bone in the wrist just behind the base of the thumb. This fracture is usually caused by stretching the hand out to break a fall or by hitting the hand against an opposing player's helmet. Healing is more difficult for this fracture than for most other fractures in the body because blood supply to the broken bone may be inadequate. It can take 8 weeks to 8 months for this bone to heal.

New techniques, however, such as implanting an electromagnet in the cast, can speed bone healing. The magnet causes the underlying filaments of the bone matrix to line up with the same polarity. This method is commonly used when no evidence of healing can be found after a reasonable length of time (≈6 weeks). If the bone does not reknit, it probably will have to be repaired surgically with a bone graft.

If left untreated, **trapezium fracture** will lead to chronic pain in the wrist and loss of ability to extend the wrist backward.

Massage Strategies

Use the sequences for contusions (page 292) and fractures (page 310).

SCAPHOID FRACTURE

Even slight tenderness in the anatomic snuffbox around the scaphoid, as well as swelling obliterating the space between the thumb's extensor tendons, suggests the presence of a **scaphoid fracture** that may not appear on an x-ray until 2 weeks after trauma. Percussion on the knuckle of the index finger when the fist is closed will usually elicit pain in the scaphoid if it is fractured. Scaphoid fracture is common in ice hockey players.

Massage Strategies

Use the strategies for contusions (page 292) and fractures (page 308).

GOLFER'S WRIST

If a golf club in full swing hits the ground or a hard object other than the ball, an isolated fracture of the wrist may result. This injury is called **golfer's wrist**. The mechanism seems to be violent contraction of the flexor carpi ulnaris insertion through the pisiform-hamate ligament. X-rays may show a fracture of the hamate.

Massage Strategies

Use the strategies provided for contusions (page 292) and fractures (page 308).

LUNATE INJURY

Carpal dislocations, especially lunate, are frequently missed during evaluation. These are often associated with a trans-scaphoid fracture and necrosis. Lunate dislocation and/or fracture, or **boxer's wrist**, may be seen in any athlete as the result of a fall on the outstretched hand, but it is most common in boxers whose hands are carelessly wrapped. Damage to the median nerve is a complication. Symptoms include anterior wrist swelling with stiff and semiflexed fingers.

The lunate usually dislodges posteriorly or anteriorly, disrupting its relationship with neighboring carpals and the distal radius. Anterior displacement, where the bone rests deep in the annular ligament, is the common direction and may affect the median nerve. The lunate is loosely stabilized by anterior and posterior ligaments that contain small nutritive blood vessels. A torn ligament thus interferes with nutrition to the lunate, resulting in necrosis.

Massage Strategies

Use the strategies for contusions (page 292) and fractures (page 308).

RACQUET WRIST

Tennis or racquetball players may develop pain at the base of the hand below the little finger. Every time the player hits a ball, the racquet butt bangs into and bruises one of the small bones of the wrist.

If the pain is severe, this indicates that the little hook of bone at this spot may be broken and will have to be treated as a fracture.

Sometimes a bone bruise is found deep in the proximal hypothenar eminence in the hamate-pisiform area. This condition, known as **racquet wrist**, is common in sports requiring a hand-held object such as a hockey stick, ski pole, baseball bat, or racquet, because of the impact on the hamate prominence. It may also result from a fall when the outstretched hand strikes an irregular surface. Chronic aggravation leads to deep swelling, vascular symptoms similar to those of carpal tunnel syndrome, and distal neuralgia.

Massage Strategies

Use the strategies for contusions (page 292) and bone fractures (page 308).

TENDINOPATHY (TENDONITIS, TENDONOSIS)

The wrist is the passageway for tendons that begin in the forearm and extend into the fingers. The fingers are actually controlled by muscles in the forearm, not in the hand. Overuse of the wrist in sports causes inflammation of the finger tendons attached to these forearm muscles. This results in swelling, pain, and limited function in one or more of the fingers.

The extensor and flexor tendons in the thumb are particularly sensitive to overuse. The extensor tendon moves the thumb away from the second finger, and the flexor tendon moves it toward the second finger. Tendonitis limits the ability to grasp with the thumb. This condition is common in tennis players with pain and swelling on the thumb side of the wrist, which is caused by gripping the racquet too tightly.

Treatment consists of rest and icing the tendon in the wrist, followed by administration of antiinflammatory medications and immobilization of the thumb and wrist to further reduce the inflammation.

Massage Strategies

Use treatment strategies for tendinopathy (tendonitis, tendonosis) on page 306.

GANGLION

A **ganglion** is a cyst that appears as a small lump on the wrist or hand, which can vary from the size of a kernel of corn to the size of a cherry. It can occur on the back or front of the wrist, depending on whether an extensor or flexor tendon is involved. Both of these tendons slide through a sheath that produces synovial fluid.

If a finger tendon and its sheath become inflamed from overuse or from a blow to the wrist, part of the tendon sheath may seal off. A cyst forms because the liquid produced by the sheath is trapped. The cyst, or ganglion, swells inside the tendon sheath as the cells produce more fluid, and it can become quite painful.

The ganglion may open at one end if there is pressure from overproduction of fluid or from a sudden blow. The fluid runs out, and the ganglion collapses. The problem is that the raw surfaces that have blown out may seal off again, causing the ganglion to re-form.

A ganglion is a problem when it becomes painful with activity. As long as it does not bother the athlete, there is no need to treat it. If the ganglion is problematic, medical treatment includes injecting it with cortisone, which causes it to disappear. If the ganglion continues to re-form after several injections, surgical removal may be necessary.

Massage Strategies

Do not irritate the area or attempt to massage the area. If cortisone is used, avoid the area. Follow presurgery and postsurgery strategies in Chapter 18, if surgery is performed.

CHRONIC OSTEOARTHRITIS/ARTHROSIS

Chronic **osteoarthritis/arthrosis** of the wrist is a degenerative joint disease characterized by deterioration and abrasion of articular cartilage, with new bone formation at the borders of the joint. It is the most common form of arthritis. Wear from aging, trauma, and abuse of weight bearing are typical causes. Other causes include disruption of collagen, decreased ground substance, many microscopic changes, and frequent increases in the water content of the involved cartilage.

Morning stiffness that eases with activity, pain on prolonged exercise, slight joint swelling from fluid accumulation, crepitus on movement, disuse atrophy, and joint deformity are characteristic.

Massage Strategies

Use the sequences for arthritis and arthrosis (page 307).

CARPAL TUNNEL SYNDROME

The finger tendons pass through the wrist in a narrow, tunnel-like enclosure. With chronic overuse or excessive twisting of the wrist, fluid builds up in the sheaths of the tendons, causing the tendons to become inflamed and swollen. The carpal ligament can become thickened from overuse. Both of these conditions narrow the tunnel and pinch the main nerve that passes through the tunnel to the fingers.

The complex of symptoms resulting from this condition is called **carpal tunnel syndrome**. The pain extends up into the forearm and down into the hand, and there may be numbness, tingling, and even loss of strength in the middle and ring fingers.

Tightly gripping something while exercising can lead to carpal tunnel syndrome. People who use a walker and cane can be susceptible to this disorder.

The treatment is rest of the affected wrist and ice application. If the symptoms do not subside, then NSAIDs may be prescribed. A splint minimizes or prevents pressure on the nerve, and steroid injection into the ligament helps reduce swelling. If the pain persists, surgery to cut the ligament at the bottom of the wrist releases the pressure.

Brachial plexus impingement at the neck and shoulder can mimic carpal tunnel syndrome symptoms. This condition needs to be ruled out before invasive treatment of the wrist.

Massage Strategies

It is difficult for the massage therapist to differentiate between brachial plexus impingement, carpal tunnel impingement, or a combination of the two; and the choice of massage therapy should be based on diagnosis by a physician.

A simple assessment can provide some clues, however. If tapping the area of the carpal tunnel impingement increases symptoms more than applying pressure on the scalenes, pectoralis minor, or brachial plexus, the primary location of the impingement is at the wrist. If applying pressure at the brachial plexus increases the symptoms more than tapping the wrist, brachial plexus impingement may be the primary causal factor. Unless specific diagnosis of carpal tunnel syndrome has been made, massage should address both the possible brachial plexus impingement and actual impingement at the wrist. See massage for impingement on page 309.

- Address the entire arm with the goal of reducing muscle tension and increasing connective tissue pliability.
- Fluid accumulation at the wrist can impinge the nerves, so lymphatic drain is appropriate.
- Specifically apply bend and shear force to the retinaculum and palmar fascia. Use enough intensity to increase pliability of these connective tissue structures but do not increase inflammation or irritation of the nerve.
- Also address reflex areas such as the opposite ankle and leg and reflex points for the arm and wrist or the foot.

THE HAND

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

Hand injuries can be so complex that referral to a medical specialist in hand therapy may be necessary.

BROKEN HAND

The metacarpals are commonly fractured, almost always due to a head-on blow to the knuckle, as when a player smashes his hand into another player's helmet or is stepped on.

The treatment for a **broken hand** is to cast or splint it for 4 to 6 weeks. If the break is directly across the shaft of the bone and the ends are jammed together, an athlete may be able to return to activity in a much shorter time with a light plastic splint. If the bones have been twisted apart and there are sharp ends at the fracture, the hand will have to stay in a cast until the fracture heals.

The type of fracture depends mainly on the direction of the injuring force applied to the hand, not the particular sport.

Massage Strategies

Use the strategies for fractures (page 310). Also address compensation in the forearm resulting from supporting the weight of the cast and limited movement.

BROKEN FINGER

A **broken finger** is very common in sports and usually occurs when a ball hits the end of a finger. Finger fractures often are not serious, particularly those in the tip of the finger. "Buddy taping," or taping an injured finger to a healthy one next to it, usually allows the athlete to continue sports activity. If the fracture is in the second or third bone of the finger, it will have to be splinted for 4 to 6 weeks to allow healing.

Massage Strategies

Use the strategies for fractures (page 310).

DISLOCATED FINGER

If a finger is struck with a great deal of force, one of its joints may dislocate. This is common in football and basketball. It is usually simple for the team doctor or trainer to pop the joint back into place. Buddy taping the **dislocated finger** to a healthy one stabilizes the joint, and the player can return to the game.

However, the finger needs to be x-rayed later on. A piece of bone at the base of the dislocated finger may break off, causing a fracture that extends into the joint. If not taken care of, this can result in loss of function of the finger and future disability.

Massage Strategies

Apply massage to the forearm to manage guarding. Treat as described for fractures (see page 310), and use lymphatic drain methods.

JAMMED FINGER

A **jammed finger** occurs when the tip of the finger hits something head-on. One of the joints holding the bone in the finger may not be totally dislocated, but the bone may have snapped part way out of the joint and then snapped back in. This injures the cartilage on the end of the bone, as well as the capsule around the joint, and stretches the ligaments that hold the joint together. The result is a swollen, painful finger that may appear normal on an x-ray.

A jammed finger heals very slowly. The finger should be immobilized for 7 to 10 days and then buddy-taped to the finger next to it. It can take 6 months for the joint to return to normal size, or it may remain larger than it was and/or larger than the joint on the opposite hand. Flexibility in the finger is often lost, but this loss usually is not sufficient to cause any great difficulty in dexterity.

Massage Strategies

Initially address the swelling with lymphatic drain massage. Once the swelling is reduced, use joint play methods (see Unit Two). Do not force joint movement.

TENDON TEARS

A sudden, violent force applied to the fingers can cause tendons to tear. Any inability to move one of the joints in a finger may indicate a **torn tendon**, and the client should be referred immediately to a trainer or a physician. A torn tendon must be repaired surgically to prevent permanent loss of finger function.

Baseball players often tear the tendon at the top of a finger during a blow to the end of the finger. As a result, the tip of the finger droops and cannot be straightened out at the fingertip. The tendon itself may be torn in half, or a piece of bone where the tendon attaches to the tip may have been broken off.

This condition is known as *baseball finger*. It also occurs in basketball and volleyball players who are hit by the ball on the end of the finger.

Treatment consists of splinting the finger with the fingertip held in the extended position for about 6 weeks. If the tendon does not heal, surgery is required to straighten out the fingertip.

Massage Strategies

Apply massage to manage compensation patterns in the forearm.

SKI POLE THUMB

The most common ligament tear in the hand occurs on the inner side of the thumb. This is the so-called **ski pole thumb** injury suffered by snow skiers when a thumb gets trapped in the loop of the pole during a fall. Occasionally, basketball players also suffer this injury. When the thumb ligaments are torn, the thumb cannot press sideways against the other fingers to grasp an object.

Immediate treatment consists of icing of the thumb and splinting. The thumb is immobilized for approximately 6 weeks. If it fails to heal, it will have to be surgically repaired.

Massage Strategies

Apply massage to manage compensation in the forearm.

TRIGGER FINGER

Trigger finger is the result of repeated trauma to the palm of the hand, as occurs when a tennis racquet jams into the palm or when a baseball repeatedly hits a catcher's palm. The trauma causes injury and inflammation to the flexor tendon of a finger. The tendon sheath thickens, narrowing the space around the tendon, and the tendon itself also thickens. It becomes difficult for the thickened tendon to move within the narrowed sheath.

The flexor muscles of the finger, which are stronger than the extensor muscles, are able to pull on the tendon and bend the finger. But the extensors are not strong enough to pull it back and straighten it. The finger ends up in a bent position, similar to the position of a finger that is pulling the trigger on a gun.

This injury sometimes responds to cortisone injection, which reduces inflammation in the tendon sheath. If it does not, the sheath will have to be split surgically to allow free motion of the finger.

Massage Strategies

Massage can reduce muscle imbalance by inhibiting the finger flexors. This is a temporary solution, but massage can manage compensation and help prevent the situation from getting worse.

BLISTERS

Athletes often suffer **blisters** and calluses on their hands and fingers from gripping balls, clubs, bars, and tennis racquets. Sweat makes the skin sticky, and friction between the hands and the object gripped can cause blisters. The feet are another common location for blisters.

Two theories on treating blisters have been put forth. One suggests leaving the blisters alone and letting them heal. New skin is formed under the blister, and the fluid in the blister gradually becomes absorbed. Eventually, the outer layer of skin sloughs off. Simple table salt can be made into a paste with a bit of water. This salt paste is put on a gauze pad, which is taped over the blister. The salt will draw the fluid out, decreasing the time necessary for healing. Usually this is done at night while the person is sleeping. The process may have to be repeated for 3 or 4 days.

The other theory recommends opening up the blister and letting the fluid drain. The trainer should choose which method to use.

Massage Strategies

Massage therapy is not applicable in these cases.

CALLUSES

Calluses are areas of skin that have thickened as the result of constant pressure. Pressure causes tissues underneath the callus to become tender. If the callus becomes bothersome, it can be softened with cream or ointment. The dead skin is then rubbed away with a pumice stone. If this does not help, a physician may trim the callus surgically or chemically.

Massage Strategies

Massage therapy is not applicable in these cases.

SPRAINED THUMB

If the thumb is forced out of its normal range of movement (usually backward), ligaments supporting the metacarpophalangeal joint at the bottom of the thumb are damaged.

Pain occurs in the web of the thumb when the thumb is bent backward, and swelling is evident over the joint at the bottom of the thumb. If the resultant laxity and instability in the joint are severe, a total rupture may have occurred, and surgery is required.

Treatment for a **sprained thumb** includes rest and taping of the thumb to provide support and prevent further damage. Most athletes are able to return to sports activity within 4 to 6 weeks, depending on the severity of the injury. It is important that strengthening exercises are done to restore stability and prevent reinjury. If the injury is not treated properly, the risk of reinjury and permanent instability, which will eventually require surgery, is greater.

Massage Strategies

Treat as a sprain (see page 299). Manage muscle guarding in the forearm.

SPRAINED FINGER

A **sprained finger** is common in games such as football, basketball, baseball, cricket, and handball. Usually the collateral ligaments at the side of the finger are damaged.

Point pain occurs over the joint in the finger where the damage has occurred, as does pain when bending the finger and stressing the injured ligament. Swelling of the joint is possible, causing restricted mobility. Instability of the finger occurs if the injury is severe, or if rupture of the ligament is complete.

Treatment involves taping the finger to protect it while healing. If the ligament is completely ruptured, surgery is necessary.

Massage Strategies

Treat as a sprain (see page 299), and manage guarding in the forearm.

LOWER ABDOMEN AND GROIN

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

The anatomy of the lower abdomen, groin, and pelvic girdle is quite complex. Because the pelvis is a ring, any change in anatomy or in applied forces to one area will be compensated throughout the ring. This simple fact makes it easier to understand why a leg length discrepancy or an SI joint dysfunction can greatly change shear forces across the pubic symphysis. The hip adductors (gracilis, adductor longus, adductor brevis, adductor magnus) attach at the inferior pubic ramus. The pectineus and rectus abdominis muscles, along with the inguinal ligament, attach superiorly. The muscles of the pelvic floor attach posteriorly.

SPORTS HERNIA/ATHLETIC PUBALGIA

Athletes who participate in sports that require rapid repetitive twisting and turning movements, such as soccer, ice hockey, field hockey, tennis, and football, may be at risk of developing a **sports hernia**, also called **athletic pubalgia**. A sports hernia is a disruption of the inguinal canal without a clinically detectable hernia. These injuries occur because adductor action during sporting activities creates shearing forces across the pubic symphysis that can stress the posterior inguinal wall. Ongoing repetitive stretching of, or more intense and sudden force on, the transverse fascia and the internal oblique muscles can lead to their separation from the inguinal ligament. This mechanism may also account for the common finding of coexisting osteitis pubis and adductor tenoperiostitis in these clients (Figure 20-13).

The inguinal canal carries the spermatic cord in males and the round ligament in females. The anterior wall of the canal consists of the external oblique aponeurosis and the internal oblique muscle. The posterior wall is formed by the fascia transversalis, which is reinforced in its medial third by the conjoined tendon, the common tendon of insertion of the internal oblique and transversus abdominis, which attaches to the pubic crest and the pectineal line. The superficial inguinal ring lies anterior to the strong conjoined tendon.

Sports hernia typically consists of one or more of the following: a torn external oblique aponeurosis causing dilation of the superficial inguinal ring; a torn conjoined tendon; a dehiscence (bursting open, splitting, or gaping along natural or sutured lines) between the torn conjoined tendon and the inguinal ligament; weakening of the transversalis fascia with separation from the conjoined tendon; tears in the internal oblique muscles; and tears in the external oblique aponeurosis.

Insidious onset of unilateral groin pain is the most common symptom. The predominant complaint of athletes with a sports hernia is unilateral groin pain, although bilateral pain may also occur. Pain usually occurs during exercise but may be experienced during other activities. Onset is typically insidious, but in a third of cases, the athlete may describe a sudden tearing sensation. Insidious onset often occurs in runners, whereas sudden onset is more common in ice hockey and soccer players.

Signs may be similar to those of osteitis pubis and adductor tendinopathy.

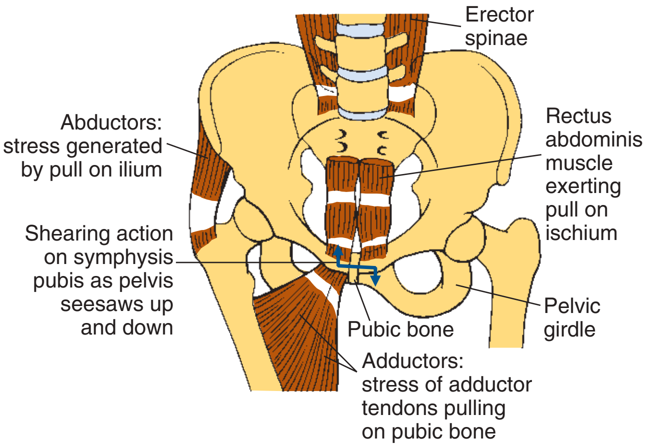


FIGURE 20-13 Action of symphysis pubis as the pelvis seesaws up and down predisposes to osteitis pubis and adductor tenoperiostitis. (From Saidoff DC, McDonough A: *Critical pathways in therapeutic intervention—extremities and spine,* St Louis, 2002, Mosby.)

Symptoms include the following:
- Local tenderness over the conjoined tendon and inguinal canal
- Tenderness increased by resisted sit-ups
- Radiating pain to the adductor region and the testicles
- Pain aggravated by sudden movements
- Pain increased by coughing or sneezing
- Resistance to conservative treatment

Surgery is the preferred treatment, although often a trial of conservative treatment is used. Specific rehabilitation that avoids sudden, sharp movements should enable athletes to return to sports participation 6 to 8 weeks after surgery. All aspects of pelvic flexibility, strength, and core stability should be addressed. Overlapping conditions should also be addressed, and coexisting osteitis pubis or adductor tendinopathy may indicate a more gradual return to athletic activity.

Massage Strategies

Therapeutic massage supports presurgery and postsurgery rehabilitation. Prevention is supported by addressing proper movement of the pelvis and SI joints, and by appropriate tension/length relationships of hip flexors and adductors. Massage can maintain normal firing patterns of the involved muscles. The attachments of the rectus abdominis can become painful if trunk firing is synergistically dominant. Use inhibitory pressure on the attachment at the ribs and down the muscles to the pubic bone. Use direct stretching on the rectus abdominis. Do not apply deep pressure into the inguinal area.

OSTEITIS PUBIS

Osteitis pubis is an inflammation of the pubic symphysis and surrounding muscle insertions likely caused by muscle injury to the hip adductors or the abdominal musculature and leading to muscle spasm, which in turn produces increased shearing forces across the pubic symphysis. SI joint dysfunction is often involved.

Osteitis pubis seems to be more prevalent in sports such as soccer, hockey, and football that involve running, sprinting, kicking, or rapid lateral movements and change of direction. These movements can lead to strain of the adductor muscles, which changes the forces directed on the pelvis. Other contributing factors are collisions that often cause minor injuries that are "played through," as well as back-pedaling (running backward), with rapid abduction of one hip to turn and run, causing hamstring or adductor strains, which change the muscle balance and forces across the pubic symphysis.

Signs and symptoms of osteitis pubis include the following:
- Pain in the lower abdominals, groin, hip, perineum, or testicles
- Adductor pain or lower abdominal pain that then localizes to the pubic area
- Unilateral pain that has been present for a few days to weeks; tenderness over the superior pubic ramus
- Pain over one or both SI joints
- Piriformis spasm and resultant sciatic-type pain

Pain increases with running, kicking, or pushing off to change direction. If the athlete complains of pubic pain of acute onset with fever and chills, a full workup for osteomyelitis must be performed.

When discrepancies of leg length are involved, the athlete may complain of hip pain in the longer limb. This also can be seen in runners and joggers who consistently run in the same direction along roadsides, with the result that one leg is shorter than the other.

Pelvic and hip inflexibility, instability, or imbalance may contribute to the development of osteitis pubis. Therapeutic exercises can increase the flexibility and strength of muscles attaching to and acting across the pubic symphysis. Particular attention should be paid to the strength and flexibility of hip flexors, abductors, adductors, abdominals, and pelvic stabilizing muscles. Care must be taken that during core training, the rectus abdominis does not become dominant. Chiropractic or other forms of joint manipulation may help with SI joint dysfunction and leg length discrepancy.

Massage Strategies

Therapeutic massage supports rehabilitation and maintains prevention by addressing proper movement of the pelvis and SI joints, as well as tension/length relationships of the hip flexors and adductors. Massage can also maintain normal muscle activation sequences (firing patterns) of involved muscles and can support proper function of the latissimus dorsi, lumbar dorsal fascia, and gluteus maximus, which act as a force couple of the SI joint. Gait reflexes are often disrupted, especially adductor/abductor interaction. At each massage session, all gait reflexes should be normalized.

The attachments of the rectus abdominis can become painful if trunk firing is synergistically dominant. Use inhibitory pressure on the attachment at the ribs and down the muscles to the pubic bone. Use direct tissue stretching on the rectus abdominis. (See rectus abdominis release in Unit Two.)

Often reflexive tension is seen in the sternoclavicular joints and surrounding muscles because they are functionally paired with the SI joints. The integrated muscle energy technique is especially effective with leg length discrepancy:

- Increase the distortion by pulling on the long leg to make it longer, or by pushing up on the heel of the short leg to make it shorter, and then have the client push or pull out of the distortion pattern. The quadratus lumborum will be short on the short leg side.
- Use quadratus lumborum release paired with scalene release. The psoas may also be involved, and the pelvis will likely have some sort of rotational pattern.
- Use indirect functional techniques to balance the pelvis. These methods are described in Unit Two.

GROIN PULL

Making a sudden lateral movement while rotating the leg when running or skating can pull a groin muscle. Several different groups of muscles attach to the groin area. The flexor muscles bend the hip, the adductor muscles bring one leg in against the other, and the rotator muscles bring the knee across the opposite leg. Muscle testing to identify which motion creates the pain can determine which muscle is involved. The rectus abdominis attachment at the symphysis pubis can mimic a **groin pull**.

Treatment includes rest for 3 or 4 days, followed by a gentle stretching program. Return to activity should be gradual.

Massage Strategies

See rectus abdominis release methods in Unit Two. Address compensation patterns, and apply the massage sequence for strains (see page 297). Because the injury is located in the groin, massage in this area must be applied with specific permission; it must be performed confidently, possibly with an objective third person present.

THE HIP

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

The hip is a stable ball-and-socket joint. Because the ball of the hip fits so tightly into the socket, the hip does not dislocate as easily as the shallow shoulder joint and is much less prone to injury. Because hip dislocation requires immense force, it is very rarely seen in athletics.

OSTEOARTHRITIS/ARTHROSIS

Osteoarthritis/arthrosis of the hip is a degenerative process in the hip caused by wear and tear or by an injury. The surfaces of the joint become rough, causing pain during hip movement. There is no apparent swelling because (1) the tight hip joint has little room for fluid accumulation, and (2) the joint is buried under large muscles, so swelling is not apparent.

Treatment for osteoarthritis/arthrosis of the hip includes antiinflammatory medication and rehabilitative exercise. Hip replacement may be required later in life. Hip replacement is a major reason why people are in physical rehabilitation.

Massage Strategies

Use the sequence for arthritis (see page 307). If a hip replacement is done, follow sequences for presurgery and postsurgery massage.

BO JACKSON INJURY

Avascular necrosis, or **Bo Jackson injury**, was a little-known sports injury until super-athlete Bo Jackson developed it. It is usually caused by a blow to the knee or foot with the leg extended. During the injury, all of Bo Jackson's weight came down on one leg that was locked at the knee. The full impact of the blow was transmitted up to the hip. This caused the ball of the hip joint to hit the wall of the socket with great force, compromising the blood supply in the area and causing gradual deterioration of the surrounding cartilage and bone.

Diagnosis of avascular necrosis is confirmed by MRI scan. Treatment typically consists of rest, with no weight bearing on the hip, for 6 to 12 months. Surgical procedures may hasten recovery. If the condition does not improve, the bone will eventually be destroyed, and a hip replacement will be required.

Massage Strategies

Use the sequence for increasing arterial circulation and lymphatic drainage (see Unit Two).

BROKEN HIP

A **broken hip** causes severe pain and an inability to move the hip or walk. In the supine position, the leg with the broken hip may appear to be shortened, with the foot rolled to the outside while the other foot points up.

Usually, surgical repair is necessary. This injury is rare among young athletes, although a violent force can break even a young athlete's hip. A broken hip usually occurs in the elderly, who have more brittle bones. A broken hip is a major reason why older women, in particular, are in orthopedic rehabilitation.

Massage Strategies

Massage is targeted at compensation patterns. Use presurgery and postsurgery massage procedures (see Chapter 18).

Older clients require more healing time and less aggressive massage application.

BUTTOCK PULL

A pull on the gluteal muscles, or **buttock pull**, will cause pain in the area, particularly in response to any physical effort. Performing a straight leg raise will be painful.

Massage Strategies

Focus on compensation patterns. Use the sequence for muscle strains (see page 297). Firing patterns will need to be normalized during the subacute phase.

ILIOTIBIAL BAND SYNDROME

The iliotibial (IT) band provides lateral stability to the hip so that it cannot move too far to the outside. In some people, particularly runners, the band overdevelops, tightens, and saws across the hip bone. Each time the athlete flexes and bends the knee, the band rubs against bone, causing pain. Although this condition, known as the **iliotibial band syndrome**, often causes knee pain, it may also cause pain over the point of the hip (Figure 20-14).

A snapping pain in the hip is almost always due to the snapping back and forth of the IT band over the point of the hip.

Massage Strategies

The fascial sheath weaves into the hamstrings and quadriceps. Also, contraction of the gluteus maximus and tensor fasciae latae muscles increases tautness of the IT band. It may be necessary to reduce tension in the latissimus dorsi muscle because the fascial tension pattern runs from the left shoulder latissimus attachment to the lumbar dorsal fascia and then crosses to the right gluteus maximus into the right IT band, and vice versa.

- To increase pliability of the IT band, massage and stretch the lumbar fascia.
- Then massage and lengthen the gluteus maximus. Muscle energy methods are appropriate.
- Address the tensor fasciae latae muscle, especially trigger point activity. This muscle is too small to be adequately lengthened and stretched using joint movement. Direct manual stretch is more effective.
- Massage and lengthen the calf muscles on the affected side. Make sure the gastrocnemius and soleus are not adhered. Use mechanical force at the fibular head to soften the connective tissue in this area.
- Massage and lengthen the hamstrings and quadriceps. Finally, specifically address the IT band.
- Massage the IT band using a connective tissue approach across the direction of the fibers. Massage applied in the longitudinal direction to create tension force is not very effective and can irritate nerves under the IT band. Use bend, shear, and torsion forces instead, and continue until the band is warm and pliable. Do not overmassage or create any inflammation.

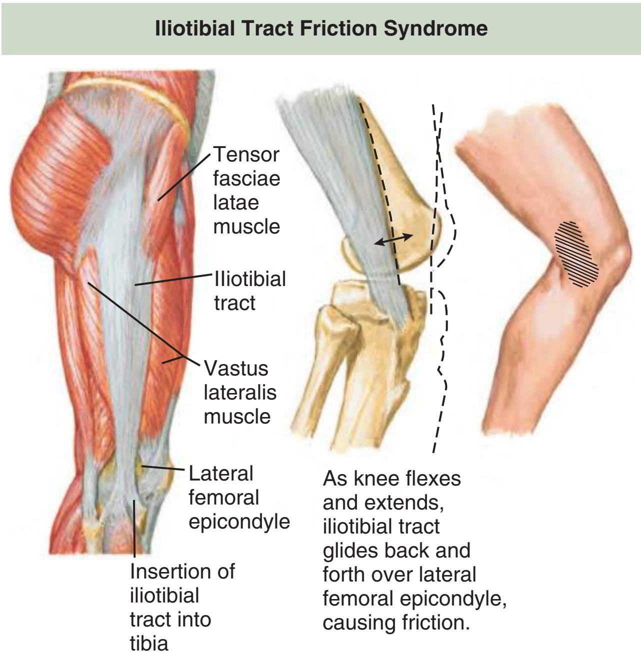


FIGURE 20-14 Iliotibial band syndrome. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

HIP POINTER

A **hip pointer** is a blow to the rim of the pelvis that causes bleeding where the muscles attach. Hockey and football players are susceptible to hip pointers. Treatment consists of ice application and rest until the pain subsides, which usually takes 1 to 2 weeks.

Massage Strategies

Use lymphatic drain methods (see Unit Two) in the injured area.

THE THIGH

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

The thigh muscles are often massive in athletes. These muscles are involved in all lower extremity activities and have dual functions of stability and mobility.

The thigh contains the major leg muscles. The hamstring muscles in the back of the thigh are the driving force in all running activity. Hamstring function helps determine how fast and how strong a runner is. The large quadriceps muscle in the front of the thigh straightens the knee. This is the main muscle used in jumping; it also provides the power to pedal a bicycle, to decelerate a movement burst, or to start and stop actively, and it stretches rapidly during the long running stride as the foot moves forward.

HAMSTRING PULL/TEAR/STRAIN

Probably the most common injury in the thigh area, and the most common muscle pull, is the **hamstring pull**. The hamstrings are implicated in conditions ranging from low back pain to jumper's knee. Many sport activities subject the hamstring muscles to great force, and consequently they are prone to strain. A weak core increases susceptibility to hamstring injury (Figure 20-15).

Although a hamstring sometimes will tear as a sprinter drives out of the starting block, a hamstring usually pulls from overstretching, not overcontracting, the muscle. It is not the first part of the stride, when the muscles contract (concentric function), but the second part of the stride, as the leg muscles stretch (eccentric function), that causes the muscle strain injury.

A hamstring tear may feel as if the muscle has "popped"; sharp pain and swelling are noted in the thigh, and maybe even bleeding, depending on the degree of muscle damage. Degrees of tears are one (mild), two (moderate), and three (severe). The back of the thigh may turn black and blue, usually right below the area of pain, because blood works its way down by gravity. Palpation of the back of the thigh may indicate a defect or a gap in the muscle where the fibers have torn if the strain is second degree or higher. The athlete will not be able to raise the leg straight off the ground more than 30 to 40 degrees without feeling severe pain.

Rehabilitation begins with the combination of protection, rest, ice, and compression during the acute phase. The amount of rest depends on the severity of the pull or tear; it typically lasts 2 to 3 days. This should be followed by limited activity until pain-free range of motion is achieved. Icing the muscle for 20 minutes 3 or 4 times a day will reduce the chance of aggravating the condition. Care for subacute cases includes a gentle stretching program. As long as the stretch is gentle and steady and does not separate the healing ends of the injured hamstrings, this is beneficial. In the early phase of healing, passive stretching of the muscle by movement in a

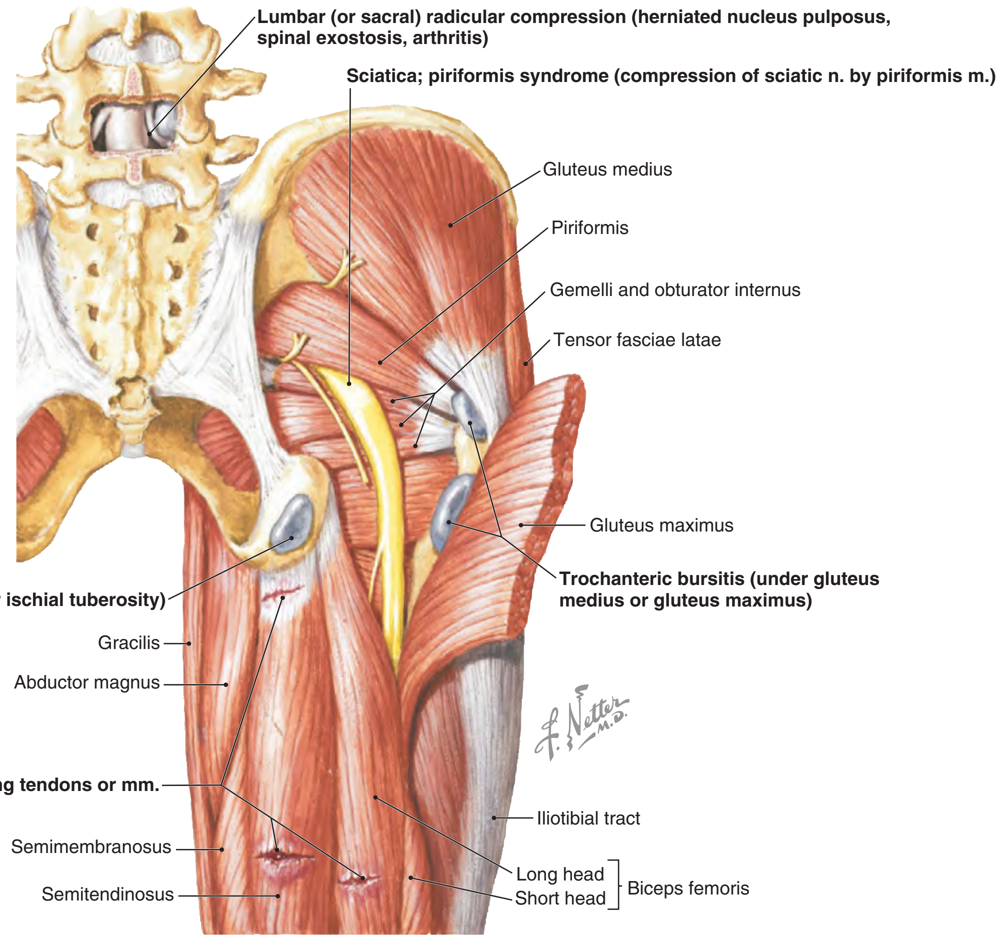


FIGURE 20-15 Hip, buttock, and back pain. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

bend-and-shear pattern above and below the tear is preferable to tension stretching by straightening the leg.

Symptoms of sciatica can mimic a hamstring pull, with pain in the back of the thigh. If thigh pain extends below the knee, if there is any numbness in the lower leg or foot, or if the pain in the back of the leg becomes worse with stretching, sciatica may be the culprit.

Massage Strategies

- Use sequence for muscle strains and passive stretching by bending the hamstring back and forth, above and below the injury.
- Do not use longitudinal tension to stretch during early healing (the first 5 to 7 days).
- Focus massage on the opposite biceps and the same-side triceps and quadriceps for reflex action.
- Reset firing patterns during the second and third stages of healing.

Because hamstring injuries are so common, specific applications are outlined next.

Prevention of Hamstring Strain and Treatment for Short Hamstrings

It is important to address the specific muscle group function to prevent or deal with an injury when it is minor (tweaked). The first protocol will describe these strategies. The second protocol will address the sequence for treating actual hamstring injury.

Understanding the importance of the kinetic chain influence is essential to effectively work with the hamstrings. This group of muscles functions as both postural (stabilizers) and phasic (movers) muscles, that is, they hold the body upright in gravity and also produce movement. The movement function affects both the hip as extensors and the knee as flexors. The quadriceps group is antagonist and often functions in co-contraction with the hamstrings to stabilize the knee if instability is present, or if the knee has been injured.

The hamstrings cross two of the three joints in the kinetic chain in the lower limb. This interactive function is most apparent in closed chain functions. The hamstrings are also reflexively functional with the biceps brachii muscles, especially during gait activity such as walking and running.

If the core is weak, a predictable chain of events can be described as an extended result of lower crossed syndrome or layer syndrome. The general pattern of dysfunction is as follows:

- Weak transverse abdominis and internal and external obliques
- Short psoas and rectus abdominis
- Inhibited gluteus maximus
- Short hamstrings
- Short gastrocnemius
- Synergistic dominance in trunk flexion, hip extension, and knee flexion firing patterns
- Short biceps brachii
- Short muscles (with increased tension) of the cervical area, especially the erector spinae in the cervical area, the upper trapezius and levator scapulae, and the thoracolumbar erector spinae
- Alteration of kinetic chain gait reflexes (usually with flexors not inhibiting when they should)

As you can see, hamstring dysfunction influences reflect a full-body pattern, and all of these areas must be addressed to support optimal hamstring function, including healing of injury. Specific treatment of the hamstrings is an extension of the strategies found in the general protocol. If hamstring shortening is present, begin working with the arms, trunk, and foot, and work toward the hamstrings. Direct work with the hamstrings should be the very last aspect of treatment.

- Use general massage coupled with focused inhibitory pressure on the belly or on attachments of all muscles that were assessed as short. While working on the short muscles (e.g., the biceps brachii), have the client flex and extend the knee.
- Correct all firing patterns.
- Correct all gait reflexes.
- Specifically address the hamstrings. An effective method is to have the therapist lower the leg to apply compression on the client's hamstrings while the client moves the knee. It is important that the compressive force is applied down and out to carry muscle tissue away from the bone. Alternatively, the forearm can be used.
- Knead the hamstring muscles, making sure that all muscles slide over each other. If any binding is noted, use shear force or compression with movement to separate the soft tissue layers.
- Next, use the position of the eyes and head to assist hamstring lengthening and stretching. Avoid direct application of contract-and-relax application because the hamstring muscle tends to cramp. To address the hip portion of the hamstrings, use a straight leg raise; stop at the first indication of bind, and have the client turn the eyes and head in large, slow circles. Slowly lengthen the muscle.

When an increase in range is no longer noted, apply slight overpressure to stretch the connective tissue. Hold for 30 to 60 seconds. Slowly return the leg to a neutral position. Repeat.

- To address the hamstring portion at the knee, flex the hip to 90 degrees; then extend the knee to the first indication of bind.
- Again, have the client turn the eyes and neck in slow circles, and add alternating flexion and extension of the client's elbows.
- Slowly increase the length until no further increase in range of motion is possible. Apply overpressure to stretch the area just past bind, and hold 30 to 60 seconds. Slowly return the leg to a neutral position, and repeat.

Do not apply this sequence within 24 hours before competition because the proprioceptive functions will be altered and the legs may feel rubbery.

Injury Treatment

If a strain in the hamstrings is noted, it is necessary to follow the massage recommendations for acute, subacute, and remodeling phases of healing. The sequence just described is used gently in the last two or three stages of the subacute healing phase and more aggressively as the third stage (remodeling) of healing progresses.

During the acute stage of healing, only approximate the tissue. Remember, a strain is a hole in the muscle tissue. It is important to keep the ends of the hole as close together as possible. The acute phase of healing can last up to 7 days and even longer in severe, second-degree strains and third-degree injuries.

- Do not reduce muscle guarding or stretch the hamstrings. Do not use friction or compression.
- Work with lymphatic drain and gentle gliding to push the healing ends of the muscle together (approximate tissue).
- Massage all reflex areas. In later stages of the acute phase, gentle shaking can be applied.

In the subacute phase, continue to follow the acute strategies, but increase intensity and begin to knead the injured area. As the final healing stage begins, treat as short hamstrings with kneading.

Continue to address scar tissue development for up to a year in hamstring strains. At every massage session, beginning in later stages of the subacute phase, the area should be kneaded more aggressively as healing progresses. Occasionally, adhesions are formed and shear forces (friction) are required. Areas of adhesion that have been frictioned need to be treated as if they are in the subacute phase for 3 days. Friction is applied every third day until the tissue normalizes.

It is absolutely necessary for the client to begin and maintain effective core training, flexibility, and proprioceptive retraining programs. Although therapeutic exercise is the job of the physical therapist/athletic trainer, it is important for the massage therapist to encourage compliance and to educate the client about effective exercise methods.

Unfortunately, athletes often begin to practice and compete before total healing has taken place. Typically, the athlete returns to training 2 to 3 weeks after the injury. This is usually right in the middle of the subacute healing phase, and muscle guarding still serves a useful purpose. Do not overstretch the area. Performance intensity will have to be reduced, and reinjury is common. Those who begin performance-based activity too soon are prone to fibrotic tissue formation.

If the client has an old hamstring injury, especially one with scarring and fibrosis, knead the area thoroughly with each massage, and use the short muscle prevention sequence. Improvement should be noted in 6 months if massage is applied at least once a week, and if the client follows core training and flexibility programs. Clients who are not diligent with self-help will need massage at least twice a week.

BRUISED QUADRICEPS

A blow to the quadriceps muscles can crush the muscle fibers against the femur bone, causing bleeding into the muscle. This muscle is highly vascularized and therefore is prone to heavy bleeding. Bleeding causes swelling and sometimes severe pain, as well as inability to fully flex the knee.

Immediate treatment of a **bruised quadriceps** consists of application of ice to the muscle for 20 to 30 minutes, with the knee flexed as far as it will go. Apply ice packs to the thigh and then wrap the leg with the knee fully flexed, using an elastic bandage to pull the leg back against the hamstring. This compresses the quadriceps muscle and puts enough pressure on the blood vessels to stop the bleeding.

The athlete should apply ice to the thigh several times a day as long as discomfort or swelling is present, and should stretch the muscle by flexing the knee as far as it will go.

Blood in the quadriceps can cause *myositis ossificans*. If this condition is not treated vigorously, bony deposits will prevent fibers in the muscle from extending fully, limiting range of motion. This is a difficult condition to treat and can disable an athlete for up to a year.

Massage Strategies

- Apply repeated lymph drain massage to the entire leg.
- Address reflex patterns in opposite triceps and same-side biceps and hamstrings for pain control.
- During the subacute healing phase, use torsion forces to knead the area to prevent fibrosis.

QUADRICEPS PULL OR TEAR/STRAIN

A **quadriceps pull or tear** is usually a running or jumping injury. It is less common than a hamstring strain, but the treatment is the same. The muscle is iced, rested for a few days, and then stretched.

Massage Strategies

Use the massage sequences for muscle strains (page 297) and lymphatic drain (see Unit Two). Address the opposite triceps and the same-side biceps and hamstring for reflex stimulation pain control.

FEMUR FRACTURE

A **femur fracture** in sports is rare because the femur is so strong. Also, much of the rotary force of the leg is absorbed by the knee and is not transferred to the thigh bone.

This injury causes sharp pain in the leg and usually requires surgery to fixate the bone.

Massage Strategies

Use the procedures for fractures (see page 310).

THE KNEE

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

Note: Comprehensive massage treatment for the knee is found on page 384.

The knee is a complex joint that not only bends and straightens but also twists and rotates. It depends heavily on the soft tissues that surround it–muscles, tendons, and ligaments–for stability. The knee joint is held together by four very strong ligaments. The medial and lateral collateral ligaments provide side-to-side stability. They are found on the inside and outside of the knee between the femur and the tibia. The anterior and posterior cruciate ligaments provide front-to-back stability. They are found inside the knee. The anterior cruciate runs from the front of the tibia to the back of the femur; the posterior cruciate runs from the back of the tibia to the front of the femur. They cross in the middle.

Because the knee is a weight-bearing joint that is subjected to many different types of motion, it is vulnerable to tearing of its cushioning cartilage–the medial meniscus and the lateral meniscus–and of supporting ligaments on both sides and inside the knee.

Because of its structure, the knee is extremely susceptible to blows from the side. It also can be severely damaged by rotating, twisting forces. It is the most poorly designed of all the joints in the body to withstand athletic activity. The knee is the most commonly injured joint in the body, accounting for about one-fourth of all sports injuries. A knee injury is the injury most likely to end an athlete's career. Nearly 1 million knee surgeries are performed each year (Figure 20-16).

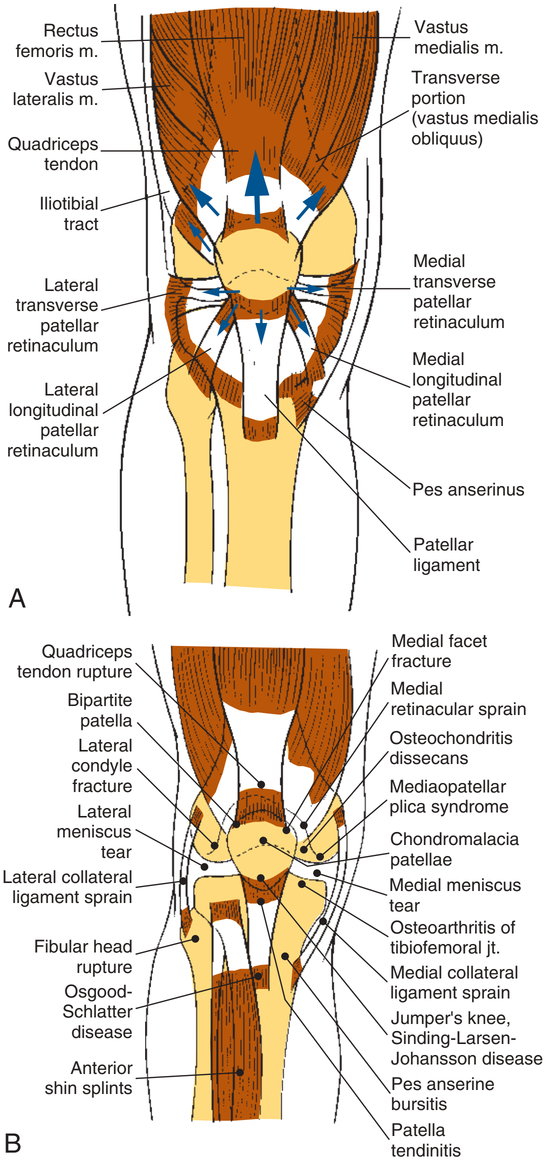


FIGURE 20-16 Knee injury. **A,** Location of typical knee injury. **B,** Structures influencing movement of the knee—specifically, the patella. (From Saidoff DC, McDonough A: *Critical pathways in therapeutic intervention—extremities and spine,* St Louis, 2002, Mosby.)

PATELLOFEMORAL SYNDROME

Patellofemoral syndrome describes a variety of injuries affecting the patella and its groove on the femur. Patellofemoral syndrome is the most common knee injury in athletes and other physically active people. Typically, women–especially adolescent females–experience more patellofemoral problems than men. Runner's knee, biker's knee, patellofemoral pain syndrome, patellofemoral stress syndrome, patellalgia, and chondromalacia patellae are just a few of the common terms used to identify this syndrome.

The precise cause of pain in this syndrome is not known. The cartilage that lines the undersurface of the kneecap has no nerve endings and is not the likely cause of pain. Some experts feel that pain is a result of wear on the bone underlying the cartilage, or possibly breakdown products of injured cartilage.

Injury is usually a result of repetitive running and jumping activities rather than a single traumatic event. Symptoms usually develop gradually, with initial pain consisting of dull knee stiffness or ache present early in activity. During warm-up, stiffness/pain may lessen or disappear and then return hours after a workout. As the injury progresses, pain may be present throughout activity. Symptoms may worsen when descending steps or hills. Squatting and kneeling may also aggravate symptoms. *Crepitus* (a "crunching" sound under the patella with movement of the knee) can occur. Sitting for an extended time and then resuming activity may result in pain and stiffness until the muscles "loosen up." In advanced cases, the knee may "give way" when the person is walking or running.

The patella moves up and down in its groove when the knee is extended or flexed. If repetitive forces acting on the patella during this up-and-down motion are unbalanced, as during running and jumping, or if the patella moves side-to-side too much, painful symptoms may develop, caused by misalignment of the patella in its groove. The patella normally goes up and down (tracks) in the groove as the knee flexes and straightens. If the patella is misaligned, it will pull off to one side and rub on the side of the groove. This causes both the cartilage on the side of the groove and the cartilage on the back of the patella to wear out. Occasionally, fluid builds up, causing swelling in the knee (Figure 20-17).

As a result of altered patellar tracking, pain is noted in the back of the patella or in the back of the knee after running, going up and down stairs, and running hills. It will become painful to sit still for long periods with the knee bent. This is called the "theater sign," because people cannot sit through an entire movie or play without having to get up and move around. One causal factor is an inward roll of the foot and ankle that causes the tibia to internally rotate, which turns the knee to the inside as well. The kneecap ends up sliding at an angle instead of straight up and down.

Muscle activation sequences are disrupted and are both the cause and the result of the condition. Inappropriate firing patterns of the quadriceps muscle (usually firing of the vastus lateralis initially and inhibition of the vastus medialis), especially the oblique pattern of the vastus medialis obliquus, are part of the problem. Trigger points develop that can refer pain into the knee.

Diagnosis depends on a history of symptoms and pain elicited during physical examination. No single test confirms patellofemoral syndrome. In fact, some athletes with this injury may have normal examination results. X-rays and other medical imaging techniques of the patellar joint may be helpful.

About 80% of all patellofemoral problems can be treated without surgery. Treatment is directed at correcting muscle imbalance, including weakness or alignment problems of the lower back, pelvis, hip, and lower extremity. Almost all studies of patellofemoral syndrome indicate weakness in the quadriceps, specifically the vastus medialis. Appropriate flexibility and strength exercises are required, and strengthening of hip and abdominal muscles corrects abnormal alignment of the low back, hip, and pelvis, relieving patellofemoral strain. Persons who pronate excessively (flat feet) are believed to be at increased risk for patellofemoral injury. Therefore, treatment may include orthotics to correct overpronation.

Braces and taping are commonly used to relieve symptoms. They are effective in reducing pain severity but do not cure the problem. Ice therapy after exercise may relieve symptoms. NSAIDs can reduce pain.

Massage Strategies

The vastus lateralis usually is dominant and needs to be inhibited with compressive gliding and kneading. Make sure to address all firing patterns and gait reflexes. Use bend, shear, and torsion forces to maintain pliability in connective tissue structures surrounding the patella.

JUMPER'S KNEE

Inflammation of the tendons that hook into the upper and lower ends of the patella is called **jumper's knee**. The

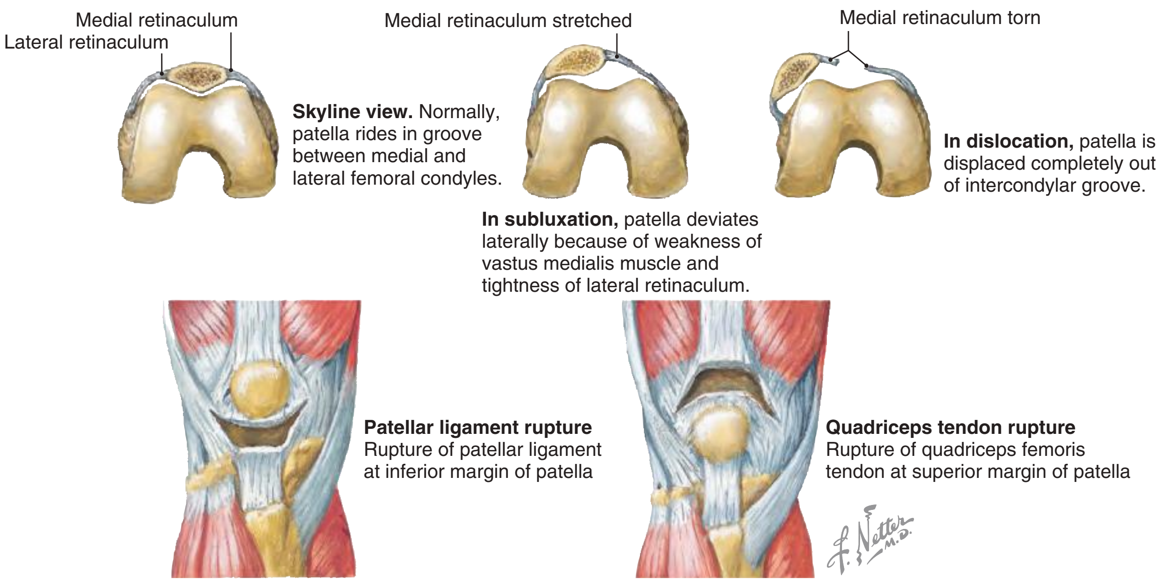


FIGURE 20-17 Patellar injuries. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

quadriceps and patellar tendons help to straighten the leg. When these tendons are overstressed, they become inflamed. The sudden, violent vertical leap that occurs during jumping straightens out the knee and may cause tiny tears that irritate the tendons. It usually hurts more going up than coming down because greater force is exerted to get up into the air. Any jumping exercises can aggravate the condition.

Treatment consists of rest and ice application. NSAIDs may reduce the pain.

Massage Strategies

Massage strategies for tendonitis are appropriate (see page 306).

SPRAINED KNEE

A **sprained knee** can result from twisting during a fall, stepping into a hole while running, or being hit from the side while playing sports.

A knee sprain, by definition, is an injury to a knee ligament. The sprain may vary in severity from a slight stretch to a complete tear of the ligament. A mild, or grade 1, sprain stretches the ligament and causes pain and swelling. A moderate, or grade 2, sprain partially tears the ligament and is much more disabling. A severe, or grade 3, sprain is a complete rupture that often needs surgical repair (Figure 20-18). The most commonly sprained knee ligament is the medial collateral ligament (MCL). This ligament can be injured by a blow to the outside of the knee, particularly when the foot is planted in the ground when impact occurs. The blow causes the knee to move toward the inside of the body and stretches the ligament. Point tenderness and pain occur on the inside of the knee, and the knee will feel like it may buckle to the inside.

A sprain of the ligament on the outside of the knee, the lateral collateral ligament, is caused by a blow to the inside of the knee, which forces the knee to the outside. This is much less common than an MCL sprain because it is hard to get hit on the inside of the knee.

If an athlete receives a blow to the knee and the pain is on the same side of the knee that was hit, this is probably a bruise, and the pain will go away. Pain on the opposite side of the impact is considered a serious injury that needs careful treatment.

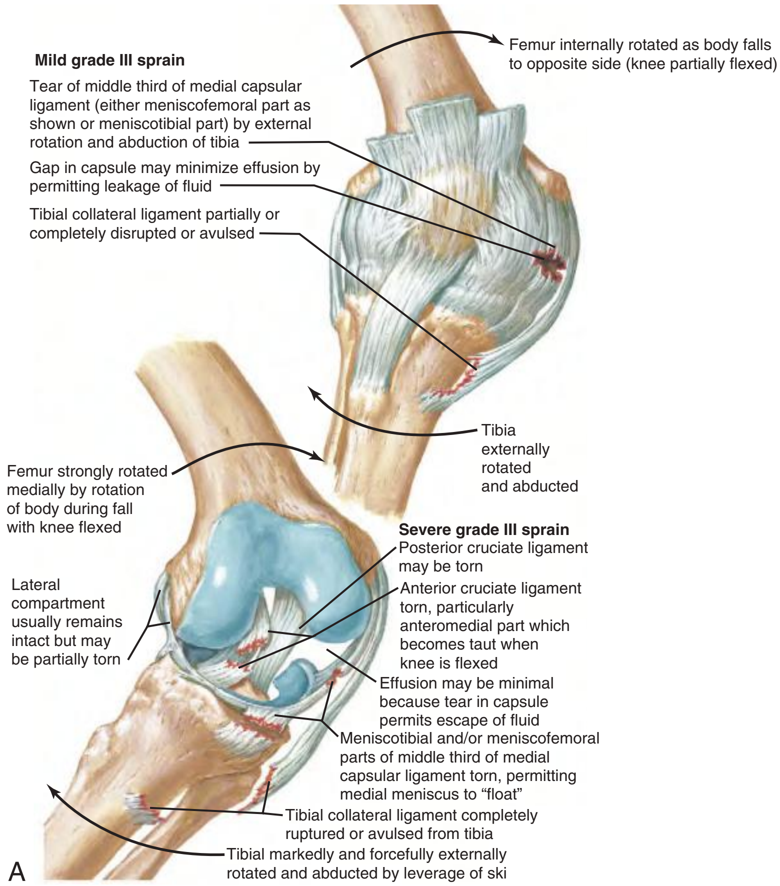


FIGURE 20-18 Injury of the knee. **A,** Mechanisms of knee sprains.

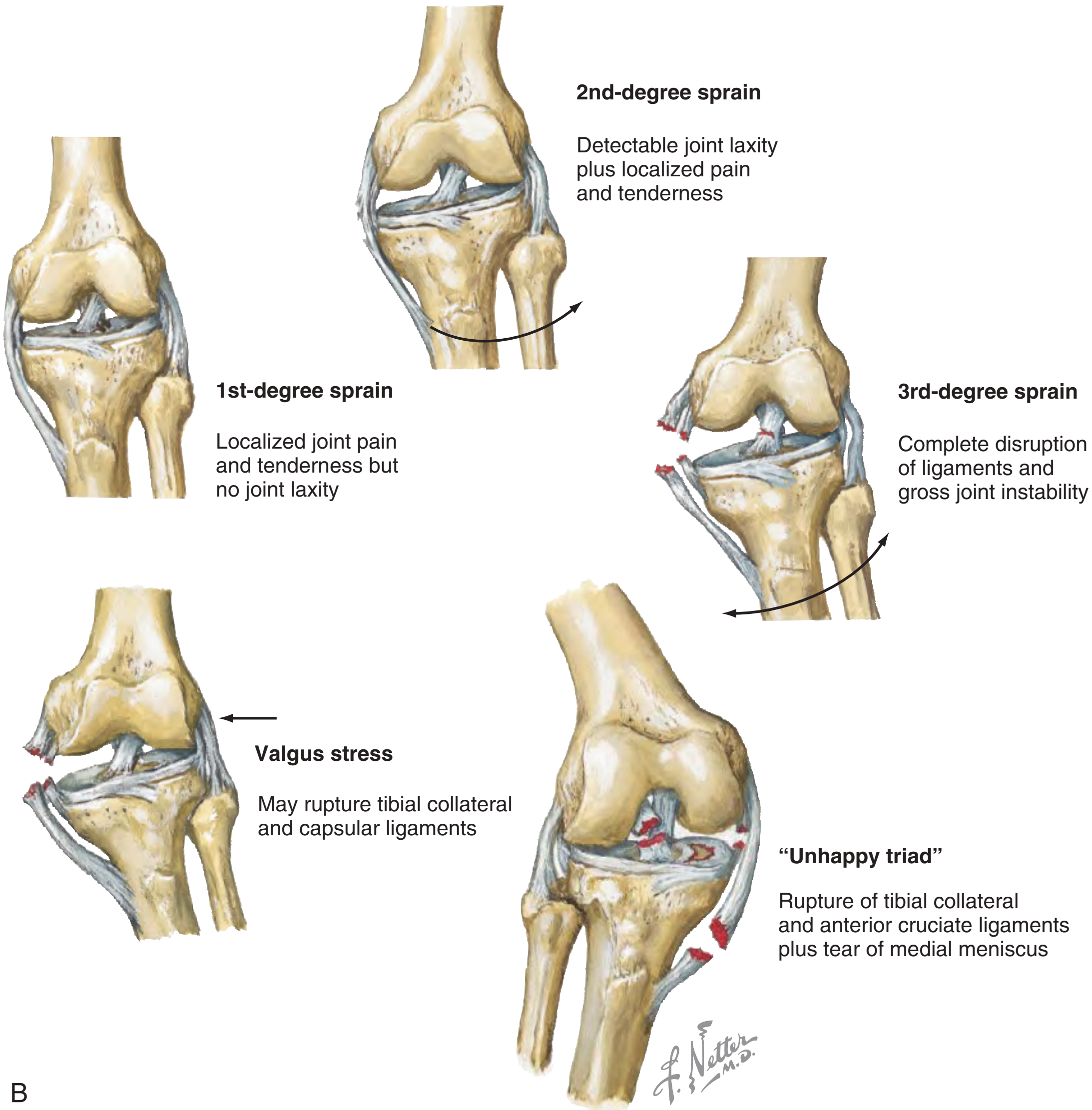


FIGURE 20-18, cont'd **B,** Sprains of the knee ligaments. *(Netter illustrations from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

Immediate treatment for a sprain is standard PRICE therapy. Rest the knee while it aches, and ice it intermittently several times a day. Wrap it in an elastic bandage in between icings, and keep it elevated as much as possible.

The purpose of rehabilitation exercises is to strengthen the quadriceps muscles in the front of the thigh (leg extensions) and the hamstring muscles in the back of the thigh (leg curls). These muscles, particularly the quadriceps, begin to lose strength within 12 hours after a knee injury. These muscles control the knee and must be restrengthened.

Massage Strategies

Use the procedure for sprains (page 299) and the specific protocol for the knee (page 384). Massage supports appropriate firing patterns, making rehabilitation exercises more effective.

THE TERRIBLE TRIAD OF O'DONOHUE

A very severe injury to the knee, and one common among athletes, is called the **terrible triad of O'Donohue**, named after a long-time team physician at the University of Oklahoma and one of the deans of sports medicine. He was the first to describe this injury, which consists of an MCL sprain or tear, an anterior cruciate ligament (ACL) tear, and a medial cartilage tear, all due to a single blow to the knee.

This devastating injury requires complete surgical repair. It is impossible to rehabilitate all of these structures and have a functioning knee again without surgery.

Massage Strategies

Use presurgery and postsurgery protocols (see Chapter 18). Normalize firing and compensation patterns during the mid-subacute phase of healing, and introduce strategies for the knee (see page 384).

ANTERIOR AND POSTERIOR CRUCIATE LIGAMENT INJURY

Cruciate ligament injury of the knee is a sprain. The anterior cruciate ligament (ACL) is most often stretched, torn, or both, by a sudden twisting motion when the feet are planted one way and the knees are turned another way. The posterior cruciate ligament (PCL) is most often injured by a direct impact, as occurs in an automobile accident or a football tackle.

Injury to a cruciate ligament may not cause pain. Rather, the person may hear a popping sound, and the leg may buckle when he or she tries to stand on it. The anterior and posterior drawer test indicates whether the knee stays in proper position when pressure is applied in different directions. MRI is very accurate in detecting a complete tear, but arthroscopy may be the only reliable means of detecting a partial tear.

Treatment for an incomplete tear includes an exercise program to strengthen surrounding muscles and possibly a protective knee brace for stability.

The most severe ruptures are usually caused when a heavy athlete, such as a football lineman, is running and then plants his foot and turns 90 degrees to go upfield. This twisting can cause a complete ACL rupture. If the ACL ruptures, there is usually a loud pop along with sudden pain and instability in the knee. The knee will swell up rapidly because the ACL bleeds heavily when injured. Medical treatment is necessary.

MRI scan may help determine whether the ligament is stretched or totally torn. If it is torn, it will have to be repaired surgically. Modern methods of repair, such as arthroscopic surgery, and new approaches to rehabilitation, such as beginning exercises immediately after surgery, support recovery, which may take as long as 6 to 7 months. Knee braces are available that will allow return to activity.

The surgeon may reconstruct the torn ligament by using a graft of healthy ligament from the client or from a cadaver. Although repair using synthetic ligaments has been tried experimentally, the procedure has not yielded results as good as those obtained when human tissue is used.

One of the most important elements in successful recovery after cruciate ligament surgery is adhering to an exercise and rehabilitation program for 4 to 6 months. Such a program may involve the use of special exercise equipment at a rehabilitation or sports center.

Massage Strategies

Use specific strategies for the knee (see page 384).

DISLOCATED KNEE

A **dislocated knee** is an extremely severe traumatic injury to the knee; it is one of the few true orthopedic emergencies. Total dislocation of the knee, in which the whole knee is torn out of the socket, is caused by a severe blow. The lower leg moves away from the upper bone, and only the skin is holding the lower leg together. This can cut off the blood supply to the lower leg and necessitate amputation.

Massage Strategies

This is a medical emergency. Once this has been addressed, follow strategies for dislocation (see page 307).

DISLOCATED PATELLA

The back of the patella is shaped like a wedge and rides in a V-shaped groove in the front of the lower end of the femur between the two condyles. If the patella is hit at an angle, it can be knocked out of this groove. The patella almost always dislocates to the outside because the outer lip of the groove is much shallower than the inner lip. It is interesting to note that the patellar groove is much shallower in females than in males, so dislocation is a more common and recurrent problem in women.

A **dislocated patella** causes pain, and the knee will appear deformed because the patella will sit way out to the side. Usually it can be popped back into place by a physician without too much difficulty. It may even pop back in by itself on the way to the doctor's office or emergency room. Even if it pops back in, however, it must be x-rayed to make sure that a piece of bone has not been knocked off the undersurface. Occasionally, the patella is locked out of place so severely that surgery is needed.

Treatment requires immobilization of the patella in a splint for about 3 weeks to allow the tissues on either side of the bone to heal. These tissues hold the patella in place, and if they remain torn, the patella will be prone to recurring dislocation.

After a period of rest, the athlete must strengthen the quadriceps with rehabilitative exercises. These exercises will increase the tone of the muscles pulling on the tendon underneath the patella. This will hold the patella in the groove so that it will not be likely to pop out again.

Massage Strategies

Use specific strategies for knees shown on page 384 and for dislocations provided on page 307.

BROKEN PATELLA

The patella may fracture from a head-on blow, causing pain and swelling. X-rays confirm the fracture.

A **broken patella** needs to be immobilized and may even need surgical repair, depending on the direction of the fracture line. If the fracture line is vertical, immobilization should be enough. If the fracture line is horizontal, the two pieces will be pulled apart by the quadriceps and will need to be wired together until they unite.

Massage Strategies

Use presurgery and postsurgery strategies, if needed, and normalize firing patterns in the subacute healing phase.

LOOSE BODY IN THE KNEE

If an athlete has sudden episodes of knee pain and knee locking, a loose body may be floating inside the joint. The loose body may be a piece of cartilage that has torn off or a piece of bone that has chipped off the tibia, femur, or patella. The bone may have been previously injured. It gradually dies, and a piece can fall off the bone and float inside the knee.

Onset of these symptoms may not occur until months to years after a traumatic injury such as a blow to the knee. Just as suddenly as the pain appears, it disappears, and full range of motion returns.

These on-again, off-again symptoms are due to a loose body in the knee getting caught between the upper and lower bones. When the loose body floats back up into the hollow space in the knee, out of the way, the pain is relieved.

The loose piece may feel like a pea that suddenly floats into the knee under the pressure of the person's weight and then suddenly disappears.

Arthroscopic surgery is necessary to remove the loose body.

Massage Strategies

Use presurgery and postsurgery strategies (see Chapter 18), and normalize firing patterns. Also, see knee strategies on page 387.

OSGOOD-SCHLATTER DISEASE

Seen only in adolescents, **Osgood-Schlatter disease** is not really a disease but a syndrome. It is an overuse syndrome related to the growth process.

The lower end of the patellar tendon attaches to a knob on the surface of the tibia, called the *tibial tuberosity*. As a child grows, this knob becomes larger to increase the surface to which the tendon attaches. Constant yanking on this tendon from running and jumping can cause some irritation in the knee. Every time a child with this syndrome straightens the leg, as when going up stairs or riding a bicycle, the pain becomes worse. Also, growth of the knob is stimulated by the constant irritation, and the knob may protrude as a lump on the shinbone, which will be tender to the touch.

This is a self-limiting syndrome. It always disappears by late adolescence, when the knob stops growing. By then, the tendon is yanking on a solid piece of bone, and the pain goes away, although the protuberant knob will remain.

A few weeks of rest is required only if there is severe pain. Casting and other aggressive treatment are usually unnecessary.

Massage Strategies

Use general massage for pain control. Do not aggressively massage the area.

ILIOTIBIAL BAND SYNDROME

Pain along the outer side of the knee is often due to the iliotibial (IT) band syndrome, particularly among runners. Pain usually begins 10 to 20 minutes into the run and gets progressively worse.

The cause of the pain is an overly tight IT band. The IT band starts at the rim of the pelvis, crosses the point of the hip (greater trochanter of the femur), comes down the thigh across the outer side of the knee, and attaches below the knee. This attachment includes the fibular head.

Sometimes the band overdevelops and tightens with exercise; it may rub hard enough to irritate the knee, causing pain. It may cause similar pain over the point of the hip.

Massage Strategies

Use massage to reduce motor tone in all muscles that influence the IT band (i.e., gluteus maximus, tensor fasciae latae, lateral hamstrings and quadriceps, and opposite side of latissimus dorsi). The IT band is connective tissue that responds to shear, bend, and torsion forces to increase pliability. Tension or compression forces (gliding or direct pressure) are not effective. The side-lying position is best for treating the IT band.

OSTEOARTHRITIS/ARTHROSIS

Osteoarthritis/arthrosis of the knee is wear-and-tear degeneration of the knee, otherwise known as *degenerative joint disease*. Spurs of bone form along the edges of the knee joint and wear down the cartilage. This can be aggravated by an injury to the knee. Bow-legged people may develop severe osteoarthritis of the knee because bowing causes increased pressure of the inner part of the tibia against the medial femoral condyle. This wears out the inner cartilage and causes bone to grate on bone, leading to arthritis.

Bone spurs or pieces of worn-down cartilage can break off and become a loose body. This causes pain during activity and swelling of the joint. Antiinflammatory medications can ease the pain. If an x-ray reveals a large amount of debris in the knee, arthroscopic surgery can clean out the joint, which will provide relief for a few years.

If the pain becomes so severe that it interferes with activity, the knee may have to be replaced with an artificial joint. Knee replacement is a common reason for people to be in physical rehabilitation programs.

Massage Strategies

Use the protocol for arthritis (see page 306). If knee replacement is necessary, apply presurgery and postsurgery strategies (see Chapter 18). Pain control should be the focus of massage. Also see the knee protocol on page 387.

PREPATELLAR BURSITIS

A large sac of fluid may form in the front of the patella **(prepatellar bursitis)** as the result of a sudden blow or other trauma to the knee. This condition is common among roofers and carpet layers, who work on their knees; it was called "housemaid's knee"—a reference to maids scrubbing floors on their knees.

Trauma to a bursal sac in front of the patella irritates the patella and causes fluid to form in the sac. Treatment is drainage of the bursal sac followed by injection of cortisone into the sac if it continues to fill with fluid. If the condition persists, the sac is removed surgically.

Massage Strategies

Lymphatic drain methods may be helpful.

TORN CARTILAGE

A blow on the outer side of the knee causes the inner side to stretch. This can cause one of two things to happen. The MCL, which is attached to the cartilage, can tear the cartilage as it stretches, or, when the stretching force is removed, the inner side of the knee can close again with some force, driving the condyle back into the cartilage. The grinding action on the knee as it rotates can also damage cartilage. The same thing happens when the femoral condyles rotate on the tibia with body weight compressing it.

Pain from the **torn cartilage (in the knee)** may be on the inside or the outside of the knee, depending on which cartilage has torn. A clicking sound may be heard inside the knee during movement as the bone rides over the torn part of the cartilage. A common symptom is the inability to make a sharp turn even when walking.

Most cartilage tears do not heal by themselves. This is possible ONLY if the tear is at the outer edge of the cartilage, or if it is small. Cartilage has a poor blood supply except at the outer rim, so about 90% of cartilage tears have no ability to heal, and the torn piece needs to be surgically removed.

Treatment includes participation in a rehabilitation program to restrengthen the muscles around the knee.

Massage Strategies

Focus on procedures for pain relief, as well as presurgery and postsurgery strategies, if necessary. Also see the knee protocol on this page.

BAKER'S CYST (POPLITEAL CYST)

A **baker's cyst**, or **popliteal cyst**, is a collection of fluid in the back of the knee joint. It is usually a symptom of another problem, or it may be an incidental finding with no significance.

Most often in adults, a baker's cyst is found in conditions with chronic swelling or fluid accumulation in the knee joint. These conditions include knee arthritis, meniscus injuries, and ligament injuries. Treatment of a baker's cyst that is the result of a problem within the knee consists of treating the underlying problem.

If conservative treatments fail to correct the cyst, an operation to remove the cyst can be performed.

Massage Strategies

If the cyst is removed surgically, presurgery and postsurgery strategies are appropriate. Do not massage on the cyst.

MASSAGE FOR KNEE INJURY AND PAIN (FIGURE 20-19)

Knee injuries that involve strains and sprains are addressed by the strategies described for these types of injuries (see page 299). Knee surgeries are mostly arthroscopic procedures, and presurgery and postsurgery massage strategies are appropriate in these cases. These are relatively straightforward applications for easily diagnosed knee conditions.

More complex is the knee aching experienced by many athletes and those in physical rehabilitation. The beginning stages of patellofemoral syndrome fall into this category. The general protocol described in Unit Two supports knee function. Those methods are expanded here in relationship to knee pain, injury, and function.

Muscle activation sequences (firing patterns) of muscles around the knee joint need to be optimal for pain-free joint function. These firing patterns are often disrupted, and the problem usually begins with the core muscles, as described in relation to low back pain and hamstring injury. The knee is just as common a location for pain as the low back for two reasons.

First, the knee is the middle joint in a closed kinetic chain that involves hip, knee, and ankle. If the mobility or stability of the hip or ankle is compromised, the knee has to adapt to the changes in force distribution. So if the hip or the ankle is hypomobile, the knee becomes more mobile to continue to allow movement—as a result, stability is decreased and injury potential is increased. This situation occurs during the injury process as traumatic forces are transmitted through the hip, knee, and ankle complex; if hypomobility exists in the hip or ankle, the knee will be the weak link in the chain and will incur the greatest force and therefore the most trauma.

Conversely, if the hip or the ankle is hypermobile, the stability of the structure and muscles of the knee increases, making the knee more vulnerable to injury because flexibility and pliability in the tissues are insufficient to absorb traumatic forces.

Second, as previously mentioned, core instability may affect knee function. Here is how the progressive degeneration of function spreads: the inner abdominal muscles responsible for core stability are weak and inhibited. As a result of the adaptive process, the next functional group of synergists becomes dominant—that is, the psoas and the rectus abdominis. If these muscles are tight and short, the gluteus maximus is inhibited and cannot function as a hip extensor, which is especially important in running. Also, the gluteus maximus functions to support knee stability by keeping appropriate tautness on the IT band. When the gluteus maximus is inhibited, weak, and long, the abductors and deep lateral hip rotators become short. The orientation of the femur is changed, usually to external rotation, which will change the fit of the patella and the tibia at the knee. Rubbing of the bones within the knee capsule begins, creating problems with patellar tracking. The hamstrings and the vastus lateralis become dominant, and the vastus medialis is inhibited and weak.

Also, the erector spinae in the lumbar area becomes overactive to assist with hip extension. Firing patterns are disrupted, with the hamstring and the erector spinae firing first during hip extension, and the gastrocnemius firing

FIGURE 20-19 Massage for the knee.

1. Identify the target area (medial collateral ligament [MCL]). Determine the stage of healing—acute, subacute, remodeling.
2. Assess and address knee extension firing patterns.
3. Assess for swelling (effusion).
4. Lymphatic drain as needed.
5. If injury is acute, approximate (push together) injured tissues.
6. If injury is subacute, begin direct stretching of tissues to support mobile scar formation.

FIGURE 20-19, cont'd
7. If injury is in the remodeling stage or is an old injury that has become fibrotic and adhered, apply friction.
8. Use direct tissue-stretching methods on medial and lateral sides of the knee.
9. Assess and mobilize the patella.
10. Massage soft tissue attachments of the posterior knee. This example shows supine position, but prone and side-lying are very effective for this aspect of massage.

first in knee flexion. The vastus lateralis fires first in extension and pulls the patella laterally. The vastus medialis is unable to balance the lateral pull, further increasing patellar tracking problems. Pain can occur behind the knee at the attachments of the gastrocnemius on the femur and the hamstring on the tibia. The IT band is too taut, and the normal position of the fibula is altered, eventually affecting the ankle. The tibia now becomes twisted into external rotation, and internal rubbing within the knee capsule is increased.

Because the gastrocnemius is functioning primarily at the knee, the soleus is responsible for ankle plantar flexion. Rubbing between the two muscles can cause the fascia to adhere, making them function as one muscle pulling in different directions. The Achilles tendon becomes short and painful, which can lead to irritation of the plantar fascia. Both of these conditions reduce ankle mobility, which needs to have a minimum of 10 degrees of dorsiflexion (15 to 20 degrees is much better) to allow proper knee function. The ankle becomes hypomobile, and the knee is further strained. The rectus femoris of the quadriceps group tries to balance the increasing lateral pull on the patella. This muscle also functions as a hip flexor. Friction against the underlying fascia over the vastus intermedialis results in adherence of these two muscles as they stick to each other and shorten. The adductors and the sartorius attempt to support knee function but are ineffective, and the pes anserinus attachment of the sartorius, gracilis, and semitendinosus becomes irritated and inflamed. The sartorius can actually shift position, with the distal end moving anteriorly over the medial condyle on the tibia. Typically, this occurs if the femur becomes externally rotated and the tibia is internally rotated. Pain occurs just below the knee on the medial side.

To complicate matters even more, attempts to stretch inhibited muscles while the synergists are dominant do not work because the overactive muscles are generating reciprocal inhibition. This is where massage sequencing becomes important.

Comprehensive treatment must start at the beginning of the progression: stabilize the core, and reset the firing patterns. If the condition is chronic, the connective tissue will be dense, and adherence between adjacent muscle layers will be common. Massage needs to normalize the connective tissue, ensuring that all muscles are able to slide freely over each other. The short and tight muscles—usually the psoas, quadratus lumborum, rectus abdominis, hamstrings, gastrocnemius, vastus lateralis, abductors, and deep lateral hip rotators—need to be inhibited and lengthened. Then strengthening exercises for the transversus abdominis, abdominal obliques, gluteus maximus, and vastus medialis can begin. Firing patterns can be reset and reinforced; this may be required at each massage session in the series of treatments until the neuromuscular relationship is reeducated. Once the soft tissue will allow movement, the trainer, physical therapist, physician, or chiropractor can begin to reorient the bones. The pelvis is usually rotated: the symphysis pubis is offset, the femur and tibia are excessively rotated, and the fibula is fixed in place. Massage can support this intervention through the methods described for joint play, as well as by indirect functional methods for the pelvis and other joints.

Factors other than core instability, including any ankle sprain, can contribute to knee problems; a high ankle sprain is more serious. Ankles that are hypomobile for any reason will increase the tendency for knee pain. This occurs because the fibula changes position, and this changes force distribution through the knee. Also, compensation for ankle sprain will change firing patterns at the knee. Low back pain can strain the knees; conversely, knee pain can strain the back.

- Note that relationships of functional change in the ankles or knees flow in all directions—up, down, across, and diagonally through the body—influencing adaptive changes remote from the original change.
- Inappropriate strength programs that focus too much on the biceps and triceps will stimulate gait reflexes to reflexively shorten the hamstrings and quadriceps. Usually the biceps are overworked.
- Squats and lunges strain the knee when they are performed incorrectly or are overdone.
- Changing shoes changes how the foot is positioned, and the force translates to the knee if the ankle is hypomobile or hypermobile.

Specific Massage Applications for the Knee

Massage needs to address the soft tissues, so that therapeutic exercise and joint mobilization are effective. Working with the knee is truly a full-body massage application. To support knee function and rehabilitation, follow these strategies as appropriate for acute, subacute, and remodeling stages of healing. Apply lymphatic drain methods because any swelling in the knee can inhibit muscle and joint function.

- Make sure that all muscle layers that cross joints of the lower extremity are sliding freely over the underlying tissue. Use kneading and compression plus movement to introduce bend, shear, and torsion forces to the muscle layers. Specifically address the IT band by first reducing motor tone in the muscles that attach into the band (i.e., the gluteus maximus, tensor fasciae latae, and others). Then knead across the IT band to increase pliability of the tissue.
- Assess and correct all muscle firing patterns. Overactive synergists respond to compression and to muscle energy methods.
- Shaking is an underused massage method, and these muscles respond well to aggressive but pain-free shaking. This is best accomplished by placing the knee in a slightly flexed position, while instructing the client to be passive. Then manually shake the hamstrings. Shake the gastrocnemius both manually and by moving the lower leg.
- Make sure that the ankle is mobile to at least 10 degrees of dorsiflexion. Help the foot joints to function freely by massaging all the fasciae and muscles of the foot, using joint movement for each joint in the foot.
- Massage the attachments of the hamstrings and the gastrocnemius at the back of the knee, being cautious to apply excessive pressure onto the popliteal space. If any internal or external rotation of the tibia exists, the popliteus muscle will be affected.
- Trigger points in the quadriceps can refer pain under the kneecap. Assess and treat only those that increase symptoms.
- Make sure when applying massage that the elbow flexors and extensors are massaged in conjunction with the knee flexors and extensors.

THE LEG

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

Practically all of the pains that occur on the inner side of the tibia are due to improper foot strike. Most are classified as overuse injuries. Excessive pronation can lead to three leg injuries: shin splints, tibial stress syndrome, and tibial stress fracture. Pronation is the inward roll of the foot as it hits the ground. Aside from congenital abnormalities such as a clubbed foot, two foot problems cause excessive pronation. A person with a pronating foot has an overly mobile foot and ankle and loose ligaments, and the foot rolls to the inside. The other problem is Morton's foot, in which the second toe is longer than the big toe. This causes the foot to roll to the inside when the toes push off for the next step. (See the section, "The Foot," on page 394.)

SHIN SPLINTS

Shin splints is a catchall term for any pain on the inner side of the shin. A true shin splint injury is rare. What people call shin splints are actually pains in the muscles near the shin bone. They can be caused by running or jumping on hard surfaces and by overuse.

Pain is felt on the inner side of the middle third of the shin bone, which is where the muscle responsible for raising the arch of the foot is attached. When the arch collapses with each foot strike, it pulls on the tendon that comes from this muscle.

In the pronating foot, the arch stays down because the foot is rolled to the inside. Consequently, the muscle starts to fire while there is still weight on the foot, and it is unable to bring the arch up. Because of these multiple firings during each foot strike and the pull against great weight, some of the fibers of the muscle are torn loose from the shin bone. This causes small areas of bleeding around the lining of the bone, as well as pain.

The key element of treatment is an arch support to prevent excessive pronation and pull on the tendon. This usually solves the problem almost immediately. Many athletes do well with a simple, commercially available arch support. Those who have a more serious problem may need an orthotic device custom-made by a sports podiatrist.

Massage Strategies

Caution: Make sure that the condition is not compartment syndrome. Apply massage as described for muscle strains on page 299.

TIBIAL STRESS SYNDROME

Most runners with shin pain have **tibial stress syndrome**. Excessive pronation causes the shin bone to rotate inward with each step, while the upper part of the leg remains almost fixed. This abnormal twist of the bone, coupled with repetitive impact trauma, puts stress on the shin bone and causes irritation and pain.

Treatment includes wearing an arch support or orthotic device, depending on the extent of foot disability. This will support the foot and will stop rotation of the tibia. As soon as the rotation stops, the soreness will begin to disappear, often in as little as 2 to 3 weeks.

Massage Strategies

Even though this syndrome is not a muscle strain, massage for muscle strains (page 299) is effective.

PAIN ON THE OUTSIDE OF THE LEG

Another type of pain occurs as **pain on the outside of the leg** and is due to stress on the fibula from pounding and shock transmission up the outside of the leg, rather than twisting.

When the foot rolls to the outside (supination) because the arch is too tight, pain can result. If the client's shoes are turned over to the outside, the client lands on the outside of the foot when running. A high-arched, rigid foot will not collapse on impact. Because the arch of a supinated foot does not collapse to sustain the shock of the foot strike, the shock is transmitted up the outside of the leg and can result in bone pain and a possible stress fracture of the fibula.

Treating this condition is difficult. The best treatment is to provide maximum padding for shock absorption at the outer side of the foot.

Fibular pain is less debilitating than tibial pain because the fibula is not a true weight-bearing bone. The pain should disappear in 2 to 3 weeks with proper padding under the foot.

Massage Strategies

Use strategies for fractures (see page 299) because the injury is to the bone.

COMPARTMENT SYNDROME

Compartment syndrome occurs when an overdeveloped muscle crowds the connective tissue sheath that surrounds it, causing pressure and pain. It can be acute or chronic.

The leg is unique in that the various muscles are contained in thick, fibrous tubes called *compartments*. The design of these compartments does not allow them to expand very much, so overdeveloped muscles will be somewhat compressed within the compartments.

Acute Compartment Syndrome

During exercise the leg muscles become engorged with blood, and the pressure on the veins doesn't allow the blood to leave the affected muscle. Blood continues to enter the muscle from the arteries, where the pressure is higher than that inside the compartment and builds up until blood from the arteries can no longer nourish the muscle. When oxygen cannot be transported by the arteries, the muscles can become damaged. Eventually, the muscle fibers die if the condition is not corrected. Compartment syndrome can also be caused from impact trauma or a muscle tear to the area.

Pressure inside the compartment causes pain in the anterior muscles of the leg. This area swells and becomes very sensitive to any pressure.

This is a surgical emergency. If the compartment is not opened up to relieve the pressure within, the affected muscles will die, with permanent loss of function.

Massage Strategies. Massage is contraindicated in these cases. However, as a preventative measure, massage can increase and maintain pliability in the muscle sheath.

Chronic Compartment Syndrome

This injury occurs mainly in runners. Symptoms consist of pain that gradually develops during a run, getting worse until it is impossible to continue. After a period of rest, the pain disappears, only to return when the athlete tries to run again. The cause is usually training too much too quickly. An athlete who has laxity in the ankle ligaments, usually from multiple sprains, is prone to this condition.

Treatment includes rest until pain subsides and antiinflammatory medication.

Surgery is necessary only if pressure in the compartment is increased.

Massage Strategies. Use connective tissue methods to manually stretch the muscle sheath. Carefully monitor for increased symptoms; if this occurs, refer the client to a physician immediately.

LEG MUSCLE PULLS AND TEARS/STRAINS

Leg muscle pulls and tears commonly occur in the major muscles of the calf, the gastrocnemius, and the soleus. Pulls and tears represent different degrees of the same injury, which occurs when muscles are suddenly overstretched beyond their limits. The degree of overstretching determines whether the muscle is pulled or actually torn.

Treatment depends on the severity of the injury and consists of rest for a few days and then a gentle, gradual stretching program.

Massage Strategies

Use the strategies presented for muscle strains (see page 299). Prevention—the best treatment—is reinforced by using massage to maintain the normal resting length of the muscle, as well as the pliability and elasticity of connective tissue in the area. It is necessary to make sure that firing patterns are normal, and that the muscles are not adhered together. If using bending, shear, and torsion forces to separate the muscles, place the gastrocnemius in passive contraction—knee flexed and ankle plantar flexed—to facilitate movement over the soleus.

CALF CRAMPS

Calf cramps are dangerous because the sudden muscle pain can be so severe that an athlete may fall and risk other injury. A number of factors, including dehydration, electrolyte imbalance, poor physical conditioning, and improper diet, may cause cramps. Calf cramps usually occur after periods of repeated heavy exercise.

Massage Strategies

When the calf muscle twitches uncontrollably, this is a sign that it may go into spasm.

- When the muscle does cramp, apply broad-based compression to the belly of the muscle.
- Then massage the muscle from the top down toward the feet until the pain subsides.
- Gently stretch the calf.

Refer the athlete to the trainer or physician for hydration and electrolytes.

ACHILLES TENDINOPATHY (TENDONITIS, TENDONOSIS)

The Achilles tendon is the large tendon at the back of the ankle. It connects the gastrocnemius and the soleus muscle to the calcaneus bone. **Achilles tendinopathy (tendonitis, tendonosis)** (inflammation) can be acute or chronic (Figure 20-20).

Inflammation usually develops just above the point where the tendon attaches to the heel bone. Signs of Achilles tendonitis include pain when pushing off during walking or when rising on the toes, redness and swelling over the tendon, and a crackling or creaking sound heard during movement of the tendon.

Achilles tendonitis results from repeated stress on the tendon, which may be caused or aggravated by the following:

- Overuse
- Running on hills and hard surfaces
- Poor stretching habits
- Tight, short calf muscles
- Weak calf muscles
- Worn-out or ill-fitting shoes
- Flat feet

In addition, Achilles tendonitis can develop as the result of participation in sports involving stop-and-start footwork, such as tennis, racquetball, football, and basketball.

If the feet overpronate, this can increase strain on the Achilles tendon because the tendon is twisted as the foot rolls in.

If the warning signs of Achilles tendonitis are ignored, or if it is not allowed to heal properly, the injury can become chronic. Because the Achilles tendon has a poor blood supply, it heals slowly. Chronic Achilles tendonitis is a difficult condition to treat. Pain experienced during the acute phase of the injury usually disappears after warm-up but returns when training has stopped. The injury gets worse until eventually it becomes impossible to run.

Symptoms of acute Achilles tendonitis include the following:

- Pain in the tendon during exercise
- Swelling over the tendon
- Redness of the skin over the tendon

Symptoms of chronic Achilles tendonitis include those of acute tendonitis as well as those listed here:

- Pain and stiffness in the tendon, especially in the morning
- Pain in the tendon when walking, especially uphill or up stairs

A major predisposing factor is overtraining. As a general rule, athletes who increase their training stress by more than 10% weekly run a 50% risk that injury may occur after 4 weeks. Achilles tendonitis can occur in any athlete—both professional and amateur—who may have increased speed workouts, hill running, jumping, or total training volume. The Achilles/calf muscle tendon group is

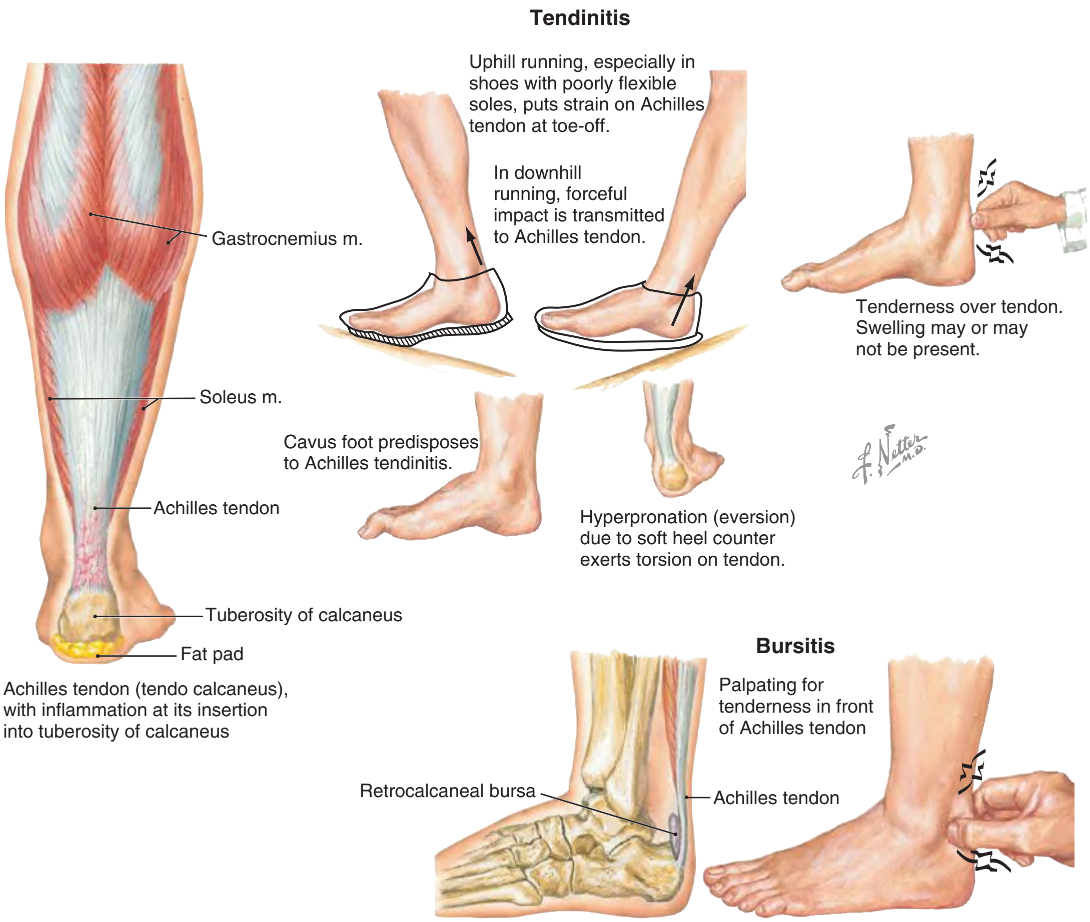


FIGURE 20-20 Achilles tendinitis and bursitis. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

responsible to a large extent for the push-off that leads to the airborne or "leaping" phase of running.

Treatment begins with PRICE therapy. Next, reduce training by 50%. Then gradually reinstate training intensity by 10% per week as treatment continues. Continued icing helps reduce swelling and inflammatory change.

Short-term use of NSAIDs, usually for no longer than 14 days, is helpful. After this time, most of the changes seen in these conditions have more to do with tissue breakdown than with inflammation. Steroid injection sometimes is used but is not recommended. Some specialists believe that this can increase the risk of a total rupture.

Specific rehabilitation exercises help restore the strength of supporting muscle groups. These exercises emphasize strengthening the muscles that support the foot, arch, and lower leg. In general, exercise needs to work on both concentric (contracting) and eccentric (lengthening) strength.

Stretching should be done cautiously while any tissues are inflamed, and should be directed at motion deficits. Begin by performing two or three pain-free stretches of affected muscle groups lasting 30 seconds, then increase the repetition slowly.

Massage Strategies

In the acute stage, do not use any massage methods that increase inflammation. Lymphatic drain procedures are appropriate in the painful area. Focus on short structures, muscles, and/or connective tissue causing the inflammation. Calf muscles are almost always involved. Make sure that the gastrocnemius and the soleus are not adhering to each other. The cause of shortening of calf muscles needs to be addressed as well.

Disrupted firing patterns such as those described for the knee usually are involved and need to be normalized. Once the inflammation is reduced and the acute phase has passed, bend, shear, and torsion forces can be introduced during massage.

Light massage usually can be performed daily; however, for deeper techniques, alternate days may be more appropriate, giving the tissues time to recover. See the massage sequence for tendonitis on page 306.

ACHILLES BURSITIS

Inflammation can occur in the bursa between the heel bone and the Achilles tendon. This is called **Achilles**

bursitis or *retrocalcaneal bursitis*. Initially, pain and irritation are noted at the back of the heel. Visible redness and swelling may be observed in the area, and the back of the shoe may further irritate the condition. Achilles bursitis can lead to increased swelling, pain, and disability.

Treatment consists of a combination of self-care measures. Surgery is rarely needed. Cortisone injections occasionally may be beneficial, but repeated injections are not recommended because of increased risk of rupture of the tendon.

Massage Strategies

Use the sequence for bursitis (see page 306).

ACHILLES TENDON RUPTURE

The athlete can overstretch the Achilles tendon and tear (rupture) it. Rupture can be partial or complete. **Achilles tendon rupture** typically occurs just above the heel bone, but it can happen anywhere along the tendon.

With a complete rupture, a pop or snap typically occurs, along with immediate sharp pain in the back of the ankle and lower leg, making it impossible to walk properly. Complete rupture of an Achilles tendon usually is treated with surgery. Ideally, surgery should occur within 2 weeks of the injury. The procedure generally involves making an incision in the back of the leg and repairing the torn tendon.

Postsurgical rehabilitation includes a period of 6 to 12 weeks with the leg immobilized in a walking boot, cast, brace, or splint. To prevent the tendon from healing in a stretched position (which would make it useless), the foot initially may be pointed slightly downward (plantar flexed) in the boot or brace, and then gradually moved to a neutral position. For the first few weeks, the cast will likely extend above the knee, then it will be reduced to below the knee.

After removal of the immobilization device, range-of-motion and stretching exercises can begin. It is usually 6 months to a year before the athlete can return to activity.

Nonsurgical treatment of an Achilles tendon rupture typically involves wearing a cast or walking boot, which allows the ends of the torn tendon to reattach. Studies indicate that this method can be effective without risk of complications, such as infection, that can occur with surgery. However, the incidence of recurring rupture is higher with the nonsurgical approach, and recovery can take longer. Surgical repair of a ruptured Achilles tendon is usually preferable, especially if the person wants to continue to take part in strenuous physical activities.

Partial rupture of the Achilles tendon can occur in athletes in all sports, including running, jumping, throwing, and racquet sports. After partial rupture, scar tissue is formed; this is likely to lead to tendinopathy. Often the athlete will not feel pain at the time but will become aware of the rupture later, when the tendon has cooled down. When the athlete resumes activity after a short period of rest, a sharp pain may occur that disappears after warm-up, only to return. Stiffness of the Achilles is often noted in the morning. A small swelling in the tendon may also be present.

Massage Strategies

Prevention is important. It is critical for normal gait that the ankle can dorsiflex at least 10 degrees; 20 degrees is optimal. A tight Achilles tendon may limit dorsiflexion and may predispose the athlete to ankle injury, as well as to strain in the knee, hip, and low back. Apply massage to stretch the Achilles tendon complex. Stretching should be performed first with the knee extended, and then with it flexed 15 to 30 degrees. Use both longitudinal and cross-directional stretching.

If a partial rupture is present or has occurred, palpation may reveal a particular lump or bump in the tendon that is sensitive. Massage outcomes include reduced swelling, increased circulation, and prevention of adhesions. If pain and swelling increase, reduce massage frequency and intensity.

Achilles tendon massage will work best when applied in conjunction with massage of the leg muscles, especially the calf muscles.

Depending on the healing stage, apply massage as follows:

Acute stage: With fiber direction toward injury.
Subacute stage: With fiber direction away from the injury.
Remodeling: Bend and shear force across the tendon.

Also see the sequence for muscle strains on page 299. Surgical repair of a tendon follows the presurgery and postsurgery protocol in Chapter 18. The Achilles tendon will be thick and rigid after surgery, and massage should be performed slowly and gradually to increase tissue pliability. Do not overwork the area. It typically takes a year of rehabilitation, including massage, to restore function to the ankle.

TENNIS LEG

The popliteus tendon runs parallel to the Achilles tendon on the inside of the leg. The disability resulting from rupture of this tendon is called **tennis leg** because it is often seen in tennis players; the rupture occurs as the athlete takes the first, hard step toward the net. Popliteus tendon rupture is more common in older athletes.

Another cause of this condition is a blow or hit to the back of the calf, which may rupture the popliteus tendon. The injured person will be unable to stand on the toes and may have a gait similar to that seen with an Achilles tendon rupture. The base of the bulging muscle on the inner side of the calf will be tender, and black and blue areas may be seen.

Initial treatment consists of PRICE. A gentle stretching program can begin as soon as pain decreases, and should be continued until full flexibility is regained. Normally, the tendon will heal in 10 to 21 days.

This injury should be examined by a physician to differentiate it from an Achilles rupture.

Massage Strategies

Apply the general acute, subacute, and remodeling sequences for muscle strains (see page 299).

FRACTURES

Breaking the tibia or fibula is a traumatic injury that requires medical treatment. A fracture of the tibia is serious because this bone heals slowly, and sometimes poorly, because of the sparse blood supply in some areas of the bone.

A fracture of the tibia commonly seen in skiers is called a *boot-top fracture* because the leg breaks right at the top of the rigid ski boot. Before the advent of rigid boots, ankle fractures were common in skiers, but now the ankles are protected, and fractures of the tibia are more common.

A fracture of the fibula is less serious than a fracture of the tibia because the fibula is not a true weight-bearing bone. Normally, an athlete can return to activity 4 to 5 weeks after a fibular fracture, with padding to protect the leg from further damage.

Massage Strategies

Use sequences for fractures (see page 310).

STRESS FRACTURES

If twisting of the tibia or fibula is severe and is repeated enough times, the bone will crack. This is known as a **stress fracture**.

The problem with identifying a stress fracture is that the crack is so small that it typically cannot be seen on an x-ray until it begins to heal itself a few weeks later. If the x-ray is negative but pain still exists, a bone scan is often necessary.

Suspect a stress fracture if the pain level resulting from the fracture suddenly increases, or if pain was noticeable only while running but now is noticeable when walking.

Treatment for a stress fracture of the tibia or fibula consists of reduced activity and rest. Severe pain may require the use of crutches. Typical healing time is 6 to 8 weeks.

Massage Strategies

See sequences for fractures on page 310.

TIBIALIS ANTERIOR TENDON SHEATH INFLAMMATION

The tibialis anterior muscle is the large muscle that runs down the outside of the shin. Its tendon can be felt at the front of the ankle. Inflammation can develop as a result of overuse, particularly when running on hard surfaces or in racquet sports that require frequent change of direction.

Symptoms of **tibialis anterior tendon sheath inflammation** include pain during dorsiflexion and plantar flexion, and swelling and redness in the area over the tendon.

Treatment includes PRICE therapy.

Massage Strategies

Massage includes lymphatic drain methods, pain control, and strategies to manage compensation. Massage can help reduce tension in the muscles of the lower leg, which in turn may reduce strain on tendon attachments to the bone, allowing the injury to heal and preventing it from returning once training resumes.

As always, it is important to assess the effects of massage both after treatment and on the following day. If pain or inflammation is increased, reduce the frequency and intensity.

THE ANKLE

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

In the ankle, three bones form a “mortise” joint. The dome of the ankle bone (the *talus*) sits in a squared-off socket formed by the tibia and the fibula. The joint is held together by three moderately strong ligaments on the outside of the ankle and one very large, very strong ligament on the inside.

Because of the ankle’s unique structure, the foot can move in many directions. The foot’s up-and-down movement allows walking. First, the foot swings “up” on its ankle hinge to permit the heel to strike the ground; then the foot rocks “down,” so that the forefoot can push off the ground, thereby propelling the walker forward.

Other important ankle movements include rolling the foot to the inside and to the outside. This allows adjusting the foot to walking and running on uneven surfaces.

The ankle is susceptible to two main types of injury: sprains and fractures. It can be difficult to differentiate between the two injuries. A large, swollen ankle may only be sprained, whereas a healthier looking ankle may be broken. Therefore, every ankle injury, except the most minimal sprains, should be x-rayed.

SPRAINS

If the foot rolls to the outside on an uneven surface, it may continue to roll over until the ligaments on the outside of the ankle are stretched or torn. The presence of small holes in playing fields leads to many sprains. Even on a flat surface such as a basketball court, a player can always step on someone else’s foot and turn the ankle. Ankle sprains account for as many as one-fifth of injuries. Although most sprains are minor and do not require surgery or extensive treatment, diagnosing the severity of

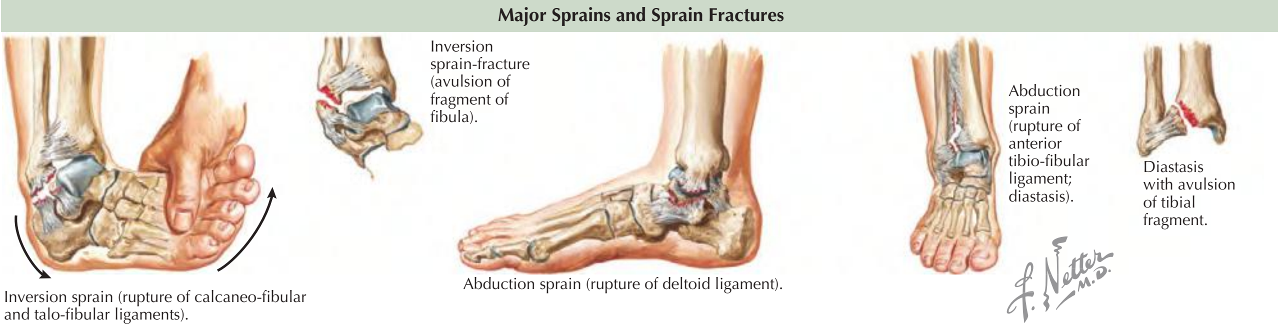


FIGURE 20-21 Ankle injuries. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

the injury is difficult; therefore, all ankle injuries should be evaluated by a physician (Figure 20-21).

Signs and symptoms of the three degrees of ligament sprain are as follows:

- First degree
  - Some stretching or perhaps tearing of the ligament
  - Little or no joint instability
  - Mild pain
  - Mild swelling (however, moderate swelling can occur)
  - Some joint stiffness
  - Mild muscle guarding
  - *Quick check*—Able to stand on one foot (the one with the sprain) and be stable, although it hurts
- Second degree
  - Some tearing of the ligament fibers
  - Moderate instability of the joint
  - Moderate to severe pain
  - Swelling and stiffness
  - Muscle guarding
  - *Quick check*—Able to stand on one foot (the one with the sprain), but it hurts and is unstable
- Third degree
  - Total rupture of a ligament
  - Gross instability of the joint
  - Severe pain initially, followed by no pain
  - Severe swelling
  - Significant muscle guarding
  - *Quick check*—Cannot bear weight on the foot with the sprain

Outward Sprain. The most common ankle sprain is the result of a roll off the outer part of the foot that injures the ligaments on the outside of the ankle. Swelling and pain are noted in the outer area of the ankle, with black and blue marks around the injury. Within a few days, the foot and the toes may also be discolored from blood from the broken vessels flowing downward because of gravity.

If pain occurs on the inside of the ankle as well, x-rays are necessary. When the foot rolls over, the central bone of the ankle can knock against the tibia on the inside of the ankle. This may bruise the bone or even break off a piece, which makes the injury a fracture.

Inward Sprain. An injury resulting from rolling off the inside of the foot is much less common than an outward sprain and usually results in a fracture rather than a sprain. The inside ligament is actually stronger than the inside bone, and, rather than spraining, it may pull off a piece of bone where it attaches *(avulsion fracture)*. This type of ankle sprain always requires an x-ray.

Forward Sprain (High Ankle). A third type of sprain results when the front of the foot rolls over the toes. This pulls the tendons in front of the ankle and tears the ankle capsule (the membrane that surrounds the ankle bones) and the sheath between the tibia and the fibula. This is the most serious type of ankle sprain.

Calf muscles get tighter and weaker after an ankle sprain. Massage can normalize the imbalance. An outward sprain results in increased shortening in the medial tissues. An inward sprain results in shortening of the lateral calf. A forward sprain usually results in co-contraction of all muscles surrounding the ankle.

Inability to bear weight on the affected ankle should prompt further evaluation by a health professional to determine the extent of the injury. Referral is necessary if the client complains of the following:

- Numbness in the foot or ankle
- Increased swelling rather than a gradual decrease
- Reinjury of the ankle
- A sensation that the ankle "gives way" while walking or running

Early use of NSAIDs may actually cause increased bleeding into the area of injury, so use should be limited in the acute phase of healing. For recurring sprains, an orthotic device with a lateral flange or a built-up area over the side of the heel can prevent the ankle from turning over. Persistent sprains may require surgical repair of ankle ligaments.

People with tight ligaments, including those with a supinating foot or Morton's foot (discussed later), may be prone to ankle sprains. In both cases, the supinating foot

BOX 20-2 Ankle Exercises

"Alphabet" exercise: Draw each letter of the alphabet in the air using the big toe as the "pencil." Repeat the entire alphabet 5 times. Do this exercise 3 times per day.

Motion exercise: Move by flexing and extending the ankle up and down, without pain, as far as it will go, 10 to 15 times. Do this exercise 5 times per day.

Stability training: Stand on the unaffected leg first and maintain stability; then switch to the affected leg. To make this more challenging, close the eyes and repeat.

tends to land on the outside, which predisposes the ankle to turn out over the foot.

Ankle sprains should be taken seriously. An aggressive rehabilitation program is necessary to speed recovery and reduce the chance of reinjury (Box 20-2).

Massage Strategies

Use sequences for sprains/strains (see page 297).

BROKEN ANKLE

An ankle can break if it is turned severely and with great force–for example, when a basketball player comes down from a rebound and lands on the side of another player's foot, turning the ankle with the force of his or her full weight. A football or soccer player can break an ankle if the cleats are dug into the ground and someone falls on or rolls into the ankle. In baseball, catching the cleats while sliding into a base is a common cause of a broken ankle.

A **broken ankle** is difficult to diagnose and can be mistaken for a sprain. Common signs of a broken ankle include the following:

- A recurrent, diffuse ache in the ankle that increases with exercise or a continual ache
- Swelling after exercise, followed by pain-free periods
- Limited movement
- Bruising in the ankle

Massage Strategies

The ankle needs to be x-rayed and medical treatment applied, including embolization.

Use massage procedures for fractures (see page 310). Also use sequences for sprains and strains (see page 297).

TIBIALIS POSTERIOR SYNDROME

The tibialis posterior muscle comes from behind the tibia and forms a tendon that passes behind the medial malleolus. Inflammation can occur around the medial malleolus and farther down under the foot, where the tendon attaches. This condition is called **tibialis posterior syndrome**. Those who pronate are more likely to suffer from this injury. Treatment involves PRICE and possible use of orthotics.

Massage Strategies

Use lymphatic drain massage (see Unit Two) and sequences for sprains and strains (see page 297).

DISLOCATION OF THE FIBULARIS (PERONEAL) TENDONS

The fibularis tendons run behind the lateral malleolus. If the tissue that holds the tendons in place is torn by an ankle sprain, the tendons can slip forward over the malleolus. Repeated dislocations can result in inflammation. This injury is common in athletes with unstable ankles.

Symptoms of **dislocation of the fibularis** tendons include the following:

- Pain when the foot pronates
- Pain or tenderness behind the lateral malleolus
- Swelling and bruising

Treatment includes PRICE, followed by gentle stretching when inflammation has decreased. Surgery may be required in severe cases to mend the tissue that holds the tendons in place.

Massage Strategies

Even though this is not a true strain or sprain, the strategies for strain and sprain are effective (see page 292).

THE FOOT

Objectives

1. Identify specific injuries based on location.
2. Develop and implement appropriate treatment plans for massage application for a specific injury.

If their feet hurt, clients tend to be miserable. The foot absorbs the shock of the body's weight landing on it during walking, running, and jumping. The foot supports up to 4 times the body weight during running, and it bears at least 1800 foot strikes for every mile. It locks into a rigid position during toe push-off, acting as a lever for propulsion. The foot must roll from outside to inside as the body weight comes forward from the heel to the front of the foot.

A structural abnormality of the foot can cause stress all the way up the leg into the back. The lower extremity can be viewed as a set of building blocks–foot, ankle, calf, leg, knee, thigh, hip, and lower back–placed one on top of the other. When one building block does not function as it should, the blocks above it also do not function properly because they have an insecure base. Nearly all overuse injuries of the lower extremities are due to an abnormality in the way the foot hits the ground.

In most people, bones, muscles, and tendons under the foot create an arch. Some people, however, are born with "fallen arches," or flat feet. Contrary to popular belief, flat feet are not a problem for athletes. Most experts believe that flat-footed people should not limit their activities and do not need special treatment. In fact, flat feet usually are more flexible, have greater range of motion, and are better able to absorb the shock of running and jumping than "normal" feet. However, athletes with high arches are more injury-prone. An unusually high-arched foot is more rigid and has limited range of motion during quick, agile movements.

One of the best ways to recognize foot problems is to look at the wear pattern in a pair of athletic shoes. A pronating foot wears out the inside of the heel and toe, and the shoe breaks over to the inside. If the shoe is placed flat on a tabletop, it will lean to the inside. A supinating foot wears out the outside of the shoe, from the heel all the way down to the toes. This shoe will lean to the outside. A Morton's foot wears out the shoe on the outside of the heel and mid-sole, and then straight across the sole to the inside of the big toe.

Orthotic devices containing carefully placed divots and bumps are designed to shift the weight in a way that forces more optimal movement. They are made from a variety of materials, from layered foam to leather-covered cork to hard plastic.

PRONATING FOOT

The **pronating foot** has loose ligaments and, because it does not have the proper support, rolls to the inside. The foot appears to be flat because the arch becomes compressed when the foot rolls over. However, when the weight is taken off the foot, the arch reappears. A person with true flat feet has no arch at all.

The inward roll of the foot causes the entire leg to rotate to the inside. The kneecaps point toward each other. Every structure in the person's leg and hip is pulled out of optimal alignment.

A pronating foot can be supported with an arch support under the inside of the foot. This keeps the foot in line when it strikes the ground and prevents the leg from rolling inward.

Massage Strategies

See massage strategies for the foot.

SUPINATING FOOT

The **supinating foot**, or cavus foot, rolls to the outside. The ligaments are tight, and the foot is rigid with a high arch, causing the person to walk on the far outer portion of the foot. Because the arch is too tight, it cannot collapse when the foot hits the ground. With no arch to absorb the shock of each step, the shock travels up the outside of the leg.

The supinating foot requires soft padding under the outside of the foot. This will cause the foot to roll back slightly toward the middle and will provide some padding to reduce pounding on the legs. An orthotic device can take some of the weight off the outer side of the foot.

Massage Strategies

See massage strategies for the foot.

MORTON'S FOOT

With **Morton's foot**, the second toe is longer than the big toe. The problem is that the bone behind the big toe (first metatarsal) is too short. This inherited trait occurs in about 25% of the population and causes problems in more people than the two previously discussed foot abnormalities combined.

Forward momentum during walking or running occurs by pushing off with the big toe ("toeing off"). Just before toeing off, all of the weight is on the head of the first metatarsal. In persons with Morton's foot, the foot buckles to the inside, and the weight rolls along the inner side of the big toe. This is similar to what happens with the pronating foot, but a Morton's foot does not pronate until weight is placed on the toes.

People with Morton's foot first strike the ground with the far outer part of the foot. Walking on the inner side of the big toe often causes a large callus to form. Also, the big toe will be pushed toward the second toe, and pressure on the inside of the big toe may cause bunions.

Morton's foot is corrected with an orthotic device that has an arch support built up under the big toe joint.

Massage Strategies for the Foot (Figure 20-22)

Massage the foot thoroughly. Make sure that the joints move freely, and that connective tissue structures are pliable, especially in a high arch. Trigger points can develop in the calf as a compensation pattern. Do NOT massage these trigger points until the foot position is improved through exercise and orthotics. They are serving an appropriate compensation function.

METATARSALGIA

Metatarsalgia is pain in the front of the foot just behind the toes that can be due to the stress of placing weight on the toes during running. Usually the pain occurs in the second or third toe. The heads of the metatarsal bones in these toes may drop slightly, and excessive weight placed on them when coming up on the toes causes pain.

A pad placed behind the heads of these toes will lift and take the weight off them, which usually relieves the pain.

Massage Strategies

Use procedures for contusion (see page 292).

METATARSAL STRESS FRACTURE

A **metatarsal stress fracture**, as the name implies, results from an excessive amount of stress on a metatarsal bone. When excessive force is transmitted to the 2nd, 3rd, or 4th metatarsal bone, the bone can crack from overfatigue.

If mild pain is felt in the foot for days or even weeks during activities, followed by sudden, severe pain in the front part of the foot, a stress fracture of the foot has probably occurred.

FIGURE 20-22 Massage of the foot.
1. In prone position using kneeling or seated body mechanics, apply compression with the forearm.
2. The fist can be used to target compressive force to the plantar fascia.
3. In side-lying, the forearm is used for compression while the hand moves the foot in various positions.
4. Use a narrow contact to massage attachments of the plantar fascia.

With a metatarsal stress fracture, the upper and lower surfaces of the foot will be tender, with some swelling. An x-ray of the foot, and sometimes a bone scan, is needed to confirm the diagnosis.

Treatment includes rest for 4 to 6 weeks to allow the fracture to heal. Crutches are necessary only if severe pain occurs when walking. Casting usually is not necessary. Early use of an orthotic device will provide relief while the fracture heals.

A stress fracture of the 5th metatarsal, behind the little toe, is a more serious injury. This results from an excessive load on the outside of the foot, as occurs in the supinating foot.

These fractures heal poorly and require immediate medical attention. Simple rest is not the answer. Casts and crutches for anywhere from 6 weeks to several months may be required. Many of these fractures need to be treated surgically, with a screw used to hold the fragments together.

Treatment of metatarsal stress fractures includes placement of metatarsal pads in the shoes. These are placed behind the metatarsal bones so that during walking, the body weight comes down on the pad of the foot, instead of on the bone, thus relieving mechanical stress. In some cases, walking boots with a rocker bottom or rounded soles are used.

Broken bones in the foot other than the toes require immediate medical attention and casting. Immobilization of the foot for 4 to 6 weeks is customary.

Massage Strategies

Use sequences for fractures (see page 310).

BROKEN TOE

A **broken toe** is usually buddy-taped to the toe next to it. Gauze is placed between the two toes before they are taped together; otherwise, sweat will cause the skin to soften and flake.

Massage Strategies

Use sequences for fractures (see page 310).

BLACK TOENAILS

Athletes who run as part of their sport may have **black toenails** that may eventually fall off. Constant banging of the toenail against the toe box of the shoe causes bleeding under the toenail, which is why it looks black. The problem usually is caused by an undersized shoe.

People with Morton's foot have an additional problem. The toe boxes of running shoes are designed with the assumption that the big toe is the largest toe. In the person with Morton's foot, the second toe is largest, so most athletic shoes do not fit properly. The condition is usually ignored, but making sure that shoes fit properly prevents this condition.

Massage Strategies

Massage is not applicable in these cases.

TURF TOE

Turf toe is a sprained joint at the base of the big toe. Turf toe can occur after very vigorous upward bending of the big toe. It got its name based on the fact that it occurs frequently in athletes who play and practice on artificial surfaces such as Astroturf. When the athlete is running on natural grass with cleats on, the grass gives, and some of the stress of toeing off is absorbed by the ground. The hard surface of artificial turf has no "give," and the entire stress of toeing-off is transferred to the toe joint. The shoe grips hard on the surface and sticks, causing the body's weight to go forward and bending the toe upward.

Turf toe is also a common injury in martial arts.

When the toe is bent upward, this causes damage to the ligaments, which can become stretched. In addition, the surfaces of bones at the joint can become damaged. An x-ray can determine whether a bone has been broken.

Swelling and pain are noted at the joint of the big toe and the first metatarsal bone, along with pain and tenderness when the toe is bent or is pulled (stretched) upward.

Risk for this injury is increased when excessive range of motion is present in the ankle, and when soft, flexible shoes are worn. Playing on grass with shoes with short cleats decreases the risk.

Turf toe is very painful and is slow to heal. The athlete should rest until the pain is gone, but this seldom happens. Recovery can take 3 to 4 weeks, depending on the severity of the sprain. When it begins to heal, the trainer can tape the toe down so that it cannot extend upward.

If this injury does not heal properly, it may develop into *hallux limitus*, which occurs as decreased range of motion due to arthritis around the joint.

Massage Strategies

Massage is focused on full-body compensation patterns because of the change in how the client walks and runs, which strains all muscles involved. Often the low back or knees will ache. Address firing patterns at each massage session. Gentle, pain-free traction seems to relieve pressure and pain in the joint. Also use strategies for sprains and pain management (see page 299).

PLANTAR FASCIITIS

The plantar fascia is the connective tissue covering on the sole of the foot that holds up the arch. It runs the length of the foot, from just behind the toe bones to the heel bone. This shock-absorbing pad can become inflamed, a condition called **plantar fasciitis**, causing aching and sharp pain along the length of the arch (Figure 20-23).

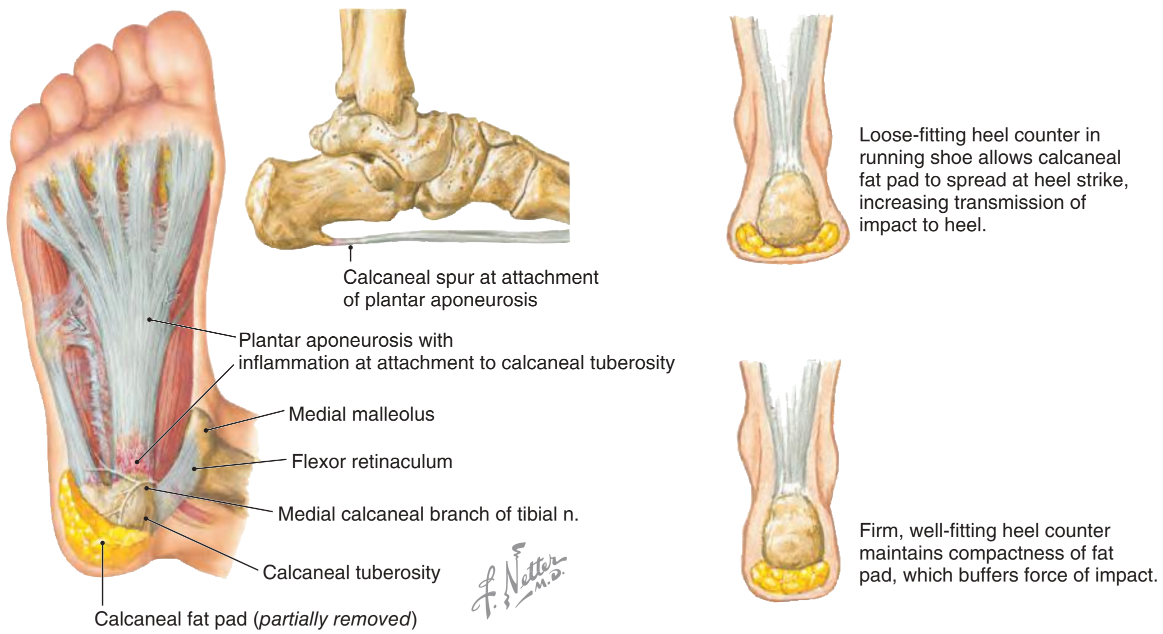


FIGURE 20-23 Plantar fasciitis. *(Netter illustration from www.netterimages.com. © Elsevier Inc. All rights reserved.)*

Log on to your Evolve website to view expanded examples of massage of the foot.

Pain is due to overstretching or partial tearing of the plantar fascia. This injury usually happens to people with rigid, high arches. They feel the pain when putting weight on the foot, or when pushing off for the next stride. As the arch starts to come down, it stretches the plantar fascia and pulls on its fibers. The torn fibers become inflamed and may shrink. The plantar fascia tears a little more with every step, resulting in intense pain.

Plantar fasciitis can affect anyone but is more common among older athletes, overweight athletes, and those engaged in prolonged exercise. Distance runners, golfers, tennis players, and basketball players are examples of athletes who frequently develop plantar fasciitis. Plantar fasciitis is particularly common among middle-aged people who have been sedentary, and who suddenly increase their level of physical activity. Running and jogging lead to most of the injuries. Inappropriately fitting shoes or a weight gain of 10 to 20 pounds can contribute to the condition. The condition is treated with ice and stretching. A cortisone injection may be used if necessary. Orthotics are often prescribed.

Massage Strategies

Inflammation is a symptom of this condition. Therefore, in the acute stage, do not use any methods that increase inflammation, especially friction. Lymphatic drain application is appropriate in the painful area. Focus treatment on the short structures–muscles and/or connective tissue.

Disrupted firing patterns as are described for the knee are usually involved and need to be normalized. Once inflammation is past the acute phase, bend, shear, and torsion forces can be introduced during massage to address the Achilles tendon and the plantar fascia. Make sure that the gastrocnemius and the soleus are not adhered to each other and are not short.

MORTON'S SYNDROME

Nerves that transmit messages to the brain from the toes pass between the metatarsal bones. If the arch is weak, the metatarsal bones can pinch a nerve, causing inflammation, or **Morton's syndrome**. This is most likely to happen between the 3rd and 4th metatarsals, resulting in pain or a numb sensation on one side of a toe and on the adjacent side of the next toe when the foot is squeezed. The pinched nerve causes pain or numbness on the sides of the toes nearest to the nerve.

Treatment includes rest, orthotics, NSAIDs, and exercises to strengthen the arch of the foot.

Surgery may be required if other treatments fail.

Massage Strategies

Caution: Do not massage over the painful nerve. Lymphatic drain methods may be helpful. Focus on management of compensation and causal patterns.

HEEL SPUR

A **heel spur** is a hook of bone that irritates the heel and is often caused by an irritated, overstretched plantar fascia.

Pain is located at the heel, where the plantar fascia attaches into the heel bone. Constant pulling on the plantar fascia at this point can cause the heel bone to overgrow and form a spur, which is visible on x-ray.

Treatment includes an arch support, which can hold the plantar fascia and keep it from overstretching. Surgery is also an option in some cases.

Massage Strategies

See massage strategies for plantar fasciitis. Do NOT massage over the area of the spur.

HEEL STRESS SYNDROME

Heel stress syndrome occurs on both the inside and the outside of the heel bone, but more severely on the inside. This syndrome is due to excessive pronation of the foot. The heel rolls to the inside, and the force of the weight is delivered at an angle rather than straight down. It feels as if the heel is bruised.

Treatment includes the use of an orthotic device.

Massage Strategies

Focus on compensation patterns arising from changes in gait. Do NOT apply heavy pressure in the painful area. Treat as a contusion (see page 292).

TOE TENDINOPATHY (TENDONITIS, TENDONOSIS)

Tenderness and swelling only along the top of the foot are usually due to **toe tendonitis**–an inflammation of the tendons that raise the toes. Pain is intensified if the toes are held down and then are pulled back up against resistance.

Shoes laced too tightly or poor padding under the tongues of the shoes can cause toe tendonitis.

Treatment consists of icing the tendons intermittently until pain and swelling subside. As with many conditions of the foot, this condition is related to ill-fitting shoes (Box 20-3).

Massage Strategies

Massage as for tendinopathy (see page 304).

TARSAL TUNNEL SYNDROME AND ENTRAPMENT OF THE MEDIAL CALCANEAL NERVE

The tarsals are the long bones of the foot. The tunnel holding the medial and lateral plantar nerves is located just below the medial malleolus.

An overpronated foot rolls during walking or running, putting pressure on these nerves, which can become irritated and inflamed. When pronation or pressure from shoes is excessive, the medial nerve can become trapped. Pain radiates from the inside of the heel out toward the center of the heel. This complex of symptoms of irritation,

BOX 20-3 Choosing an Athletic Shoe

Wearing proper athletic shoes can reduce the risk of all the injuries that stem from a poor foot strike and lead to pain all the way up the leg to the back. Following is a list of necessary features for sports-specific shoes.

RUNNING SHOES

Look primarily for good cushioning and good stability. The soles should curve up in the front and back, with a slightly elevated heel; heel counters should be firm, and the edges should be sharp for stability. The shoes should be lightweight with soft, breathable, flexible uppers. They should have good mid-sole cushioning and soles that are grooved or studded. If the foot tends to pronate, choose a shoe with a straight last and extra firmness along the inner edge for greater stability. If the foot tends to supinate, a shoe should be chosen with a curve that forces the foot inward and with a soft mid-sole and heel counter.

WALKING SHOES

Walking shoes support the heel-to-toe gait of walking. They should have adequate flexibility in the forefoot and adequate room between the toes and the top of the shoe. The shoes should be lightweight and should have strong heel counters, good mid-sole cushioning, slightly elevated heels, and flexible soles that curve up at the heel and toe. The upper should be made of breathable materials and should have a hard, reinforced area to protect the toe.

TENNIS SHOES

Tennis shoes are designed for good lateral support and good shock absorption. They should be heavy and strong with flat soles and a hard, squared-off edge. Also look for a reinforced front, a cushioned mid-sole, a firm heel counter, and a sole with circles to facilitate turning.

RACQUETBALL SHOES

Look for lightweight uppers, good mid-sole cushioning, and tacky, round-edged soles that are thinner and more flexible than those of tennis shoes.

VOLLEYBALL SHOES

Volleyball shoes are lightweight and flexible with reinforced toes, well-cushioned mid-soles, and soles made of ridged gum or rubber with rounded edges for good lateral support.

AEROBICS SHOES

Aerobics shoes are a lightweight combination of tennis and running shoes. They should have good shock absorption; stabilizing straps may be good for the side-to-side action of low-impact aerobics. Good aerobics shoes will have slightly elevated heels; firm heel counters for stability; lots of mid-sole cushioning; and wrapped, soft rubber soles for lateral support.

BASKETBALL SHOES

Basketball shoes are designed to be heavier than tennis shoes, with good shock absorption, ankle support, traction, and stability. This means good lateral support, hard rubber cup-ridged soles, and sturdy mid-soles.

FOOTBALL SHOES

Football shoes have thick, rigid, leather uppers with sturdy heel counters and spiked rubber soles.

BASEBALL SHOES

These shoes have uppers made of leather or nylon and leather, soles with sharp edges for good traction, a long tongue flap that folds back over the laces to keep dirt out, and soles with cleats of molded plastic or hard rubber.

CYCLING SHOES

Cycling shoes have stiff soles for efficient pedaling. Racing shoes should have a very stiff sole, and touring shoes should have a little more flexibility. The snug-fitting, stiff uppers should be made of leather or leather and nylon with no cushioning. Shoes for mountain biking may use more durable materials. Many cycling shoes have Velcro snaps for a snug fit. The shoe should fit snugly into the toehold on the pedal, and the soles should have grooves to help grip the pedals.

WEIGHT-TRAINING SHOES

Weight-training shoes require a wide base for stability and a firm mid-sole for support. Stabilizing straps can lock in the heel to provide a firm footing.

CROSS-TRAINER SHOES

Cross-trainer shoes are designed to combine flexibility, stability, and cushioning in one pair of shoes. Choose shoes with reinforced toes and with restraining straps for good lateral support.

inflammation, and pain caused by the entrapped nerve is called **tarsal tunnel syndrome**.

Symptoms include the following:

- Pain radiating into the arch of the foot, the heel, and sometimes the toes
- "Pins and needles," or numbness, in the sole of the foot
- Pain when running or standing for long periods

Tapping the nerve just behind the medial malleolus may reproduce the pain.

In the acute stage, treatment includes PRICE. If overpronation is present, an orthotic device should be worn.

Massage Strategies

Use sequences for nerve entrapment (see page 312).

PES CAVUS (CLAW FOOT)

Pes cavus (claw foot) is a genetic defect in the foot that causes an excessively high arch and supination. Claw feet are relatively inflexible. The high arch is associated with very tight calf muscles at the back of the lower leg.

Pain in the feet may be noted during running and with painful and bent toes that cannot be straightened. Treatment is difficult and typically involves orthotics and, in severe cases, surgery.

Massage Strategies

Focus on management of compensation patterns in the calf, and maintain pliability and mobility of foot structures.

IN MY EXPERIENCE

Because of my level of experience, I am often involved with injury rehabilitation of athletes. I have stared at so many pictures and models of knees that the images appear during my dreams. My biggest nightmares are rib injuries and turf toe. Both hurt so much and there is so little that can be done. I am thrilled when working with an athlete who has a bone break because bone heals really well. If an athlete comes to me with a ligament injury, I cringe.

I have used lymphatic drain more than any other method. Once, the client and I both fell asleep during the lymph drain process! The client was lying on the floor, and I was kneeling beside him draining away. He fell asleep, and apparently so did I. He woke me up, and my hands were still on his ankle.

It may seem inappropriate to tell funny stories about injuries, but laughter is healing. I recall working very intensely (24 hours a day for 16 days) with an athlete recovering from arthroscopic knee surgery to remove a loose body. Time was critical, so out came the vitamins, essential oils, and arnica, the rescue remedy, the magnets, the ice, and the healing energies and intentions. The athlete and I spent so much time together that we did not even talk anymore. He slept, watched TV, or talked on the phone. I lymph-drained until I was drained. Massage was applied morning, noon, and night, encouraging firing patterns and range of motion. Every time the athlete saw me coming, he opened his mouth to take something and lie down wherever he was for whatever massage he was going to get. He always smelled like a flower or a piece of fruit because of the essential oils. Magnets were stitched into the elastic compression sleeve worn around the knee. He made the time deadline and never missed a practice or a game.

The outcome was very good, but the process was often hysterical and ridiculous—maybe not then, but especially now, when I look back. I have no clue what worked and what didn't. I also know that there was more involved than what I did. Body, mind, and spirit combine for the miracle of healing.

BUNION/HALLUX VALGUS

A **bunion/hallux valgus** is a painful prominence on the side of the foot where the big toe begins. This condition is marked by soft tissue swelling and enlargement of the affected joint (at the first metatarsal head of the big toe). Both biomechanical factors and genetic anatomic defects may contribute to this abnormality.

Poorly fitting shoes will exert friction and pressure on a joint that already may be somewhat abnormal in function or size. The resulting swelling and tenderness will get even worse from wearing a shoe that is not wide or deep enough to accommodate the bunion.

Often the big toe is bent in toward the other toes–this deformity is called *hallux valgus*–or even can lie across them.

Excessive pronation and Morton's foot can lead to the formation of bunions.

Massage Strategies

General massage of the foot may be helpful. Do not irritate the bunion.

IN MY EXPERIENCE

An injury can occur in many different ways other than as a direct result of an athletic activity. People often get hurt just fooling around, during general daily activities, or when participating in a sport other than their primary activity. I remember a football player who strained his back while bowling and a basketball player who sprained her ankle when stepping on her child's toy. I (the author) severely strained, sprained, and tore ligaments in my left knee while teaching balance exercises. The upside of actually experiencing an injury is that now I understand what it feels like when clients say, "It feels like my knee is going to buckle," and what the rigors are for rehabilitation. I also learned how to adapt body mechanics while continuing to perform massage because this event happened at the beginning of the football season.

The only way to be truly effective when using massage during injury rehabilitation is to be able to use your problem-solving skills. The workbook section of this chapter asks you to manipulate information in multiple ways to help you apply the information in different contexts. You may get tired of flipping through the chapter pages while completing the workbook questions, but—oh, well—repetition is part of excellence. It is true that repetition can be tedious, but so is lymphatic drainage if you are doing it right.

Nevertheless, if a basketball player sprains an ankle by stepping on another player's foot or on one of her child's toys, or if I end up blowing out my knee, I still use massage strategies for sprains.

SUMMARY

This chapter describes the sports injuries encountered by the massage professional that occur most commonly. Most of these injuries should be treated and monitored by the physician or athletic trainer, and the role of the massage therapist is usually supportive.

In all injury situations, rest and appropriate rehabilitation are important for proper healing. Massage supports both. It is hoped that this chapter will be used often as a reference. If you have a client with any of these injuries, use this textbook to begin your research, and then access other resources to expand your knowledge. In general, it is best to undertreat, not overtreat, an injury. The sooner after injury that massage can begin, the better will be the outcome. Old injuries that are symptomatic need to be taken into a controlled acute phase with precise frictioning, and then addressed as an acute injury. This process is repeated over and over, and this takes patience and persistence. Preventing injury is always better than having to treat an injury. When in doubt about what to do, apply lymph drainage methods, and use sequences that entrain healing energies.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises.

1 List at least five major benefits of massage that support healing mechanisms.
2 List 10 injuries that are treated with strategies for wounds.
3 List 10 injuries that are treated with strategies for tendinopathy (tendonitis, tendonosis).
4 List 10 injuries that use lymphatic drainage as the primary treatment method.
5 List 10 injuries that are medical emergencies.
6 List 10 injuries that are most likely to occur from trauma.
7 List 10 injuries that are most likely to occur from repetitive strain.
8 List 10 injuries for which core stability is a factor.
9 List at least five errors made during massage treatment of injuries.
10 Based on the typical strain and injury potential of a specific physical activity, identify five injuries that you feel would be common in the following sports or exercise programs:

Aerobic dancing
Baseball
Gymnastics
Golf
Tennis
Football
Soccer
Running a marathon
Long jump in track and field
Weight lifting
Volleyball
Rowing
Hockey
Biking
Race walking
Skateboarding
Surfing
Roller skating

11 Identify your favorite sport or exercise activity, and list five common injuries that may occur while it is performed.

UNIT FOUR

Case Studies

Case Studies

This unit presents a unique perspective for a textbook. The unit is written more like a series of stories that chronicle the clinical practice of massage therapists specializing in sport and fitness massage. The content is technically correct and is presented in an interpersonal context of experienced massage therapists who are continually learning. The client profiles are often composite characters drawn from the author's actual experience, designed to represent accurately the real-world application of information presented in this text. The goal is to involve the reader in a clinical reasoning outcome-based massage approach that is a realistic representation of the sport and rehabilitation environment and the persons involved. This is the best way for me, the author, to shift from teacher to mentor.

Each case in this unit is a composite of many different clients, but all the situations are ones with which I have been involved personally. As I reflect on all the sport stories I have read or watched, the underlying story is about the personal sacrifices and triumphs and the persons behind the scenes–doctors, trainers, coaches, family, and massage therapists, and others who contributed to the outcome, be it regaining fitness, ability to overcome injury, winning, or losing. Shakespeare coined the metaphor of the "play within the play," and these vignettes can be thought of as the play within the competition. I purposely have used a variety of formats for these case studies so that the reader can become familiar with different narrative and documentation styles.

First, I will describe each of the clients, and then the text will follow a period of time using a charting format of the therapeutic massage session for each client. Individual methods such as lymphatic drainage or joint play will not be described. Instead, the reader needs to refer to those areas in the text or other textbooks that are recommended to support this text. Because there is no way to develop precise protocols, a clinical reasoning model is used. At the end of each case, critical thinking activities are provided to expand your critical thinking skills. Answers to the critical thinking questions are provided on the Evolve website, along with four additional case studies.

Log on to your Evolve website for a slide show of an example of a general protocol approach to massage:

Case Study *Sam*—Osteoarthritis
Case Study *Marge*—Cardiac Rehabilitation
Case Study *Laura*—Weight Loss
Case Study *Steven*—Repetitive Strain/Overuse Injury: Bursitis

CASE ONE

TOM—GOLFER

Tom is a professional golfer. He turned pro in 1990. Tom is 38 years old, is in good health, and usually is actively involved in effective strength and conditioning programs. He will slack off periodically and then overtrain to compensate. His core strength is excellent, and firing and gait patterns are usually normal. Tom occasionally gets fatigue-induced gait and firing pattern changes if he has to play on an extremely hilly course, has to play back-to-back rounds, or has overtrained at the gym. When this occurs, he complains of heavy legs, tight calves, and achy feet. He has had plantar fasciitis in both feet successfully treated with cortisone injection and orthotics. He is an intense, emotional competitor and has a tendency toward breathing dysfunction. He recently fell while skiing and broke his left fibula near the ankle. The fracture did not require surgery.

Like most golfers, Tom has a pelvic rotation and a shoulder girdle rotation that is sport-related and asymptomatic. His forearm muscles co-contract on the golf club and become short and tight. He is prone to an occasional migraine headache and has seasonal sinus headaches and periods of tension headaches.

Tom travels a lot during the tour season, sleeping in different beds. This interferes with restorative sleep. Most of his complaints are related to being stiff, restless, and unable to relax. He relies on massage for tissue pliability and normal muscle resting length because he is not consistently compliant with a flexibility program, even though he is consistent with aerobic and strength training. Tom sees a chiropractor regularly. He prefers massage 2 times a week when in town, with outcome goals concentrating on the restorative properties of the general protocol. Each session, he identifies a different focus area. Sometimes the focus is his left shoulder or mild low back pain. Often his hamstrings, calves, and feet are the focus.

Tom is ritualistic, as are many elite athletes, and wants everything as sequential and familiar as possible when he gets ready to play. He is also accommodating and understands his demands on the massage therapist. He only travels with the massage therapist if he is especially tired or has some nagging, achy areas that are interfering with his golf performance. Otherwise, when on the road, he will get a massage from a massage practitioner in the area, based on other local golfers' recommendations. He was hurt once by a massage that was aggressive and too deep, and he was sore the day of that tournament. Most of the time, if the massage is ineffective, he complains that the massage does not really make him feel looser. When Tom is at home, his massage therapist goes to his residence for the massage sessions. He usually watches the golf channel on ESPN on television during the massage. Occasionally, he will fall asleep.

Current Assessment and History

Client is 3 weeks post injury and is still in a cast. Surgery was not required. He complains of tension headache and low back pain, and is restless. He is not sleeping well. Client is home recovering. He is not taking any pain medication. Healing progress for the fibula is on schedule. He is obviously overbreathing and is out of sorts. Client seems to be experiencing increased sympathetic dominance in response to reduced activity. He is frustrated about missing tournaments because he is losing opportunities for professional advancement and finances. Overall, he is miserable.

The following revised treatment plan and series of massage sessions will support final healing of the fracture and beginning stages of rehabilitation before return to competition.

Subjective Assessment. Client reports that he is not sleeping well, and he knows he is breathing with his upper chest and is irritable. He has a recurring headache that he thinks is the result of a combination of sinus pressure and muscle tension. His shoulders, axillary areas, and low back ache from using crutches and the walking cast, and from lying around. The doctor is satisfied with the healing progress and expects the cast to come off next week. Physical therapy will begin immediately and will last 8 to 12 weeks.

Objective Assessment. Objective assessment found the following:

- Upper chest and shoulder movement occurs during relaxed breathing.
- Client is restless and fidgeting. Left hip is elevated and is anteriorly rotated.
- Gait is abnormal. Trunk, hip, knee, and shoulder firing patterns are synergistically dominant.
- Psoas and scalenes are short bilaterally; quadratus lumborum is short on the left.

CRITICAL THINKING

1. What biomechanics are involved in golf?
2. What are the various tournament locations and schedules?
3. When is Tom home, and when is he on the road?
4. What other endorsements and publicity obligations does Tom have?
5. Are there any cautions for working with the broken leg?
6. What does Tom's strength and conditioning program include?
7. Are there any recommendations from the chiropractor?

Analysis of Assessment and History to Develop Treatment Goals

This client previously has responded to massage, as described in the general protocol in this text. Assessment information is influenced by the fibular fracture and compensation and does not necessarily indicate his post-rehabilitation status.

Until the cast is off and rehabilitation begins, it is ineffective to specifically address the gait dysfunction. Two weeks into rehabilitation likely would be an appropriate time to assess gait and firing patterns and to begin to provide specific intervention. Firing patterns that would influence shoulder function and breathing would be addressed, even if the results were temporary.

The main immediate goals are to address the breathing pattern and reduce aching caused by adapting to the cast and having to reduce activity. Treatment in these areas should support better sleep, reduced irritability, and productive healing.

Short-Term Goals

Manage discomfort from compensation caused by fracture as reported each session by client.

Normalize breathing and support restorative sleep.

Long-Term Goals

Support rehabilitation and return to competition. Reverse fibrotic changes in left lower leg. Normalize all firing patterns and gait reflexes.

Manage preexisting golf-related compensation for areas of tissue shortening, low back pain, plantar fascia pliability, and tendency toward headache.

Manage and support final healing phase of fracture for 6 to 8 months.

Massage Frequency and Duration

Start with 3 times per week for 1½ hours in the client's home. Reduce frequency to 2 times per week when sleep improves and rehabilitation progresses.

The general protocol is the foundation of the massage, with strategies added for breathing dysfunction, need for restorative sleep, bone fractures, headaches, and low back pain. Each session will also address specific goals related to his condition identified by the client that day.

Session One

S–Client reports irritability, restlessness, headache (sinus and tension); low back, neck, and shoulder stiffness; and aching. He also has constipation and intestinal gas. He is doing some upper body activity with light weights but indicates that he does not know how to perform an intense cardiovascular workout with his leg casted. The doctor is not concerned with the cardiovascular deconditioning because it is minor and rehabilitation will begin soon.

O–Client is breathing with the upper chest. Neck and chest palpate as tense and restricted. Scalenes, anterior serratus, and quadratus lumborum are short. Left hip is elevated and anteriorly rotated. Edema is present in left leg above the cast. Fullness in large intestine is palpable. Firing patterns and gait reflexes are not assessed.

Massage consists of general protocol with regional contraindication for the area of the fracture. The entire breathing protocol is integrated into the general massage session. The left leg receives lymphatic drainage. The foot not covered by the cast is addressed with rhythmic compression and active and passive range of motion.

Reflexively, the right forearm and wrist are massaged specifically to influence the area of the fracture.

Scalene, sternocleidomastoid, psoas, and quadratus lumborum releases are performed bilaterally.

The vascular and tension headache sequence is performed.

Energy work over the cast, combined with rhythmic passive range of motion of the left knee, targets the area of the fracture.

Abdominal massage addresses constipation.

A–Client reports that his headache is almost gone. He feels less stiff and achy. His left foot is itchy. (*Note:* Massage likely improved circulation.)

Observation and palpation reveal 75% improvement in breathing function; edema is reduced in left leg by 50%. Client is sitting still and talking slowly. He is laughing and joking. Massage duration was 2½ hours. This is typically too long, but client seemed to respond well.

P–Continue with general massage focus and breathing function strategies. Reassess for edema. Check with client about sleep function, and about whether there were any negative effects from the long massage.

Session Two

S–Client reports that he will get the cast off next week. He indicates that after the last massage, he slept better for 2 nights but was restless again last night. He has not had a headache and is not constipated, but his low back is aching. He was tired after the last massage, but in a pleasant way.

O–Upper chest breathing is evident through observation and palpation of the shoulders. Firing patterns for the shoulder are displaying synergistic dominance. Edema is evident again in the left leg. Connective tissue bind is palpated in the lumbar and pectoral fascia.

General massage protocol is performed with sufficient pressure applied to support increased serotonin release. Lymphatic drainage is performed on left leg. Scalene, sternocleidomastoid, psoas, and quadratus lumborum releases are performed to address low back aching. Direct connective tissue methods, bend, tension, and torsion are used to increase pliability in fascia. Energy-based modality is used over cast between left lower leg and ankle and between right forearm and wrist. All breathing strategies are incorporated.

A–Breathing assesses as normal with inhale to exhale ratio of 1 : 3. Edema is reduced by 50% in left leg. Connective

tissue pliability has improved. Client reports feeling good and less stiff. He is sleepy and plans to take a nap.
P–Continue with general protocol. Client will have cast off by next session. He will discuss with the doctor specific recommendations for massage.

Session Three

S–Client had cast removed this morning. He begins rehabilitation in 2 days. The doctor instructed him to move his ankle in pain-free circles. The doctor also requests that massage avoid the area and not perform lymphatic drainage there until after physical therapist evaluates, and then to follow the physical therapist's directions.
O–Moderate lower left leg muscle atrophy is observable. Client is using one crutch as needed. He appears apprehensive about weight bearing on his left leg even though he has been in a walking cast for 3 weeks.

Left hip remains elevated and anteriorly rotated but not as pronounced. Breathing is generally good for this client. He is sleeping better and is less restless.

General massage protocol: Avoid the left leg; no specific focus, and target general support of parasympathetic dominance.
A–Client is preoccupied with what is expected at rehabilitation, how long before he can begin to play golf, and his leg muscle atrophy. He talked a lot during the massage and did not seem to relax, even though he reports feeling looser.
P–Have client get specific massage instructions from the physical therapist and a copy of the rehabilitation plan, including types of exercises and modalities.

Session Four

S–Client reports that he has begun physical therapy, including cardiovascular work with the stationary bike. The physical therapist indicates that only lymphatic drainage and circulation-focused massage should be done below the left knee. No other recommendations are given. Client forgot to get rehabilitation plan but indicates that the therapist did passive and active range of motion, and he was given homework of drawing the alphabet with his toes.
O–Ankle mobility on the left is decreased. Edema is observable. Breathing function is normal for this client. Thigh muscles are bilaterally tense; they are co-contracting. Sacroiliac joint movement on the left is restricted, and the lumbar fascia and the pectoral fascia are binding.

General massage is done with a focus on breathing and increased connective tissue pliability; do not address thigh muscle tension specifically, which seems to be guarding response. Will monitor. Incorporate passive mobilization for sacroiliac joint.

Full sequence of lymphatic drainage and venous and arterial circulation is performed, but no passive movement of left ankle. Ask client to move ankle during lymphatic drainage.

Specifically address right forearm and wrist to affect left leg and ankle reflexively.
A–Client wants me to work more on left leg, but we discussed importance of following physical therapist's instructions. Fluid movement improved in left leg. Sacroiliac joint restriction improved 50%. Will continue to monitor. Suggested client point out SI joint restriction to physical therapist. Client reports that his legs still feel tight. Explained that this may be appropriate compensation, and it will be assessed again next massage.
P–Continue general massage. Reassess sacroiliac joint. Reduce massage to 2 times per week.

Session Five

S–Client is sore from rehabilitation, especially cardiovascular workout and weight training. Client is beginning proprioceptive training. Physical therapist okays massage in fractured area as long as it does not result in pain or inflammation, with caution given against heavy pressure over fractured area. Client has a tension headache but is sleeping well. He reports that he is anxious to get back to golf. Because the fracture occurred during a nonrelated activity (skiing), the doctor feels that he should be able to begin golf-related activity as long as there is no pain during or after activity in the area of the fracture. Physical therapist manipulated sacroiliac joint.
O–Range of motion in left ankle is 90% normal. Atrophy there is beginning to reverse. Tension in both thighs is reduced. Breathing is mildly disrupted. Left calf tissue pliability is reduced. Gait reflex assessment indicates that opposite side function is normal, but unilateral assessment indicates that arm and leg flexors do not inhibit in response to activation of corresponding flexion pattern. Also adductors do not inhibit when abduction is activated. Trunk firing is normal, but hip extension, hip abduction, and knee flexion are synergistically dominant. Knee extension and sacroiliac joint movement are normal.

General massage protocol used: Address all firing patterns and gait reflexes. Begin kneading (torsion force) of left calf to increase tissue pliability. Include breathing protocol and tension headache strategies. Apply lymphatic drainage to all areas of delayed-onset muscle soreness.
A–Client feels more stable on his feet, especially on the left. Left calf is itchy and prickly (histamine response).
P–Continue general massage. Reassess firing patterns and gait reflexes. Monitor sacroiliac joint function and breathing. Begin to introduce golf-specific focus as client begins to practice.

Session Six

S–Client is doing well in rehabilitation. Physical therapist again adjusted left sacroiliac joint. Client went to driving range and hit a bucket of balls yesterday. Body and neck are tight, forearms are stiff, and low back is achy. Client indicates that it feels good to ache like he has played golf. No pain occurs in left ankle.

O–Client has a left anteriorly rotated pelvis consistent with golf activity. Firing patterns and gait reflexes returned to same dysfunction as last massage. Eye/neck reflexes do not inhibit as they should in flexion/extension pattern. Wrist flexors and extensors are short; psoas and quadratus lumborum pressure reproduces achy low back symptoms.

General massage is performed, including correcting firing patterns, gait reflexes, and eye/neck reflexes. Muscle energy (contract-relax-antagonist-contract) used on forearms, and compression used with active movement of forearms.

Scalenes, quadratus lumborum, and sternocleidomastoid/psoas were released. Kneading (torsion force) applied to calves bilaterally. Addressed breathing.

Used indirect function technique to reduce anterior pelvic rotation.

A–Client reports that he feels great. He is cautioned to not overdo it.

P–Reassess all gait and firing patterns; perform general massage.

Session Seven

S–Client overdoes it. He is sore and there is mild edema in left ankle. Physical therapy is reduced to every 3 days. Physical therapist discussed the importance of moderation during activity. Client is achy, stiff, and sore. He is irritable, but breathing is normal for this client.

O–Client appears frustrated and stiff all over. His adaptive capacity does not appear sufficient for beneficial response to focused massage. General massage protocol is used instead, with focus on relaxation and lymphatic drainage.

A–Client fell asleep during massage. I left him sleeping on the massage table and told his wife to make sure he stays hydrated.

P–Monitor for adaptive strain, and then determine massage focus.

Session Eight

S–Client is 10 weeks post injury and is doing well. Doctor and physical therapist are pleased with his progress despite the setback from overexerting last week. No more cautions are in effect for the fracture area. Client has a sinus headache.

O–Client's firing patterns continue to show synergistic dominance but correct easily. Gait reflexes are normal. Eye reflexes do not inhibit in flexion when eyes are rolled back. Client displays familiar golf pattern: low back pain, pelvic rotation, and high shoulder on the left, with inhibited scapular retraction with attachment tender points and short pectoralis minor and anterior serratus. Client displays co-contraction of wrist flexion and extension, short calves, inhibited gluteus maximus, dominant hamstrings during hip extension, and binding plantar fascia.

General massage protocol targets each area as needed.

A–Client says he is beginning to feel like himself. He plans to play a round of golf before the next massage. Client is beginning to resume adaptive patterns consistent with his golf style, and compensation in response to the fibular fracture is only mildly evident.

P–Return to general maintenance massage with monitoring of tissue pliability in left calf and ankle range of motion.

Session Nine

S–Client reports that he played golf and was rusty, but no lingering effects from the time off are apparent. He is frustrated, did not sleep well, and was restless in his sleep. He is going to play 18 holes in a charity golf tournament in 2 weeks and hopes he does not embarrass himself.

O–Firing patterns are normal except for the knee flexors. Common pattern of muscle imbalance related to golf persists, as described in previous session. Upper chest breathing is evident.

General maintenance massage will be done with connective tissue focus on calves, addressing knee flexion firing patterns.

A–Client is restless and talkative during the massage. He does not relax, but this is not uncommon for him. Firing pattern for knee flexion is corrected easily. Breathing improves.

P–Client requests three massage sessions this week because he needs to get ready for the tournament.

Session Ten

S–Client reports that golf game is improving. He is fatigued.

O–Firing patterns are normal except for the knee flexors. Common pattern of muscle imbalance related to golf is found. Upper chest breathing is evident.

General maintenance massage was performed with connective tissue focus on the calves, addressing knee flexion firing patterns.

A–Client falls asleep and is left on table. Wife will monitor.

P–Continue with pre-event preparation massage focus. Continue general massage application and methods to reduce anxiety.

The Rest of the Story

This client occasionally will experience aching in his left ankle if he is on his feet a lot, especially if the golf course is hilly. He continues to play competitively in the PGA. He still gets headaches, overbreathes, and has forearm tension, low back ache, and golf-related musculoskeletal imbalance. He is a typical professional golfer. He maintains a solid conditioning program and still does not stretch as he should to counterbalance effect of the golf swing. This client will want massage regularly his entire career and beyond.

CRITICAL THINKING

1 How do you think core strength has supported career longevity in this client?

2 A variety of headache types occur for this client. How are the headaches related to his sport activity?

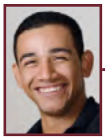
3 How might using crutches aggravate his irritability?

4 Session One addressed multiple issues. Do you think the massage was too aggressive? What would you have done the same or differently? Is there justification for addressing this many issues during a massage session?

5 What is the reason for limiting massage application on the left leg before evaluation by the physical therapist?

6 In Session Five, what do you think were the reasons for using kneading as the main method of massage on the injured calf?

7 Often during the sessions, there is mention of firing patterns, synergistic dominance, and gait reflexes. Of what value are these assessments and interventions?



CASE TWO

DARREL—BASEBALL PLAYER

Darrel is a 23-year-old minor league baseball pitcher. He played Little League, high school, and college baseball. He is intent on moving up to the majors. The only major physical problem is recurring bursitis in his right shoulder. This is problematic because it is in his pitching arm. The trainer has used ice and various other treatments, and the pain is reduced, although the pain returns if he plays consecutive games. Darrel had one cortisone injection 12 months ago that was helpful, but additional injections are not advised at this time. He is taking celecoxib (CELEBREX). Darrel also has modified his pitching style somewhat so that his shoulder is not bothering him as much. Lately, he has noticed increased tension in his forearm. Massage has not been used specifically to address the underlying factors causing the bursitis. Goals for massage intervention will be targeted on reducing the irritation causing the bursitis and providing general athletic performance support. Darrel received therapeutic massage occasionally when on vacation. Darrel will come to the office for the massage sessions.

History and Assessment

History: No major childhood illnesses. No current illness. Family history of cardiovascular disease.

Injuries: Car accident when 12 years old with a broken left wrist that successfully healed. Various contusions from playing baseball since 8 years old. Right ankle deltoid ligament second-degree sprain at 14 years old. Ankle healed but aches occasionally.

Current: No injury. Bursitis in right shoulder. Being treated with ice and antiinflammatory drugs. Restless sleep. Excessive caffeine consumption.

Medications/Supplements

CELEBREX

Megadose multivitamin, protein sports shake, and extra antioxidants.

Physical Assessment

Posture: Mild rotation of shoulder girdle to the right, pelvic girdle to the left, which is common training and

CRITICAL THINKING

1 What is causing the bursitis?

2 Why are there increased feelings of tension in Darrel's forearm?

3 What is the proper form for pitchers to prevent injury?

4 What effects is CELEBREX having?

5 What is Darrel's training and playing schedule?

6 What has the trainer been doing, and why have the results been mixed?

performance adaptation for right-handed pitcher. Externally rotated right leg and mild forward head position.

Gait assessment: Arm swing is limited on the left. Left hip flexors do not inhibit when assessed against right shoulder extensors.

Range of motion: Right arm internal rotation limited by 20%. Flexion and abduction are normal but painful at end range. Right ankle is hypermobile. Sacroiliac joint is restricted on the left, with medial hip rotation limited with hard end-feel.

Muscle testing: Right arm abductors are painful to resistance testing but do not test weak. Hip flexors are weak at maximal pressure bilaterally.

Firing patterns: Hamstring dominance is bilateral, and calf is dominant for knee flexion on the right. Trunk firing is rectus abdominis dominant. Shoulder firing on the right is upper trapezius dominant. Hip abductors on the left show quadratus lumborum dominance.

Palpation: Right shoulder is warm with reddening and increased sweating during drag palpation. Left and right forearms are taut and binding with increased tension in flexion groups. Pain, point tenderness, and heat are displayed at medial epicondyle on the right. Pain and point tenderness are noted on the medial head of the right gastrocnemius. Calf muscles are adhered on the right. Upper chest breathing pattern is noted. Fascial bind starts from occiput down spine to lumbodorsal fascia to right hip and iliotibial band. Mild edema is felt at bursae in right shoulder.

Analysis of History and Assessment

Darrel is highly focused on moving to the major leagues. He loves baseball and seems to overpractice. He has excessive caffeine intake, primarily coffee and soda, which may be contributing to the restless sleep and to the upper chest breathing. Darrell exhibits sympathetic dominance by being fidgety and talking loudly, with a description of a typical day as follows: up early, treatment by the trainer for bursitis and strength and conditioning. Often there is team practice and then more treatment by the trainer. Preseason begins in 4 weeks, with season consisting of around 120 games. Darrel wants to be ready for the season to show off his skills and to be called up to the majors by midseason if luck goes his way. He is healing but is beginning to show signs of reduced recovery.

Darrell's overtraining coupled with the playing schedule is a concern—whether he is recovering well enough not to become injury prone and excessively fatigued, which will affect performance. He does not have major adaptation issues at this time, and the various changes in posture, range of motion, and tissue texture seem appropriate for the sport activity. Exceptions to this are the point tenderness at the medial epicondyle on his throwing arm and the sacroiliac joint restriction. The sacroiliac joint restriction may indicate excessive rotation at the pelvis. The firing patterns in general indicate a tendency toward synergistic dominance, and the trunk firing pattern indicates a weak core muscle function. The upper chest breathing pattern is a concern and could be contributing to the shoulder problems and the recovery issue. Stress and emotional issues are a likely cause. Massage can address the general sympathetic dominance, the firing patterns, and the connective tissue bind. Massage cannot address the bursitis specifically but can reduce rubbing, which is causing the problem.

Massage would have to be combined with an appropriate therapeutic exercise and flexibility program to be most effective.

Darrel is highly motivated, and the trainer is supporting massage if a treatment plan is provided for approval, because the massage therapist is not employed directly by the team.

Treatment Plan

Short-term goals: Reduce sympathetic arousal. Normalize firing patterns.

Long-term goals: Support recovery. Normalize connective tissue bind. Maintain normal firing patterns. Increase range of motion of the shoulders by 50%. Reduce pain in shoulder by 50%. Support therapeutic exercise and flexibility.

Methods used: Therapeutic massage, muscle energy methods, trigger point methods, connective tissue approaches, and lymphatic drainage.

Frequency and duration: 2 times per week, 1½ hours for 6 weeks; then once per week as available during season.

Progress measurement: Firing patterns, gait assessment, range of motion, pain scale, breathing assessment, and feedback from client's trainer.

Session One

S–Client reports no change in bursitis pain since assessment. Forearms remain tight. Sleep patterns are the same as previously. Trainer does not want direct work on bursitis area. Client was hit with baseball on right hip.

O–No changes in assessment since intake session. Client has bruise on right hip. General massage protocol, including specific breathing pattern sequence. Normalize firing patterns. Perform lymphatic drainage over bruise.

A–Breathing pattern is improved as indicated by reduced movement of auxiliary breathing muscles during inhale. Range of motion of right arm has not changed. Bruised area on right hip is less swollen and painful. Firing pattern for right shoulder is normal, but other patterns have not changed.

P–Continue with full-body general massage. Reassess breathing and continue to address firing patterns. Add gait reflexes to assessment and treatment.

Session Two

S–Client reports improved sleep for 1 night. Bruise feels better, and calves are tender to the touch 1 day after massage, but feel loose. No change in bursitis. Forearms feel relaxed for 1 day.

O–Upper chest breathing is improved slightly. Firing patterns remain synergistically dominant. Gait assessment continues to show right shoulder extension not signaling inhibition to left hip flexors. General full-body protocol performed. Specific attention given to calf/forearm patterns with connective tissue focus. Shear of right gastrocnemius off soleus done. Firing patterns and gait patterns addressed.

A–Forearms and calves are more pliable but may be sore to the touch for 24 to 48 hours. Trigger point activity is still present in gastrocnemius. Gait patterns are normalized. Shoulder, hip abduction, and left calf firing patterns are improved. Other patterns would not reset. Client appears to be sleepy and reports that he is sleepy.

P–Continue with general massage, targeting firing patterns, connective tissue pliability, and breathing dysfunction.

Session Three

S–Client reports that calves were sore to the touch and during movement. Left forearm is better. Low back is aching around left lumbar area. Sleep is improving. Trainer is concerned about calves being sore during movement. Asks that massage intensity be reduced.

O–Upper chest breathing is improved, and auxiliary muscles are not active during relaxed breathing. Firing pattern for shoulder normal, but hip abduction and extension remain in synergistic dominance. Quadratus lumborum active on the left; point tenderness present at left sacroiliac joint. Calves pliable but mildly swollen. Right gastrocnemius beginning to move independently of soleus. Trigger point in gastrocnemius less tender. Forward head improved slightly. Right shoulder less tender to the touch, but right forearm muscle is tense with point tenderness at medial epicondyle.

General massage protocol: Quadratus lumborum and psoas release done bilaterally, and scalenes and sternocleidomastoid addressed. Inhibitory pressure used on trigger point in multifidus near left sacroiliac joint, and lymphatic drainage performed over shoulder and calves. All firing patterns and quadratus lumborum and psoas addressed. Rectus abdominis is inhibited, and then trunk firing patterns are reinforced.

A–Psoas, quadratus lumborum, and rectus abdominis inhibition seems to allow firing patterns to respond to treatment. All but the right calf is normalized. Reassessed gait patterns, and they were normal. Forward head position is improved. Right forearm remains tight and painful. Range of motion of right shoulder increased by 10% before becoming painful. Left sacroiliac joint remains painful to touch, but lumbar aching is improved.

P–Next session: Address short muscles in right shoulder. Continue with general massage and firing patterns. Resume connective tissue work. Suggest that client begin scapular retraction exercises and core training. Referred client to trainer for strength exercise program. Also asked client to have trainer evaluate right forearm and elbow tendonitis.

Session Four

S–Client reports that team chiropractor adjusted low back and sacroiliac joint and that they feel better. Trainer increased rotator cuff strengthening exercises and added scapula protraction sequence. Client indicated mild delayed-onset muscle soreness in the area. Calves are no longer sore. Sleep was restless, but client thinks this was the result of upper body aching caused by the increased exercise. Trainer did not increase core strengthening but intends to add exercises next week. Trainer thinks client is throwing too many pitches during practice and this is making his arm sore. He has been icing shoulder when it is sore.

O–Forward head position has returned to original assessment position. Shoulder remains rotated right, but pelvis has improved slightly since the chiropractic treatment. All firing patterns again are synergistically dominant. Gait pattern normal. Right forearm and medial epicondyle remain tight and sore to the touch. Bilateral muscle testing of wrist flexors and extensors indicates right side is overly strong–hyperresponsive to resistance pressure and painful at medial elbow. General massage with scalene/quadratus lumborum and psoas/sternocleidomastoid releases bilaterally. Deep lateral hip rotators and shoulder external rotators released (inhibited) and gently lengthened bilaterally. Pectoralis minor inhibited and lengthened bilaterally. All firing patterns addressed. Connective tissue work done on lumbodorsal and anterior thorax fascia. Lymphatic drainage performed on areas of delayed-onset muscle soreness.

A–Right shoulder strength and pain are improved according to shoulder abduction assessment. Firing patterns have normalized. Forward head posture is reduced by 90%. Shoulder rotation and pelvic rotation have improved, with shoulder rotation 10% from normal and pelvis asymmetry only slightly dysfunctional, but inflare on the right is identified in postmassage assessment. Wrist flexion on the right painful at normal resistance, but no longer hypersensitive. Point tenderness at medial epicondyle remains. Hip flexor strength is improved.

P–Continue with full-body massage with specific focus on normalizing and stabilizing firing patterns and connective tissue bind. Concern is expressed about forearm pain, and client is referred to trainer for reevaluation.

Session Five

S–Client reports that upper pectoralis area and abdomen are sore to the touch but not to movement. Right shoulder does not hurt to sleep on it. Sleep is again better and not as restless. Delayed-onset muscle soreness is better. Client reports that he is a little stiff around his shoulder until he warms up. Client continues to receive chiropractic adjustment for lumbar and sacroiliac joints.

O–Firing patterns for hip abduction and shoulder are normal. Hip extension and trunk firing patterns remain synergistically dominant. Hip flexors and shoulder abductors are strong and nonpainful at normal resistance. Right shoulder cannot sustain pressure as long as left. Gastrocnemius adherence and trigger point activity are decreased by 75%. Shoulder rotation has regressed to previous position, but pelvis remains stable. Performed general massage with inhibiting pressure to release scalenes, psoas, sternocleidomastoid, rectus abdominis, infraspinatus, teres minor, triceps, pectoralis minor, and deep lateral hip rotators. Performed passive range of motion of acromioclavicular and sternoclavicular joints bilaterally. Also inhibited hamstrings and biceps while resetting firing patterns. Used positional release on the tender points in the right forearm. Also used positional release on anterior serratus to improve ability to retract scapula. Specifically addressed fascial pliability in anterior and posterior thorax into iliotibial bands bilaterally primarily with kneading (bend and torsion force). Addressed shoulder and elbow through reflexology points on the foot and hand. Applied compression along meridians in arms and legs. Used indirect functional technique on shoulder rotation and right pelvic inflare.

A–Positional release effective for anterior serratus and forearm tender points except at right elbow medial epicondyle. Firing patterns are all normalized. Shoulder rotation improved again to within 10% of normal. Inflare improved slightly. Connective tissue bind decreased in thorax but remains in lumbodorsal fascia.

P–Continue with current plan. Again refer client to trainer for right elbow pain. Also encourage chiropractic appointments, core strength training, and rotator cuff and scapular retraction strength exercises.

Session Six

S–Client reports that he was restless for the last 2 nights and did not sleep well. He also feels like he is getting a cold. Preseason begins next week. Trainer continues to ice right shoulder and arm and is stretching shoulder, elbow, and wrist muscles. Core training began 2 days ago, and client is sore. He reports that he is in a bad mood.

O–Client again displaying an upper chest breathing pattern. Rib cage less mobile than typical for this client. Firing patterns are stable, but gait reflexes are not holding strong in the shoulder flexion/hip flexion diagonal pattern. Client not as cooperative as usual. General massage given to address lymphatic drainage, pain management, mood elevation, and parasympathetic dominance pattern, but no specific work targeted because of the cold.

A–Client falls asleep during massage and is groggy when he wakes up. Gave him some hot tea to drink. Also gave him eucalyptus and lavender essential oil to take home to inhale and rub on his chest. Did not perform post assessment.

P–Reevaluate: This was last session of 2 times per week schedule. Need to adjust treatment plan for once per week and to accommodate beginning of season.

Session Seven

S–Client has a cold, but it is not in his chest, just in his head. He indicates that he has a minor sore throat and sinus headache but feels better than last session. He would like more of the essential oil to take home. His shoulder is better as long as he continues to ice it. The trainer told him that he was pleased with the progress. The right forearm remains sore and tight. He is stiff and slightly sore from the core and rotator cuff and scapular retraction strengthening exercises, but it is better than it was. Client says he is not sleeping well. He believes it is a combination of the cold and muscle aching, and that he is anxious and excited about the season starting. He is frustrated that he does not feel like practicing hard because of the head cold and headache.

O–Assessment indicates posture is forward head and shoulder/pelvis rotation stable. Firing patterns are slightly synergistically dominant. Client appears sluggish. Session includes full-body massage with lymphatic drainage focus and headache sequence for sinuses, release of psoas and sternocleidomastoid, and addressing the diaphragm. Performed inhibition by compression on hamstring and biceps and deep lateral hip rotators and lateral shoulder rotators; and deep compression on serratus posterior inferior bilaterally (tender from sniffing). Mobilized facet joints with rhythmic compression and decompression of ribs. Massaged sinus, neck, and head reflex points on feet. Applied rhythmic compression to L1 and L4 acupressure points in hand. Continued to focus on parasympathetic dominance and restorative sleep.

A–Client reports headache is better. Firing patterns have improved. Client wants to take a nap. Did not do revision of treatment plan this session. Client is fatigued and wants to relax during massage.

P–Do reassessment and treatment plan revision next session.

Session Eight

S–Client reports that cold is better, but he still has a headache. He is going to be pitching in 2 days and asks for increased focus on his right arm. It has been sore but now is better.

O–Reassessment:

Forward head position is nearly normal.

Shoulder girdle right rotation is mild, and pelvic girdle left rotation is slight. Right leg external rotation has reduced to slight.

Arm swing still reduced on the left, but gait patterns are normal.

Internal shoulder rotation is limited by only 10%, which is acceptable. No pain occurs at end range of shoulder movement, but pain remains upon slight overpressure in the right shoulder.

Muscle strength testing is normal. Firing patterns continue to assess synergistically dominant but will correct easily, especially when obliques and transverse abdominis fire. Core training should continue to improve this situation.

Right shoulder at the area of bursitis is less point tender but continues to redden during drag palpation and remains slightly swollen.

Right forearm seems worse during persistent wrist flexion/extension, and there is point tenderness at the medial epicondyle.

Gastrocnemius trigger points have resolved, but mild fascial adherence remains in fascial planes. Fascial planes are more pliable but still bind. Upper chest breathing pattern is intermittent.

Overall Impression

The client has improved slightly to moderately in all target areas. Posture has improved, and antagonist/agonist patterns have balanced around the shoulder. Irritation on the bursae is reduced, and inflammation is improving and is responding to ice and antiinflammatory medication. Reduced shortening in flexion and rotational patterns is allowing the therapeutic exercise to be increasingly effective. The client has been fairly compliant but does display some symptoms of overtraining. Because the massage application thus far has been moderately successful for the original treatment plan goals, it would be prudent to continue and to add specific treatment for the pitching arm to attempt to reduce muscle tension and pain. A concern is that the arm is this dysfunctional, and the season is just starting. The shoulder is improving, but symptoms at the elbow are not improving. Although symptoms are not yet getting worse, the strain of competitive play may override current adaptive capacity. It would be best to speak with the trainer to coordinate a treatment plan to support performance during the upcoming session.

Results of conference with trainer: Client does have some form issues with his pitching style that worsened when he accommodated to the bursitis pain. The coaches are working now to adjust the pitching form. The bursitis is improving, and Darrel is encouraged.

Note: Not included in the chart was a discussion with the minor league coach indicating that Darrel will be called up within the next month. This information influenced the treatment plan in that the time frame is more urgent.

The trainer suggests that massage continue as before and that the flexor muscles in the right forearm should be kept loose. We agree that friction at the medial epicondyle is not appropriate at this time.

Session Nine

S–Client reports that he is feeling good. His shoulder hurts only a little after practice, and ice takes care of the pain. His forearms are tight, but he can deal with that. He continues to see the chiropractor once a week. He will be pitching in 2 days and is sleeping well.

O–Assessment indicates that firing patterns are stable. Hip extension is a bit hamstring dominant, and the rectus abdominis wants to fire during initial trunk flexion but inhibits easily, and firing patterns normalize. Right elbow extension is painful during the last 20 degrees of extension, and the forearm remains tense and binding. Point pain at the epicondyle has improved slightly. General massage protocol given with reflex application at left hamstring to reduce pain in right elbow extension. Also, biceps and triceps are inhibited. Worked on reflexology points in the foot for the shoulder and elbow.

A–All firing patterns and gait reflexes normal, with breathing slightly from upper chest. Client excited about season starting. Client reports that forearms feel looser and elbow is less painful. Reports that full elbow extension feels stiff at end range.

P–Continue with current massage plan.

Session Ten

S–Client reports that he pitched well. Shoulder was only slightly sore the next day. His low back hurts deep, especially when he sits for a while and then stands up. His legs feel heavy but not sore. His elbow hurts when extended, but he can deal with it. He will miss the appointment next week because of road trip.

O–Trunk flexion and hip extension firing patterns synergistically dominant, and gluteus maximus inhibited. Slight increase in shoulder/pelvic rotation pattern evident. Right forearm and shoulder slightly swollen.

General massage protocol performed with restorative/recovery focus: Applied indirect functional technique for shoulder and pelvic rotation; inhibited rectus abdominis, psoas, hamstring, and sternocleidomastoid; reset firing patterns; performed lymphatic drainage on right arm; provided positional release for tender point in forearm; and performed cross-directional tissue stretching of forearms and calves.

A–Firing patterns normalized, and low back pain resolved. Client slept for half of massage. Muscle stiffness in right arm better, but guarding and flinching remain at medial epicondyle tender points.

P–Next massage is in 10 to 14 days. Client will call. Continue with massage as in previous session. Gave client eucalyptus and peppermint essential oil combination for his arm. Also taught him how to use a roller to massage out his forearm and how to do positional release.

Note: Client called and is despondent. He pitched four games and blew out his elbow. He is on his way for surgery and will get a hold of me later.

The Rest of the Story

Darrel became dehydrated from excessive sweating. Potassium/sodium imbalance must have occurred, and his muscles cramped. The muscle pulled away from the medial epicondyle, and he tore his medial collateral ligament. The injury will be corrected with what is called Tommy John surgery. The muscles are reattached, and the palmaris longus tendon is used to reconstruct the medial collateral ligament. There will be a year of rehabilitation before the arm is healed completely.

The treatment plan will have to be revised to include postsurgical healing–acute/subacute/remodeling stages–along with the rehabilitation process. Darrel is depressed and angry but is determined to play again.

Massage will begin again about 1 week after surgery and will continue 1 to 2 times per week throughout the rehabilitation process. The massage approach will be similar to the previous 10 sessions, and as soon as the doctor and the trainer approve, scar tissue management will be incorporated.

The emotional state of the client is important to support healing. Energy-based modalities seem to support tissue regeneration and emotional well-being. Intentional and focused touch during massage needs to support well-being as well. Tissue regeneration; mood-elevating essential oils, homeopathy (particularly arnica), and magnets to support the healing process may be used. It would be wise for Darrel to see a sport psychologist during rehabilitation.

Finances are going to be a concern. Minor league players do not make a lot of money. The team will cover the surgery and rehabilitation costs and will pay Darrel's contract, but the massage therapist and the psychologist are not paid, and Darrel will have to find resources to cover these costs. Working with an athlete through an extended rehabilitation process is taxing and requires commitment. Boundary issues need to be monitored, and once the healing has taken place, the injury mentality of the client and the massage therapist must return to supporting performance. Many athletes will not return to preinjury performance and will have to come to grips with a career-ending event. Many traumatic injuries become chronic and require ongoing care.

For the reader: Although this is a hypothetical case, it is based on clients with whom I have worked. The person I modeled this case after did recover and played again in the minors. He was called up to the majors briefly but did not perform well. He was traded and played a while in the minors and then moved on with his life. Currently, he coaches high school baseball.

CRITICAL THINKING

1. Darrel is taking CELEBREX, a medication that has significant side effects, especially for certain populations. Based on Darrel's history, is there a concern about the medication side effects. What should the massage therapist do if anything?
2. Darrel has multiple firing pattern issues. It is likely that part of the reason for this is training effect; however, it may be prudent to begin to normalize the trunk firing issue. How would you justify this action?
3. Based on Darrel's complicated history, what would be a justifiable target for treatment goals, and why?
4. In Session Two, the calves and the forearms were worked with similar intensity. Why would this be an effective strategy?
5. In Session Three, Darrel's calves were sore, indicating that the intensity of the work in Session Two was inappropriate. What else in the SOAP note confirmed this?
6. In Sessions Three through Six, it appears as if only short-term benefits are occurring, and the client's body keeps fluctuating back and forth between symptoms. One area improves, and then something else gets worse, and so forth. Why do you think this is occurring?
7. At the point of reevaluation after Session Eight, Darrel has shown beneficial response to massage combined with medical treatment and the rehab plan of the training. Although the shoulder is improving, there is a concern about the elbow. Why?
8. Darrel's injury occurred because of multiple issues. What are they?
9. What is the potential for the occurrence of chronic pain for this client?

CASE THREE

TANIA—SOCCER PLAYER

Tania is a healthy 32-year-old woman and a recreational soccer enthusiast. Her two children play in local youth soccer programs, and she plays year-round in an indoor and outdoor league. She plays on a competitive women's recreational travel league and a coed home league. She also coaches soccer and participates in youth soccer camp. Tania played high school and college soccer. When she was in high school and college, soccer was just beginning to become popular in the United States. She has avidly followed the progress of amateur and professional soccer.

Tania is financially secure from an inheritance that she invested wisely. She is an accountant working part time. She uses the physical and competitive nature of soccer as a social interaction and for physical fitness and stress management. Tania has received massage for many years and wishes to continue weekly massage on a long-term basis as part of her wellness lifestyle. She is a sequential and logical person and expects results from massage that she can identify in a tangible manner. Tania is well educated about her sport. The anatomy, physiology, and approach of the massage must be presented to her in an analytic and scientific way. She has changed massage therapists often because they were not able to meet her expectations for pressure, focused outcomes, and symptom management for her active life. This is the third month (12 to 14 massage sessions) mark with her current massage therapist, and she is pleased with the results of the massage sessions so far. The treatment plan usually has followed the general protocol of this text with weekly focal areas indicated by Tania. Lately, she has had some pain around her pelvic bone. The pain is more of a nuisance than a constant pain. She has had osteitis pubis (pubalgia) before. She is a demanding but loyal client who has a weekly standing appointment at the office.

Overview of Client's Current Condition

Client has had various traumatic injuries since childhood. Both ankles have been sprained, but never a grade 3 injury. She had osteitis pubis in college that was slow to respond to treatment because she would not rest long enough. It eventually cleared up. She had similar symptoms during the last month of each of her two pregnancies and for about a month afterward.

Her pelvis is rotated anteriorly on the right and posteriorly on the left, with a tendency for shearing at the symphysis pubis. Sacroiliac joints occasionally fixate, but chiropractic adjustment is effective treatment. Gait reflexes, firing patterns, and range of motion are generally normal. They become disrupted if she has become fatigued; then she complains of heavy legs or an aching back. She consistently shows erector spinae dominance during right hip extension. Strength assessment is normal except for the gluteus maximus on the right. She has adapted to overexercise by maintaining a consistent core stability and flexibility program.

She takes various nutritional supplements intelligently and in moderation. She is not vulnerable to sport fads and gimmicks. She does not take medication regularly; however, she occasionally will use ibuprofen (MOTRIN) or naproxen (ALEVE) for headache or muscle aching.

Breathing function is good if she can play soccer consistently, but she will have upper chest breathing if forced to be relatively inactive. This rarely occurs, but when it does, she is irritable and usually gets a headache.

An area of point tenderness currently exists near the rectus abdominis inferior attachment on the right. It seemed to get more irritated after she attended a series of business meetings and wore shoes with a 2-inch heel. No regional or general contraindications are present.

Treatment Plan

Short-term goals: Address lower abdominal groin-type pain.

Long-term goals: Enhance sport performance and recovery. Reverse and stabilize pelvic rotation adaptation, and reduce firing pattern dysfunction.

Methods: General massage protocol with heavy broad-based pressure for serotonin and endorphin effects; indirect functional technique for pelvis; firing pattern correction.

Frequency and duration: Weekly standing appointment for 1½ hours.

Progress measures: Client-reported pain and satisfaction scale.

Session One

S—Client reports that she has been functioning well. Sleep, breathing, and soccer performance are satisfactory. She is bothered by tenderness in her symphysis area. She has been using ice but has not been taking any antiinflammatory medication. She requests her typical full-body session with attention to the sacroiliac joints and muscles attaching to the symphysis pubis.

O—Client displays typical pattern of pelvic anterior rotation on the right, posterior rotation on the left, slightly longer right leg, symphysis pubis shearing, and point tenderness. Left lumbar muscles are dominant for hip extension on the right, and the gluteus maximus is

CRITICAL THINKING

1 **What are the physical demands of soccer?**

2 **What is osteitis pubis (pubalgia)?**

3 **What are the concrete explanations of massage benefits?**

weak. In addition, there are kinetic chain–related tender points in the left pectoralis major, pectoralis minor, and coracobrachialis. The muscles on the left posterior shoulder are long but asymptomatic. Full application of the general massage protocol included the following: inhibiting pressure on rectus abdominis attachments at ribs and pubis; bilateral psoas release, with bilateral stretching of sternocleidomastoid; and inhibiting left lower lumbar with broad-based compression in shortest area, combined with left hip extension (with knee flexed) active movement.

Used positional release on tender points in left anterior shoulder area and indirect functional technique and sacroiliac joint mobilization to address pelvis.

A–Client reports that massage was effective. Point tenderness remains at symphysis pubis, but movement is not painful. Client indicates that she thinks she will see the chiropractor. Firing patterns normalized, but pelvis is resistant to mobilization. Indication of mild inflammation (heat and slight bogginess) present at muscle attachments at the right symphysis pubis. Only rectus abdominis actively tender to palpation, but right adductors took longer to lengthen than left adductors.

P–Client to see chiropractor, and massage is set for next week.

Session Two

S–Client reports that right sacroiliac joint was resistant to chiropractic adjustment and took three visits before it normalized. Leg length also normalized. She does not feel pain at the symphysis pubis unless she exercises or plays soccer while fatigued. She indicates that her adductors feel tight. Client is 2 days into menstrual cycle.

O–Adductors assessed are mildly short on the left and moderately short on the right. Consistent pattern is evident, as described in previous session. Client has some generalized edema as typical during the menstrual cycle. Left shoulder tender points are present but not as prominent.

General protocol with lymphatic drainage included the following: correct firing patterns, mobilization of pelvis, application of muscle energy (pulsed) to adductors with compression and lengthening, inhibiting pressure on rectus abdominis attachments and adductor attachments on the right, and application of compression on left anterior shoulder muscles with connective tissue stretching (active release).

A–Client reports she is tired but feels okay. Massage application effectively addressed assessment findings.

P–Suggest chiropractic adjustment this week, and expect to use same massage protocol pattern next week.

Session Three

S–Client had one chiropractic adjustment. Chiropractor is concerned about pelvic instability and symphysis pubis shearing. He prescribed some sacroiliac joint–stabilizing exercises. The right sacroiliac joint is most unstable. Chiropractor suspects that high heels destabilized the pelvic adaptive mechanism. Because the sacroiliac joint is stabilized in a force couple between the left latissimus dorsi and the right gluteus maximus, and because both of these muscles were assessed as weak, strengthening should help restabilize pelvis.

O–Confirmed chiropractor assessment. Left latissimus inhibited by upper trapezius and pectoralis major and pectoralis minor and coracobrachialis on the left. Gluteus maximus on right inhibited by short rectus abdominis and psoas. More focused assessment in relationship to high heels indicates short gastrocnemius/soleus with some binding and reflexive shortening in the forearms. General massage protocol with firing patterns, belly trigger point inhibition to short muscles, connective tissue stretching, psoas release, sternocleidomastoid release, and stretching of superficial fascia of left lumbar area.

Activated right gluteus maximus and left latissimus together, using pulsed muscle techniques, and lengthened and stretched psoas and latissimus bilaterally.

Did not do indirect functional technique or sacroiliac joint mobilization because client is under active chiropractor care.

A–Client reports that she feels off balance but believes it to be adaptive and will report back next session how long the sensation lasted. She is not playing soccer today, so she does not have to be at high performance. Firing pattern for right hip extension response improved.

P–Massage next week. Pay closer attention to right sacroiliac joint force couple.

Session Four (3 Days Later)

Client calls and requests a second appointment. Chiropractor noticed improvement and asks for the previous massage to be replicated.

S–Client reports that she agrees with chiropractor and wants same massage sequence as 3 days ago.

O–Repeat session as requested.

A–Client reported that she felt like she typically does after a massage. She responded well to the session.

P–Massage as previously scheduled.

Session Five

S–Client reports some aching in the sacroiliac joint area bilaterally but reduced point tenderness at symphysis pubis. Chiropractor is pleased with progress and requests similar massage sequence. Client has a mild tension headache.

O–Connective tissue bind in scalp appears related to occipitofrontalis shortening. Temporalis and masseter trigger points are found bilaterally. Repeat same massage sequence format as last two sessions plus tension headache sequence.

A–Headache improved but is not gone: 75% reduction in pain. Right sacroiliac joint force couple much improved. Point tenderness at rectus abdominis remains.

P–Next scheduled massage.

Session Six

S–Client sprained left ankle 2 days ago during soccer game: grade 1 sprain with outward rotation. Otherwise, nothing new to report. Client continues to see chiropractor 2 times per week but says appointments will begin to be reduced over next 4 weeks.

O–Mild edema, point tenderness, and muscle guarding are present in left ankle. Right hip extension firing pattern normal. Point tenderness at rectus abdominis attachments bilaterally slightly increased. Massage protocol used same as last three sessions, plus acute treatment for ankle sprain and addressing of kinetic chain pattern in relationship to left ankle (right lateral thigh, left lateral hip, right lateral lumbar, left lateral thorax, right lateral clavicle, left lateral head).

A–Client fell asleep. This is a rare occurrence. No noticeable change in ankle pain.

P–Session next week. Discuss proprioceptive training for ankle stability.

Session Seven

S–Client reports she played on the sprained ankle and experienced only mild discomfort. She has been keeping it wrapped and has been consistently icing it. She indicates that her left medial calf is tight and left hip is stiff. She also has a mild upper respiratory infection and a sore throat. When questioned about change in daily demands, she replied that the team she coaches is going to qualify for the playoffs, so there has been an increase in practices. When asked about her personal performance during games, she indicates she is a bit flat.

O–Left ankle bruised and mildly swollen. Kinetic chain compensation patterns include reflex shortening in the left gluteal area, right psoas, left latissimus, and right cervical area. Guarding remains in the left calf. Firing patterns are synergistically dominant. Client appears sluggish and displays overtraining symptoms. She is breathing with the upper chest. Massage followed general protocol with subacute treatment of left ankle, corrective firing pattern work, and breathing dysfunction strategies. Educated client about overtraining symptoms and proprioceptive exercises for her ankles (one foot standing sequence).

A–Client responded well to massage and realizes she is fatigued. This frustrates her. She indicates she will analyze her current workload, soccer playing, coaching schedule, and personal demands to see where she can reduce demand.

P–Massage next week.

Session Eight

S–Client is irritable, is cold and cannot seem to get warm, and has a headache. In response to questions about lifestyle demands, she is abrupt and says she is working on it.

O–Upper chest breathing is evident. Sympathetic autonomic nervous system is dominant. Left ankle is healing but a bit slowly. Full-body massage given with endocannabinoid/serotonin/endorphin focus: nonspecific broad-based deep compression, breathing dysfunction strategies, and subacute treatment of left ankle sprain.

A–Client's conversation indicates she is overloaded, has done this before, does not know why, and is concerned because she is impatient with the kids she coaches. As massage progresses and client relaxes a bit, she becomes introspective and quiet. She asks if I know of a good psychologist who understands athletes. I also suggested a complete physical to rule out an underlying medical condition.

P–Make referral to three psychologists. Massage next week.

Note: Client called and cancelled standing appointment, indicating she was having some medical tests performed.

Session Nine

S–Client reports that she has a mild thyroid deficiency, and she has begun taking thyroid replacements. She is still cold and cannot get warm. She is seeing one of the psychologists for a short-term behavior modification program. She has not made any significant lifestyle changes but is considering not continuing with the traveling team and concentrating on the home league. She requests the same kind of massage as last session because after the last massage, she felt more focused and less scattered for a few days.

O–Client less irritable and more relaxed. She appears fatigued. Breathing is slightly dysfunctional, and ankle is healing. Repeat last session and move to remodeling phase for ankle sprain.

A–Client dozes on and off during the massage. Breathing is slowed. Ankle seems somewhat hypermobile.

P–Encourage proprioceptive training for ankles bilaterally. Massage next week.

Session Ten

S–Client reports she is feeling better. The thyroid medication is helping. Left ankle is still a bit sore, but client is sore nowhere else. She says she is sleeping better but is a bit emotional at times, which is unlike her. She has no specific request for massage. She did not mention being cold.

O–No obvious postural deviations. Left calf continues to guard a bit. Knee flexion firing pattern on the left is synergistic dominant.

Full-body massage protocol with heavy pressure, parasympathetic focus, remodeling stage treatment of ankle sprain. Encourage proprioceptive training for ankles.

A–Client relatively calm. Ankle healing progress is more normal. Breathing normal.

P–Massage next week.

The Rest of the Story

This client did have to deal with some psychological issues around her intense focus on soccer. Although she continues to be a soccer lover, she did stop traveling with the recreational league and concentrated more on playing locally. She will occasionally overtrain but recognizes it and is somewhat more moderate in her activities. She undergoes a weekly maintenance- and performance-based massage because she appreciates the relaxation quality benefits and the performance benefits. Ankle hypermobility continues to be a problem, and the compensation patterns need to be managed each session. The team she coached did make it to the playoffs but did not win the championship.

She still coaches, and her kids enjoy playing soccer. She is observant of them becoming burned out and monitors their life to make sure there is an element of balance similar to that which she is learning herself.

CRITICAL THINKING

1 How is the anterior rotation of the right pelvis related to shoes with heels and the aggravated rectus abdominis tenderness?

2 From Session One to Session Six, Tania appeared to stabilize the pelvis. However, in Session Five, she indicated she had a headache, and there was connective tissue binding at the occipital base. At Session Six, she tells the massage therapist she sprained her ankle. How might this injury lead to more headaches?

3 Why is the fact that the client became ill at Session Seven not surprising, and how could this be related to the ankle injury?

4 At Session Eight, the client displays a definite downward turn in health status. How would the client's gender, age and symptoms suggest that a thyroid imbalance may be involved?

5 The ankle was sprained at Session Six. At that session, the massage was adapted to support the acute healing phase. In Session Seven, the ankle treatment was changed to a subacute approach. Why in Session Eight was a subacute approach still used?

6 The client asked for a referral to a sport psychologist specifically. What makes this a good choice on the client's part?

7 At the beginning of this case, the massage application was extremely focused on performance and musculoskeletal imbalance. How did the massage change as the client progressed to Session Ten?

CASE FOUR

JOE—FOOTBALL PLAYER

Joe is a professional football starting middle linebacker.

Note: Football is the primary sport in which I work. Physical and mental demands of this position are huge. I have worked with many linebackers, and among them I have seen the most injuries. The player, Joe, who is described in this case study, is representative of a multitude of football players with whom I have worked. The composite player history is realistic even though it sounds exaggerated.

Joe is 28 years old and is in his sixth year of professional football. He has been with two NFL teams. He also played high school and college football. His history includes the following major sport injuries:

- Right anterior cruciate ligament tear, and surgical repair successful except for lingering aching behind the knee
- Grade 3 right shoulder separation that was not repaired surgically and remains somewhat lax, but rehabilitation exercises provide sufficient stability. The shoulder aches on occasion.
- Two severe episodes of turf toe
- High ankle sprain on the left
- Slight bulging disk at L4 that has an acute episode about once a year
- Loose body removed from the left knee
- Hyperextended left elbow with a stress fracture in the olecranon process. This injury healed successfully, but it reduced range of motion in the elbow, which does not affect professional playing but it bothers him just because it is different from the right elbow.

Currently, Joe has some traumatic arthritis developing in his left ankle. Because his permanent home is in a location different from the location of the team for which he plays, he receives massage only during the season. He gets a massage at least once a week, and as the season progresses, the frequency increases up to every other day when possible. In this case, Joe is beginning training camp and the seasonal massage program.

Goals for the massage: Support recovery, manage chronic pain, and enhance performance. Massage on Tuesdays is at Joe's residence at 9 PM after the children have gone to bed (if all goes well). He has a 4-year-old daughter and a 2-year-old son, and his wife is expecting their third child in 6 months. They also have two dogs that are always in the massage area. The family stays with him during the football season in a small condo near the stadium. This is the third year working with Joe. Joe usually falls asleep during massage.

CRITICAL THINKING

1 What are the demands of Joe's football position?
2 What are the stress demands of the family in relationship to the work stress, including celebrity status?
3 What treatments are used by the athletic trainer to manage the cumulative football traumas?
4 What are the limits of performance and the cautions for massage from the bulging disk?
5 What are the specific demands of training camp?

Current Analysis of Condition

The client has participated in the off-season conditioning program and in two preseason minicamps. He has returned to begin training camp, and the family will follow in about 2 weeks. He has received a series of three massage sessions in preparation for training camp. Because of the camp schedule, he will be able to receive massage only periodically. When the season begins, the regular schedule will begin.

History Update from Last Year

No new events are occurring in Joe's life other than expecting the new baby. He has been participating in a yoga stretching program on his own, and the strength and conditioning coach has increased the focus of functional core training.

Despite the cumulative injuries, Joe indicates that he feels better beginning this season than he did last season. He tried to get massage when he was home but was disappointed in the pressure levels. He felt beat up, poked, dug on, overstretched, and over–trigger pointed, or the massage was too superficial. He has found that the yoga program helps with stamina and flexibility.

He has begun to take glucosamine and creatine.

Physical Assessment

Knee extension firing pattern is bilateral vastus lateralis dominant. Knee flexion on the right is gastrocnemius dominant. Hip extension is hamstring dominant but improved from last year. Guarding is present in erector spinae and multifidus around bulging disk, with sacroiliac joint bind on the left and slight anterior pelvic rotation bilaterally. Left elbow reduced range of motion remains constant with hard end-feel. Left ankle dorsiflexion is only 10%, and rotation has crepitus.

Joe has gained about 10 pounds. His tissues are a bit boggy and taut (creatine). Gait reflex assessment indicates that shoulder extensors do not inhibit hip flexors, and shoulder and arm abduction does not inhibit hip/leg adduction. However, hip adduction responds correctly to head and eye moved into flexion (strong) and extension (inhibited).

Increased tissue density is noted with some fibrosis identified in lumbar fascia, upper trapezius bilaterally, biceps, triceps, and forearms bilaterally. Joint capsule area of both knees is binding.

Breathing is normal for this client, with mild upper chest breathing tendencies.

Client is sleeping well for the most part. The kids get into bed with him in the middle of the night occasionally, and this disturbs his sleep.

Session One

S–Client leaves for training camp tomorrow and asks for a full-body session addressing everything. He would like to take a nap and asks for the massage to be done on the mat, where he is more comfortable. He requests extra time on ankles, feet, hamstrings, and gluteus.

O–Assessment is as previously described. Provided full-body protocol with generalized lymphatic drainage. Used pattern for sleeping client 2½-hour massage (client uses restroom once and goes right back to sleep).

A–Client reports that he feels great and is ready to go. Discuss with him the effects of creatine, and ask him to discuss with trainer. Remind him to take his arnica (homeopathic remedy).

P–Will see him on his next day off. He will call.

Session Two (8 Days Later)

S–Client is sore everywhere: Legs are heavy and skin feels fat; low back and left ankle are stiff; and hamstrings are tight bilaterally. Client requests a mat, a nap, and work on feet and head.

O–No specific assessment done because client is fatigued. Palpation indicated edema in tissue, with delayed-onset muscle soreness. Therapist assumes all firing patterns and gait reflexes are off. Massage incorporated general support for normal function using general protocol, lymphatic drainage, and sleeping client strategies.

A–Client feels less stiff and achy and wants to go to bed.

P–Wait for call.

Session Three (10 Days Later)

S–Client is tired and irritable, tending to display electrolyte and dehydration cramps. He had a mild heat exhaustion episode 3 days ago. He just wants a good massage and does not want to talk or participate. He wants to go to sleep and wants massage on mat but does not want to lie on his side. Because his low back is achy, he wants bolstering under the abdomen. He does not want a sheet drape because he is hot, so the plan is to cover him up when he gets cold and let him sleep after massage.

O–General protocol focused on parasympathetic dominance; support of serotonin, endorphin, and oxytocin release; pampering; and sleep, following suggestions for sleeping client. Incorporated energetic modalities and essential oil (lavender).

A–Client falls asleep almost immediately and is asleep when I leave.

P–Wait for call.

Session Four (10 Days Later, Day after First Preseason Game—Client Played First Half)

S–Client has a thigh bruise and low back pain. He is happy with performance, and family arrived for the game. He wants good, all-over massage and has only 1½ hours.

O–General massage protocol to include psoas, quadratus lumborum, and sternocleidomastoid releases; correction of hip extension firing patterns; use of sacroiliac joint mobilization pattern; broad-based compression on legs and arms (knees and feet used to provide compression) with movement by the client; and lymphatic drainage performed on bruise. Massage performed on mat.

A–Client is in much better mood and is less fatigued. He responds well to massage.

P–Will call.

Session Five (12 Days Later—Camp Breaks Next Week)

S–No new conditions. Client is fatigued and wants all-over treatment on mat. Asks to be left asleep on the mat after massage.

O–Mild fibrotic development is occurring in thigh bruise area. Use kneading to increase pliability. Identified mild upper chest breathing patterns. Corrected lower body firing patterns: hip abduction/extension, knee flexion/extension, and shoulder. Did not assess gait reflexes. Palpate heat and mild edema in both knees, left elbow, and ankle. Client fell asleep.

A–For fibrotic tissue, increased pliability by 75% before becoming too hot to continue work. Edema improved by 50% around affected joints. Breathing is more normal.

P–Begin weekly sessions.

Session Six (Game One)

S–Client reports he is satisfied with performance. His back is stiff, and his feet and ankles hurt. He wants general massage with attention to low back and feet. He jammed third finger on left hand. He asks for some essential oil: eucalyptus and lavender. Client found his arnica after losing it for 2 weeks. Massage is done on the mat. Okay for family to watch a movie with him during the massage.

O–Hip extension firing pattern and trunk flexion are synergistically dominant. Psoas short, and there are trigger points in lumbar multifidus and gluteus medius bilaterally. Anterior pelvic rotation increased on right. General massage: Released psoas and stretched sternocleidomastoid. Increased pliability in lumbar fascia 50%. Used indirect functional technique and joint play on jammed finger. Performed indirect functional technique to correct pelvic rotation with symphysis pubis reset. Some adhesion exists between gastrocnemius and soleus on the left, so used shearing and torsion to release bind. Used kneading and stretching for plantar fascia, which is short and binding. Addressed tenderness around large toes with joint play.

A–Client feels fine. Range of motion increased in left ankle by 5%, but did not treat trigger points, which seems to be resourceful adaptation for sacroiliac joint function. Will monitor.

P–Requested client to have trainer assess sacroiliac joint function. Massage next week.

Session Seven (Game Two)

S–Client reports sacroiliac joint is fine and that he went to trainer, who sent him to team chiropractor for adjustment. He banged the shoulder that had the previous injury. The shoulder is sore and stiff, and he cannot raise his arm easily.

O–Acromioclavicular joint on the right is binding. When addressed with indirect functional technique, client reported a pop at sternoclavicular joint, and afterward, area can move better. Trigger points remain in gluteus medius and lumbar multifidi: treated with inhibition pressure and local tissue stretching. General massage protocol given, and client fell asleep.

A–Left client sleeping on mat. Clavicle seems to be displaced, but return it to normal joint play with indirect technique. Will need to monitor response to trigger points because sleeping client gave no feedback.

P–Next week, assess for trigger points.

Session Eight (Game Three)

S–Nothing new: Client requests, “Patch me up so I can play again and again and again.” Low back is improved.

O–Trigger point activity remains, but not as point tender. Lower body appears to move in labored manner when gait is observed. Client is off balance during one-leg standing, more on the left: Left hip adductors are short. Adduction firing pattern is not inhibiting when appropriate. Client has bruise on left hip. General massage: Performed lymphatic drainage over bruise. Corrected adduction firing pattern and used contract/release stretch on adductors.

A–Client is steadier on feet during one-leg standing.

P–Massage next week.

Session Nine

S–Client has a concussion from game last Sunday. He has a headache and a sore and stiff neck and is fatigued. He will be evaluated pregame to see whether he can play. The doctor is holding him out of practices. Client requests a calming massage, something for the headache. He asks for essential oils, so used peppermint and lavender and provided rescue remedy. He reports that he has been taking arnica.

O–Client is holding head rigid, and upper body is stiff during walking. His eyes seem to track well, but his movements are slow and deliberate. Ability to balance on one foot is diminished, and he can maintain it only for 3 to 5 seconds.

General massage: focused on parasympathetic dominance; avoided oscillation and instead used tension headache strategies but with reduced pressure and duration; incorporated energy-based modalities.

A–Client indicates headache a bit better, but neck remains stiff. His balance seems better.

P–Massage next week.

Session Ten (Client Calls for a Massage Early on Thursday)

S–The only concussion symptom that remains is a headache, and the doctor thinks it may be from muscle tension in client's neck and requests that client get a massage before evaluation on Friday. Target is upper body stiffness, but with caution about abrupt movements of the neck and head.

O–Client is a bit irritable and more sensitive. (He yells at his children, which he seldom does.) Upper body remains rigid, and movement is cautious. General massage incorporated positional release for upper body stiffness as requested. Used tension headache strategies and had client apply gentle pressure to eyeballs (with his eyes closed) while rolling eyes in slow clockwise and counterclockwise circles to balance eye muscles. Assessment identified upper chest breathing pattern. Used breathing dysfunction strategies.

A–Client is able to stand on one foot for 25 seconds on left and 40 seconds on right. Reassessed for abduction firing pattern on left. Quadratus lumborum is dominant. Trigger point located in tensor fasciae latae. Quadratus lumborum released with gentle stretching of scalenes by inhibiting pressure and direct tissue stretch on scalene trigger points. Reassessed and right leg increases for one-foot standing to 45 seconds.

P–Adjust massage next session based on whether client plays or continues to have postconcussion symptoms.

The Rest of the Story

This client was held out of the game to prevent the possibility of a repeat injury. He had never had a concussion before, but the physician was cautious. His symptoms dissipated over the next 2 weeks, and he played as the starter for the season. He continues to play in the NFL.

CRITICAL THINKING

1. Joe indicates he is taking creatine. Because creatine may cause water to be drawn away from other areas of the body and into muscle tissue, what might palpation reveal? And what should the massage therapist be aware of during massage sessions?
2. Joe has a complex injury history. What if any massage modifications need to be considered because of the variety of injuries?
3. Mat work allows large clients to sprawl out and be less confined. What are positives and negatives for the massage therapist when working on a mat?
4. During Session Two, the massage therapist assumes all firing patterns and gait reflexes are off and need attention. Is the massage therapist justified in making this assumption? Why or why not?
5. In Session Six, how is Joe's stiff back related to altered firing patterns?
6. Any concussion is a serious condition. Cumulative concussions pose a risk for future problems related to brain damage. If you were going to work with this client long term, what would be signs that possible postconcussion issues are occurring?

CASE FIVE

EMMA—FIGURE SKATER

Emma's mother has been a client for years to manage chronic back pain and headaches. Emma's mother now wants to include regular massage for Emma as part of Emma's figure skating training program. Emma has had various falls and a grade 1 ankle sprain, but nothing serious. She is stiff and achy in the mornings. Emma is 13 years old.

Assessment

Observation. Emma is a small, compact adolescent. She is beginning to mature but has not yet had her first menstrual period. Some emotional tension between mother and daughter is observable.

Interview and Goals. During the interview, there were minor disagreements between mother and daughter. These centered around scheduling and accuracy of information. Mother and daughter agree that massage would be beneficial. The most current complaint is that Emma is stiff and achy in the mornings. She finds it difficult to get up and to concentrate in school for the first couple of hours.

Emma's training schedule is intense, and when asked about the possibility of overtraining, both denied this as a possibility.

Goals for the massage are to reduce stiffness and aching in the morning and to support recovery from training and competition.

Physical Assessment

Posture is typical for this type of athlete. Emma has moderate lordosis and mild anterior hip rotation bilaterally.

Gait is normal except for a slight tendency to bear weight on the balls of the feet instead of on the heel during heel-strike phase.

Passive joint movement indicates general tendency to joint laxity. The muscle tone provides the most joint stability.

Palpation assessment identifies taut skin and reduced soft tissue pliability. Whether this is primarily fluid retention or changes in ground substance density or both is unclear. Muscles palpate the same way. Tendons and fascial sheaths are taut but pliable. Identifying individual muscle layers or moving surface structures over underlying tissue is difficult.

Ligaments and joint capsules are lax. Joints are hypermobile. The pelvis has a bilateral anterior tilt. Breathing appears normal.

Muscle strength assesses strong body-wide. However, firing patterns and gait reflexes are disrupted. Hamstrings are dominant for hip extension; gluteus medius is dominant for hip abduction. Lower abdominal muscles are slow to fire. Gait reflexes are normal during contralateral patterns but do not inhibit appropriately in unilateral patterns. At this point, whether this is a training adaptation response is unclear.

Symptoms of being achy and stiff are mostly related to possible fluid retention and ground substance density.

Quantitative Goals

Reduce tissue tautness from increased fluid retention and decrease ground substance density about 50%, or until stiffness and aching in the morning are minor.

Quantifiable Goals

Support training protocol and recovery so that client is able to sustain current training and competition intensity. This goal depends on the possibility of overtraining syndrome. Should training intensity need to be reduced, massage will support recuperation.

Treatment Plan

Client will receive 1-hour massage 3 times per week for 2 weeks to normalize fluid balance and shift connective tissue density.

Client will be reassessed for benefit. If benefit is observed, massage frequency will be reduced to 2 times per week for 2 more weeks; this will be followed by reevaluation. If benefit is sustained, then massage would occur 1 time per week with additional sessions as needed.

Massage will follow general massage protocol with lymphatic drainage and connective tissue methods. Rotation of the pelvis and gait and firing patterns will not be addressed specifically but will be monitored and any changes noted and compared with any noted increase or decrease in performance.

Because the client is a minor, a parent will be present during the massage session. Because the reason for the fluid retention is unclear, the client is requested to receive a checkup from the physician before massage begins.

Report from the doctor indicates hormonal changes consistent with onset of menstruation. The doctor is concerned about client's body fat ratio, which is low, and signs of fatigue. The doctor suggests a 5-pound weight gain, an increase in essential fatty acids (i.e., fish, eggs, and olive oil), and more sleep. The doctor approves of massage as presented in the treatment plan.

Session One

S–Client reports that she is stiff and achy in the morning as usual. She is not sleeping well and does not think she needs to put on weight or reduce training intensity. In fact, she has been trying to lose several more pounds.

O–Assessment finding from previous intake remains consistent with assessment this session, with added indication of upper chest breathing. Mother and daughter

CRITICAL THINKING

1 What is the cause of the fluid shift?

2 Is the client displaying overtraining syndrome?

3 Are the changes in reflex patterns an appropriate adaptation to training?

4 How is inherent joint laxity required for this sport countered by muscle tone and tension?

squabble a bit, and then mother ignores daughter and reads a magazine. Massage was full-body approach with focus on lymphatic drainage with minimal use of connective tissue methods. The intention is to address fluid first and then address remaining stiffness with connective tissue strategies. Strategies for breathing pattern disorder are used during the massage.

A–Client relaxes toward the last 15 minutes of the massage, as indicated by breathing shift to more relaxed breathing function. The calves are much softer to the touch, and the client identifies increased ankle flexibility.

P–Massage in 2 days; repeat sequence.

Session Two

S–Client reports that ankle flexibility lasted about 1 day, and then she woke up feeling stiff again. She did sleep better. Mother reports that Emma is not eating the way the doctor recommended.

O–Fluid retention has returned, as has upper chest breathing tendency. Client is irritable. Repeated lymphatic drainage in context of general massage and included strategies for breathing. Asked client where she feels most stiff: She indicated calves, hamstrings, and neck. Introduced connective tissue kneading into these areas.

A–Client reports that she liked the kneading and she feels much looser. She is less irritable. Tissue texture is less taut and dense. Breathing is normalized.

P–Alter massage application to include fluid and connective tissue methods. Massage every 2 days.

Session Three

S–Client reports that she felt less achy and stiff the morning after the massage, but it came back the next day. She says she feels fat and stiff. She also indicates that she does not like eating the fattening food. Her father is with her during the massage.

O–Client has some edema in lower legs and hands. Her abdomen is a bit distended. She has developed a mild acne breakout on her shoulders, which disturbs her. When questioned, she thinks it is caused by eating the extra fat.

A–Client reports feeling better and indicates that her breasts were sore when she lay on her stomach. She says she still feels fat.

P–Massage in 3 days.

Session Four

S–Client participated in a regional competition and performed well. She continues to complain about feeling fat. Mother and daughter argue a bit about the diet. Client also indicates that her left glutes feel tight.

O–Left gluteus medius is short and tight. Left adductors are also short and tight. Tender point is found in belly of gluteus medius. Breathing is normal. Emma has slight edema in extremities. Lower abdomen is slightly distended. Client feels as if she has lost weight. General massage involved the following method: lymphatic drainage and connective tissue; kneading body-wide; positional release of tender point at left gluteus medius; and contract-relax-antagonist-contract and lengthening of adductors bilaterally. Increased massage focus on reflex areas of right deltoid and bilateral pectoralis major and latissimus dorsi.

A–Client reports that she feels better–like she always does–and her glutes feel better. She can stand on that leg and maintain balance without pain.

P–Suggest that massage sessions be reduced to 2 times per week because tissue density is normalizing. Mother and Emma agree. Monitor the client's weight, and refer back to physician if continue to notice changes.

Session Five

S–Client reports she had mild stomach flu. Mother thinks it was a 24-hour food poisoning. She threw up and had diarrhea for 24 hours and then did not eat much the next day. Emma indicates that she feels better than she has in weeks. She is less stiff in the morning and does not feel fat.

O–Client's tissues palpate as dense but not taut. There are mild indications of dehydration, but this seems reasonable considering the intestinal episode. Client and mother reported she is drinking enough water. Client appears and feels thinner. General massage with connective tissue focus.

A–Client reports that she feels great and really likes the massage where her tissues are twisted. It makes her feel like she has been stretched all over. Client is encouraged to stay hydrated to support connective tissue pliability.

P–Session in 4 days. Emma's weight loss is a concern.

Session Six

S–Client reports that she feels great and wants the same massage. She also indicates that her training has been going well. She is preparing for a big competition in 6 weeks. Mother is encouraged but is somewhat concerned about Emma's erratic eating.

O–Client appears and feels thinner. The tissue palpates as pliable with localized areas of bind and density. General massage is given with connective tissue focus, especially in local areas of density. Used indirect functional technique on binding tissue (ease and bind).

A–Client reports feeling flexible and calm. She indicates that she enjoys the massage and wants to keep coming. She just knows it helps her. She wants to continue 2 times per week until the competition in the regional finals next week. Discussed with mother concerns about weight loss. Mother indicated that Emma resists eating the foods recommended by the doctor. Provided a pamphlet on disordered eating in female athletes. When asked if Emma has experienced her first period, the mother replied no, although she really thought it was going to happen several weeks ago.

Explained to mother that it is common for there to be a few months where all premenstrual symptoms are present but the actual period does not occur. She agreed that many of the symptoms seem to be premenstrual related.

P–Session in 3 days. Continue massage as applied in a condition management/recovery process.

Session Seven

S–Mother reports she caught Emma throwing up. Emma says that something she ate made her stomach hurt and she felt better after she threw up. This is a major development indicating the tendency toward disordered eating. Made it clear that Emma must see the doctor before the next visit and suggested that the mother speak with Emma's various coaches and dance teacher.

O–Emma is sullen and appears thin. Her tissue pliability is good, and there is no obvious indication of fluid imbalance. Spot check of muscle strength does not indicate weakness. There are some hangnails on fingers and toes, and abrasions that had occurred just before the last session are healing slowly. Client is upset with her mother and the massage therapist. She just lies there during the massage and is uncooperative. Gave general massage with kneading as client enjoys. Did not attempt to engage client in conversation.

A–Client would not respond to post-assessment questions.

P–Massage in 4 days only if Emma has seen the doctor.

Session Eight

S–Mother reports that Emma has lost 7 pounds since her last visit to the doctor. Her body fat has dropped below the recommended ratio for females. The doctor is concerned about normal sexual development and bone density. Emma is reporting to the doctor weekly. If she continues to lose weight, she will be referred to a psychologist who specializes in disordered eating for the athlete. At this point, there are no limitations on activity. Continued massage is recommended.

O–Client is sullen and a bit defiant. She will not respond to assessment questions and indicates that she is tired, has a headache, and wants to go to sleep. General massage to reduce connective tissue density with focus on mood regulation and relaxation was provided. Included tension headache strategies in the massage.

A–Client reports that her headache feels better, and then she starts to cry. She tells us that one of the girls in her gymnastics class has been teasing her about her "big boobs and butt." She felt so much better after the "flu" a couple of weeks ago that the next time she felt fat she made herself throw up. One of the girls she trains with told her how to do it. Because she felt better afterward, she did it a few more times until her mother caught her. She has been performing well and is afraid that if her body continues to change, she will not be able to make her jumps. She is sorry she has been mean.

P–Suggest that massage continue on a weekly basis, and that Emma and her parents have a good talk with the doctor and coaches. Emma likely would benefit from education on body changes during adolescence. Also recommend at least some short-term intervention with a sport psychologist who understands eating disorders.

Session Nine

S–Client reports she has maintained her weight and would like the usual massage (connective tissue pliability focus). She has a bruise on her right forearm from a fall but otherwise feels pretty good. She saw the psychologist once, likes her, and reports that she is a skater too.

O–Contusion on forearm is large and discolored. Breathing normal. Tissue density has somewhat increased, with mild fluid retention in extremities. General massage performed with connective tissue focus: lymphatic drainage targeted to extremities and contusion.

A–Client reports that she feels good but a little fat. Explained that fluid retention does make the skin feel taut or "fat." This is not really fat, but water. Young women have fluid fluctuation because of hormone shifts. It is natural.

P–Massage again in 4 days.

Session Ten

S–Client reports she gained ½ pound, but she thinks it is muscle and that is good. She indicates that her breasts are bigger and tender. Her bruise is better, but she jammed her right big toe in dance class. Her father came with her to the session.

O–Client's posture and muscle firing and gait pattern remain consistent. Likely cause is a training effect adaptation. Bruise is improving and is soft. Right toe has reduced joint play. Used general massage with connective tissue focus and indirect functional technique/joint play on right large toe. Performed lymph drainage in the anterior chest area. Explained that tender breasts are part of the hormone changes she is experiencing.

A–Client reports a clicking sound in her toe when she moves it around and that it feels better. Her breasts are still tender.

P–Massage after 3 days.

The Rest of the Story

Obviously, this case describes development of a potential eating disorder and the role of the massage therapist in such a situation. Emma did experience her first menstrual cycle about 3 months after the last recorded session and went through an accelerated growth phase. Emma currently is going to college and is skating in various entertainment productions. She did not achieve her goal of going to the Olympics.

CRITICAL THINKING

1 Emma is only 13 years old. What are potential concerns when working with an adolescent?

2 Physical assessment indicates postural change typical for a figure skater training effect, underlying joint laxity, reduced tissue pliability, potential fluid retention, and gait and firing pattern disruption. Which of these is most easily affected by massage? What methods would be used? Which methods should be avoided?

3 The treatment plan involves a dosing (how much massage) plan that begins with frequent sessions that over 1 month are reduced to once a week. What is the benefit of such a plan? What are the problems?

4 It is apparent in Session One that there is potential concern about the client's weight and training intensity. In Session Two, concern about a potential eating disorder was coupled with tension between mother and daughter. Upper chest breathing was increased. What is the connection? How does this concern the massage therapist?

5 Why do you think Emma likes kneading methods?

6 Why do the hang nails and slowed healing time indicate a problem?

7 What is the connection between the level of body fat, the onset of menstruation, and the client's emotional state? Of what concern is this to the massage therapist?

CASE SIX

JAMAL—BASKETBALL PLAYER

Jamal is a 20-year-old rookie basketball player. He is a point guard. It is the second week of training camp. He reports to the trainer that he aches all over and has some cramping in his hamstrings and calves. The leg cramping goes away with increased hydration and ingestion of electrolytes. Jamal has been referred to the team massage therapist for management of delayed-onset muscle soreness. The trainer for this team is especially good and very well respected. He expects all treatment to be preapproved and his treatment requests to be followed exactly.

Assessment

Observation. Jamal is emotionally pumped up but seems fatigued. His movements are generally a bit stiff. He keeps trying to stretch out while talking. Jamal displays upper chest breathing and is talking fast; the exhale is shorter than the inhale.

Interview and Goals. When asked how well he is sleeping, Jamal reports that he is tossing and turning and cannot get comfortable. His history indicates high ankle sprain on the right during his freshman year of college, when he stepped on a fellow player's foot and then rolled forward. He had a grade 2 groin pull on the right the last year he played college ball, but the injury was not basketball related. He got hurt while demonstrating martial arts kicks when he was not warmed up (he was goofing around and showing off a little). Both injuries healed well, but the groin continues to get stiff. He has to keep the area stretched out, or he feels the pulling. He has been playing basketball since he was a little kid. He played well in high school, received scholarships to college, and was drafted by the NBA. Nothing unusual is disclosed in the history form, except a recent tendency toward constipation. On a pain scale of 1 to 10, he says he feels like a 12.

His goals for massage are to reduce the aching and stiff feeling and to enhance his athletic performance. The trainer's goal is management of delayed-onset muscle soreness. Contacted trainer asking to include approaches for constipation; this was approved.

Physical Assessment

Posture: Appropriate for basketball positional demands.
Gait: Slightly reduced stride on the right.
Range of motion: Abduction of leg on the right is reduced by 10% compared with left leg and has a binding end-feel. Elbow and knee flexion bilaterally are reduced slightly because of soft tissue approximation (muscle tissue bumping into itself). *Note:* Most basketball players are muscular and toned but structurally long and lean. Point guards, however, may be more muscular and compact because of positional demands.

Palpation

Near touch: Client is generally giving off heat.
Skin surface: Generally damp with axilla, feet, and hand sweating.
Skin: Generally taut.
Skin and superficial connective tissue: Binding at clavicles, which may interfere with lymph flow. Tissue in general feels dense but boggy.
Superficial connective tissue: Dense.
Vessels and lymph nodes: Difficult to palpate because they seem buried in tissue.

Muscles: Muscle tone is appropriate for training effect. General tone is increased from when client was first seen a month ago, indicating a response to training effects during training camp. Gluteus maximus is short and tight bilaterally.

Tendons: General tenderness at musculotendinous junction in phasic (movement) muscles of arms and legs. Mild binding of Achilles tendon on the right.

Fascial sheaths: Mild binding during superior and inferior movement in sheath that runs from cranial base to sacrum and continues down iliotibial band into calves. Bind also noted in abdominal and pectoral fasciae.

Ligaments: Normal.

Joints: Aching increased with traction, indicating soft tissue as primary causal factor. Joints of the feet are especially sore. Right tibia is slightly externally rotated, which is consistent with history of high ankle sprain. Knee is asymptomatic.

Bones: Normal.

Abdominal viscera: Abdominal muscle development makes palpation difficult; appears normal, with some fullness over descending colon.

Body rhythms: Fast upper chest breathing pattern.

Muscle Testing

Strength: All muscles test strong, but excessive synergistic recruitment is evident.

Neurologic balance: Generalized hypersensitivity is evidenced by fast, jerky contraction pattern and inability to contract muscles slowly.

Gait: Normal, but inhibition pattern for arms is slow to engage (it takes a few seconds for muscles to let go).

Interpretation and Treatment Plan Development

Clinical Reasoning. The profile for this client is common for most training camp or early season situations. It does not seem to matter what the sport or level is–high school to professional. Basketball, track and field, football, soccer, baseball, rowing, rugby, lacrosse, horseback riding: The sport does not matter. What is important to note is that training camp, or the first few weeks of any intense training and conditioning program, is not the time to introduce massage for therapeutic change. The adaptive capacity of the body is maxed out. The goal is to manage symptoms and help the athlete sleep.

As described previously in this text, delayed-onset muscle soreness is a complicated response to increased physical and muscular activity demands. Soreness can be local or generalized, depending on the activity. Remember, although the term *delayed-onset muscle soreness* would indicate a muscle problem, the situation more likely involves the circulatory, lymphatic, and autonomic nervous systems and breathing functions. Simple delayed-onset muscle soreness in local areas may result when a muscle moves repetitively in eccentric contractions, as do rowers, or in sustained isometric contraction as in motocross. Inflammation occurs along with possibly some microtearing of muscle fibers. Inflammatory mediators (primarily histamine) are released during physical activity, capillary permeability is increased, and interstitial fluid accumulates, causing simple edema. Increased fluid pressure in the tissue stimulates pain receptors, making the person feel stiff and achy.

Metabolic by-product (not lactic acid) buildup from exercise irritates nerve endings as well. Increased muscle tone can result in pressure on lymphatic vessels, interfering with normal lymphatic flow and further stressing the lymphatic system. In addition, increased sympathetic arousal, which is part of athletic function, especially in contact sports, increases arterial pressure and blood flow.

If normal expansion in the capillary bed of the muscle is restricted because of increased motor tone and muscle tone and connective tissue thickening, more plasma flows out of the capillaries but cannot return, requiring the lymphatic system to handle the increased interstitial fluid volume. When the body is in a sympathetic state, the ground substance of the connective tissue thickens to provide increased resistance to impact. This process should reverse itself when arousal is diminished and parasympathetic dominance takes over, but often with athletes, arousal levels do not reverse and connective tissue remains thicker, placing pressure on pain receptors and contributing to stiffness. The combination of fluid pressure and connective tissue thickening makes the tissue feel taut and dense. More complex patterns result, with sustained sympathetic arousal. Upper chest breathing patterns and a tendency for breathing pattern disorders are common and perpetuate the underlying sympathetic arousal.

Management of this condition requires reduction of any muscle tension (both muscle and motor tone increase) interfering with circulation and lymphatic flow, mechanical drainage of interstitial fluid and support for arterial and venous circulation, reduction of the sympathetic arousal pattern, and an increase in ground substance pliability. Massage must be accomplished without adding any inflammation to the tissues and without straining adaptive capacity. Friction or use of any other methods that would cause tissue damage is contraindicated.

Delayed-onset muscle soreness is to be expected in planned training programs. Each sport, in this case basketball, places specific demands on certain movement patterns. It is essential that massage applications support the training effect and not interfere with it. Although symmetry in form is ideal, specific sport demand causes hypertrophy in certain muscle groups, and body-wide compensation occurs during a normal training regimen. This has to be considered during assessment and application of massage.

This particular client/player is displaying symptoms of combined delayed-onset muscle soreness and sustained sympathetic arousal. His breathing is appropriate to training activity but is not reversing during down time; therefore, his sleep is disturbed and he is constipated. Tissues are fluid filled, with thickened ground substance, making the tissue feel dense. Connective tissue binding is also occurring in the back and in the groin, especially on the right, and in the chest in the area of the right and left lymphatic ducts. Reduced abdominal movement caused by upper chest breathing and overdeveloped abdominal muscles (primarily rectus abdominis) does not support movement of the lymph within the abdominal cavity. Muscle strength, with synergistic recruitment and slow response to inhibition patterns, can be attributed to overtraining and sympathetic arousal, which are especially common in rookie athletes who are trying hard to be really good performers.

The client likely is excited about being in professional basketball and is trying to prove himself in camp, which contributes to the sympathetic arousal. (*Reader note:* Be aware of the psychological implications of performance anxiety here, and how so many of these symptoms are physical manifestations of it.)

In combination with the athletic trainer's support and proper hydration, massage can be focused to achieve the following:

1. Reduce sympathetic arousal.
2. Soften the connective tissue ground substance.
3. Increase lymphatic flow.

The massage likely will help but needs to be done in the evening, before the client goes to bed. This will make scheduling difficult.

The player must stay hydrated, and increased urine production may awaken him at night, interfering with sleep. If the massage intervention is too intense, he may be sluggish the next day, and his performance will be compromised.

With general nonspecific massage, sleep should improve; this would reduce the recovery time. Reflexes should be more appropriate, and coordination and timing should improve, which supports performance. With reduced sympathetic arousal, constipation should be reduced.

Training personnel referred the client; therefore, they are supportive. The player has had massage before and liked it but is worried about anything that could affect his performance. The massage therapist feels that it is important to deal with the situation but does not enjoy beginning massage at 9:30 PM. The player is likely to respond to the nurturing and to notice a reduction in anxiety.

Treatment Plan

Quantitative Goals

1. Reduce pain sensation to a tolerable 5 (on a scale of 1 to 10).
2. Ease feelings of stiffness by 50%.
3. Normalize breathing.
4. Normalize elimination.

Qualitative Goals. The player will be able to perform at or near optimum levels and will be able to participate in all training activities without excessive soreness.

Treatment Regimen

Daily massage will be given for 5 days just before bed for 45 minutes. The frequency then will be reduced to 2 times per week. Lymphatic drainage and circulation enhancement massage with rhythmic, broad-based compression deep enough to spread muscle fibers in all muscle layers and to increase serotonin and endogenous opiate (endorphin) availability will be provided. Application of all methods should not create any inflammation and should not alter the training effect. The focus will be on reduction of sympathetic arousal and normalization of muscle and motor tone, reflex patterns, and fluid dynamics in the body. Limited use of myofascial release in the binding tissue of the back, groin, and chest, along with controlled used of kneading, primarily to squeeze out the capillary beds and soften the ground substance, is appropriate. Abdominal massage to encourage peristalsis, with a specific focus on the large intestines to move fecal matter, is indicated. Breathing, muscle tone, fluid retention, firing pattern, reflexes, and sleep patterns will be monitored as indicators that the player is responding to massage.

Session One

S–Client reports he is sore and tired. Trainer wants massage to target fluid retention and sleep.

O–Client's tissue palpates as taut. Skin is warm around knees and ankles. He continues to breathe with the upper chest. Full-body lymphatic drainage is the general approach, with attention to breathing pattern strategies.

A–Client has to get up twice to use restroom. He falls asleep on the massage table and then immediately goes to bed. Tissues palpate less taut after massage.

P–Repeat massage tomorrow.

CRITICAL THINKING

1 **What are the demands of basketball training camp?**

2 **What is the trainer's understanding of, and expectation for, therapeutic massage?**

3 **What are the performance demands of a point guard?**

Session Two

S–Client reports that he was a little less stiff in the morning but still feels like a truck hit him. His low back hurts. Called trainer for permission to address low back pain. Trainer's instructions are to work only surface tissues for symptom management and to use a counterirritant ointment.

O–No change in assessment findings. Low back pain is common in training camp. Repeated lymphatic drainage and breathing strategies and applied broad-based compression to lumbar and sacroiliac joint area.

A–Tissue tautness again is reduced. Client reports being less stiff and that low back feels better.

P–Repeat massage tomorrow.

Session Three

S–Client reports increased constipation and headache. Breathing is improved, and he is sleeping better. He is feeling less stiff and achy.

O–Client's abdomen palpates as constipated. Trainer has given him a laxative. Modify massage to the general protocol with limited focus on connective tissue. Concentrate on ease and bind and general kneading. Add abdominal massage for constipation and vascular headache strategies.

A–Client went immediately to the restroom after massage and stayed there a while. Indicated that he would see me tomorrow.

P–Massage tomorrow: Reassess firing patterns.

Session Four

S–Client has a large abrasion with bruising on left knee. He reports that he is feeling better and his practices have been good. He definitely is not constipated.

O–Reassessment of firing patterns indicates synergistic dominance for hip extension and shoulder flexion. Tissue texture is more pliable. Knees are warm to the touch. Breathing is slightly from upper chest. He talks a lot during the massage. General massage protocol is nonspecific and avoids left knee.

A–Client is excited about his performance. There is a preseason game in 2 days, and he wants to do really well. Chose not to address the firing patterns directly because he is doing well in practice. Will continue to monitor.

P–Last sequential massage occurs tomorrow; then sessions will be reduced to twice a week. This will be his last massage before the preseason game. Will switch to pre-event format.

Session Five

S–Client indicates that he feels good. He asks for a massage like the one yesterday.

O–Only minimal assessment is performed. Use pre-event strategies. (*Note:* This is not the time to identify deviation from the norm, which may make client nervous about ability to perform.) Used full-body general massage with no specific focus.

A–Client says he feels great.

P–Massage in 3 days, after event. Need to reassess how to massage in context of response to game activity.

Session Six

S–Client performed well in the game. He is sore in general but not stiff. He indicates that his chest feels tight. His nose is stuffed up.

O–Client appears a bit sluggish. These are definite sinus symptoms. The abrasion on his knee is healing a bit slowly, indicating strain in adaptive capacity. He has a contusion on his left shoulder. General massage has post-event focus, with added attention to sinus congestion, and essential oil mixture of eucalyptus and peppermint provided for him to rub on his chest.

A–Client really likes the smell of the essential oil. (*Note:* Use of essential oils was preapproved by trainer.) He feels sleepy even though peppermint is a bit of a stimulant.

P–Massage in 3 days again will be a pre-event situation.

Session Seven

S–Client has a cold with a sore throat. He feels a bit feverish.

O–General relaxing massage.

A–Client is a bit discouraged. Explained that a cold is common at this point in the season.

P–Massage in 4 days: post event.

Session Eight

S–Spoke with trainer about status of player. He indicates that Jamal is coming along well in spite of the cold. There is some indication of overtraining syndrome, but this is common and should settle down once the actual season starts. He asks if two sessions a week were still necessary. Indicated that it may be best to not change the schedule on Jamal at this point. Two sessions per week is typical for this type of training intensity. He agrees. Client indicates that he is feeling better but still is stuffed up with a mild sore throat. Explained again that this is not uncommon with this type of training intensity. He indicates that his neck feels tight, and he has a spot in his back that is really tight and sore.

O–Assessed for shortening in posterior serratus inferior because client has been sniffing and coughing: General shortening is evident; the neck area is generally short. Abrasion and contusion are healing, so applied lymphatic drainage over contusion and subacute strategies for wounds on abrasions. Provided general massage with broad-based compression on posterior serratus inferior, with added muscle energy methods, by instructing the client to sniff and cough while the compression was applied to create post-isometric relaxation. Then applied direct tissue stretching. Used muscle energy methods and eye position activation to reduce tension in neck muscles. Taught client how to roll on a tennis ball to relieve back symptoms.

A–Client reports that his back is much better and his head is not as stuffy. Asks for more essential oil mixture.

P–Massage in 3 days with pre-event focus.

Session Nine

S–Client is feeling better. He reports that he could not find his tennis ball and rolled around on his deodorant bottle instead. He said it worked but the area felt a little bruised. Explained that the tennis ball should be squished a little when used to apply compression, so the tissue does not feel bruised. The deodorant bottle was a good option but does not squish, and so the compression is a bit heavy. Gave him another tennis ball. He says his ankles and feet ache.

O–The client's cold is improving, and he looks healthier. Some shortening in upper chest fascia. Posterior serratus inferior is still short and a bit tender to the touch. Provided general nonspecific massage with myofascial release (ease/bind) on anterior chest, provided direct inhibitory pressure on gluteus medius trigger point (belly location) with reflex massage stimulus to right deltoid and extra attention on ankles and feet, specifically targeting joint movement and range of motion.

A–Client is sleepy and not communicative. He gives little post-assessment feedback. Gluteus medius trigger point released, but it seems like compensation. Palpated increased tone in hamstrings but did not specifically address this.

P–Massage in 4 days with post-event focus.

Session Ten

S–He just wants a massage.

O–No special assessment today: General protocol recovery massage.

A–Client falls asleep during the massage. Goes right to bed.

P–Shift to season schedule next session.

The Rest of the Story

This client continues to play in the NBA. He was traded two seasons later and has played for four other teams. He has stayed relatively injury free. He continues to get regular massage, asking for recommendations from fellow players at each team with which he signs. He is now pushing 34 years old and is beginning to feel the adaptive strain, even though he has not had a major injury. He has been a reliable player, never a star, and has had to develop an inner peace over this situation. He would like to stay in the NBA for 15 years, which would make him around 35 when he retires and moves on with his life.

CRITICAL THINKING

1. The trainer is supportive of massage but wants to be in charge. Is this an appropriate action? How would you be in compliance with the request?
2. Training camp is a common part of team sports where the team gathers together to work toward getting ready for competition and securing positions on the team. It is an intense time that begins with the assumption that the athletes are fit and ready to pursue performance. How would this affect the massage treatment plan?
3. The massage application is primarily general full-body massage. Why?
4. At Session Seven, the client has a cold, a sore throat, and a fever. Why is this a common occurrence?
5. In Session Eight, Jamal asks for essential oils. Why would he like using essential oils?
6. In Session Nine, a compensation pattern appears to be developing. What might be occurring?
7. In Session Ten, the client indicated that he just wanted a massage and then went to sleep. What is occurring?

CASE SEVEN

MORGAN—CHEERLEADER

Morgan is a 16-year-old female cheerleader. She has been involved in dance and gymnastics since she was 5 years old. She fell during a routine and sprained her right ankle and knee. The deltoid ligament on the lateral aspect of her right ankle received a second-degree sprain when she landed on the outside of her foot. Her leg tangled in a fellow cheerleader's leg, resulting in a grade 1 sprain of the lateral collateral ligament of the right knee. She was on crutches for a few days until she could bear weight on her foot. Appropriate first aid was administered, and follow-up medical care included external stabilization and passive and active movement without weight bearing to promote healing with pliable scar tissue formation. Weight bearing has been allowed for the past 5 days. It has been 10 days since the accident. The client's mother cleared the massage with her doctor, who supports the intervention to manage some of the compensation from using crutches and to promote healing of the injured area. The client complains of neck, shoulder, and low back stiffness and pain. Antiinflammatory and pain medications were used for the first 3 days and then were withdrawn because these medications can slow healing. The client is generally in good health but has a history of various sprains and strains. This particular ankle was sprained last year. She sprained her left wrist when she was 10 years old.

Assessment

Observation. The client is limping slightly. Discoloration is evident around the ankle but not the knee. The ankle still appears swollen, but the knee looks normal. The client fidgets during the interview. Her mother is concerned but not overbearing, letting the client answer most questions and adding information where pertinent. The right ankle is wrapped with an elastic support.

Interview and Goals. The history notes multiple sprain injuries and a tendency for generalized hypermobility. The client hopes to participate in a cheerleading competition in 2 months. Her mother is more realistic, thinking it will be at least 3 months before the ankle is strong enough for competition. The client complains of being stiff all over. No unusually pertinent information is indicated on the history form.

The client's goals for the massage are to support healing of the injured ankle and knee, to reduce the general stiffness, and to reverse the compensation from limping and from use of crutches.

Physical Assessment

Posture: Client is not fully weight bearing on the injured leg. Her posture is very good except for a slight lordosis and hyperextension of her knees, which is common in gymnasts.

Gait: Limited by limping, pain, and sense of instability.

Range of motion: Client is generally hypermobile, most likely because of training effects from dance training, gymnastics, and cheerleading.

Palpation

Near touch: Heat is detected at ankle and knee injury sites and in the shoulders.

Skin surface: Drag and dampness are present in areas of heat. Bruising surrounds area of ankle injury.

Skin: Smooth and pliable.

Skin and superficial connective tissue: No areas of bind noted.

Superficial connective tissue: Connective tissue is resilient. Localized swelling remains at lateral right ankle.

Vessels and lymph nodes: Normal.

Muscles: Muscles feel elastic but generally shorter in the belly, especially the calves, hamstrings, and adductors. Trigger point activity is evident in the belly of the adductors, hamstrings, and quadriceps in the injured leg. Supraspinatus, upper trapezius, and pectoralis major and pectoralis minor are short bilaterally, with tenderness in the axillae where the crutches contact. Psoas is short bilaterally. Muscles of the right leg have increased tone, most likely because of normal guarding of the injured joints. Quadratus lumborum and the gluteal group on the left are tender to moderate pressure. A very tender area near the musculotendinous junction of the lateral head of the right gastrocnemius palpates like a grade 1 muscle tear.

Tendons: Tendons in the muscles of the right leg are tender to moderate pressure.

Fascial sheaths: Resilient but seem too long.

Ligaments: Generally loose.

Joints: End-feel is not identified until joints are in hyperextension. Increased joint play is noted in major mobility joints.

Bones: Normal.

Abdominal viscera: Normal.

Body rhythms: Normal.

Muscle Testing

Strength and neurologic balance: Muscles test normal except for those guarding the injured knee and ankle, which is expected. These muscles are displaying increased tone and are not inhibited as expected. Left quadratus lumborum is firing before tensor fasciae latae and gluteus medius.

Gait: Disrupted by limping and crutches. Flexor patterns in the arms are facilitating together instead of following contralateral patterns. Flexors and extensors of the left leg do not inhibit when tested against the arms.

Interpretation and Treatment Plan Development

Clinical Reasoning. Ligament sprains and muscle strains are common injuries and are diagnosed as slight (first degree), moderate (second degree), or severe (third degree). When a joint is sprained, it is common to have strain in the muscles that are extended during the injury. Protective spasms around the tear (tiny microtears to more severe tears) act to approximate (bring torn fibers together to support healing), protect, and guard the area. In general, all muscles that surround the joint increase in tone to stabilize and reduce movement. This should dissipate as the injury heals but can become chronic, limiting range of motion in the area. It is important to not stretch muscles that are torn in the acute and early subacute phases of healing. Protective spasm (guarding) is intense and painful in first- and second-degree tears. If a total breach of a muscle or tendon occurs, there may be little pain.

First- and second-degree injuries are more painful and have a greater tendency for swelling than third-degree injuries.

Ligaments begin to be repaired immediately, and the inflammatory response is an important part of this process. Some inflammatory mediators are vasodilators that help blood reach the ligaments. This is important because ligaments do not have a good blood supply. Muscle tears (strains) heal much more easily because of the high vascular component of the tissue. It takes 3 to 6 months or longer for a grade 2 sprain to heal fully. Repeated injury contributes to ligament laxity and joint instability.

Sprains are common in persons with joint hypermobility. Hypermobility can occur in only one joint that has a recurring injury, or it can be more general, appearing in most joints of the body. Some disorders (e.g., Marfan syndrome) are characterized by lax connective tissue. Most ligament laxity is functional, such as increased range of motion required in many sports or dance activities. Once the plastic range of a ligament has been increased, it does not return to the previous range but remains long and lax. Joint play is increased, and instability results.

The client fits this profile. She likely will remain hypermobile, with increased compensating muscle tone to provide stability. This situation leads to general stiffness, especially if activity is reduced. Depending on the degree of laxity, the client may find that stretching does not reduce muscle tightness because joint end-feel and longitudinal tensile force do not occur until the joint is hyperextended or reaches an anatomic barrier.

The client's gait changes seem to arise from the use of crutches. Because the injury is recent and crutches are no longer used, gait dysfunction should reverse easily with massage and general activity.

Low back pain may stem from a dermatome distribution, referring back from the knee, combined with posture changes from limping and using crutches. The tendency for low back pain may be present because the client's psoas muscles are short.

Interventions

1. Massage can support the healing process in acute, subacute, and final healing stages by increasing circulation to the area, maintaining normal and appropriate muscle tone, and supporting mobile scar formation.
2. Referral for diagnosis of suspected muscle strain is recommended.
3. Referral to a physical therapist or an exercise physiologist for a sequential strengthening program is indicated for the vulnerable joints.

Massage intervention would have to be long-term to meet the client's goals and would have to be combined with an incremental treatment plan for current acute and subacute healing stages.

Cost and time are factors, and the mother or the father needs to be with the client during each massage because she is a minor.

The client has unrealistic healing expectations and likely will be frustrated with a 6-month intervention plan.

Decision Making and Treatment Plan Development

Quantitative Goals

1. Generalized stiffness reduced by 75%.
2. Reverse compensation from use of crutches.
3. Support for circulation and mobile scar formation in injured areas.

Qualitative Goals. The client will be able to resume normal daily activities, but not sports activity, in 2 weeks, and can resume limited cheerleading activities within 6 weeks, as well as full use of the area in 6 months.

Treatment Regimen

Condition Management/Therapeutic Change. Condition management consists of two phases. Therapeutic change is phase three.

- *Phase one: early subacute–current.* One-hour massage will be provided 3 times for the first week. Full-body massage will be used to support circulation and reverse muscle tension in the shoulders and chest caused by the use of crutches. Specific application of gliding will be used along the sprained ligament and associated strained tendons in the fiber direction of the muscle and toward the injury to help align the scar tissue. Lymphatic drainage in swollen areas will support healing. Passive range of motion with rocking and gentle shaking of all adjacent joints will encourage mobility and healing in the injured areas.

Ongoing ice application will encourage circulation as a secondary effect of the cold. Injured areas would benefit from ice application for 20 minutes, 2 or 3 times a day.

CRITICAL THINKING

1 What are the performance demands of dance, gymnastics, and cheerleading?

2 What are the current treatments for joint laxity?

3 Is age a factor in joint laxity?

Session One

One-hour massage according to treatment plan for phase one.

Session Two

One-hour massage according to treatment plan for phase one.

Session Three

One-hour massage according to treatment plan for phase one.

Reassessment. Client reports that she does not have shoulder aching, but her low back still aches. Generally, she feels less stiff. Client can bear weight on the injured ankle with no pain but experiences pain if she rotates the ankle. The knee remains tender to medium pressure but does not feel unstable when walking. The client's physician does not believe that there is a tear in the gastrocnemius.

- *Phase two: subacute phase to remodeling.* Ice applications will be valuable for 1 or 2 more weeks. Massage applications will be provided for full-body sessions, twice a week for 4 weeks. Very gentle gliding across the fiber configuration of the tissue will support mobile scar formation. The intensity of gliding and of cross-fiber friction on the injured tissues will increase gradually as healing continues. Trigger points and general tone in the muscles that are guarding will be addressed with muscle energy methods, lengthening, and broad-based compression. Kneading can restore the pliability of the connective tissue ground substance. The area of the gastrocnemius will be treated with caution because it remains tender even though the doctor did not think it was strained. No deep pressure will be used, but localized stroking across the grain of the muscle can support mobile scar formation. Because self-stretching is not effective without moving into hyperextension patterns, the client's muscle tissue can be stretched and lengthened manually during massage with compression and kneading that introduce bending and torsion forces into the soft tissue. Psoas muscles can be lengthened by muscle energy methods and psoas release. Core training is encouraged. Hypermobility is the main issue, and although massage can manage the symptom of muscle stiffness, the reason for these conditions is the body's attempt to provide stability. The client really needs a comprehensive therapeutic exercise program. Massage will proceed with caution to minimize discomfort without reducing stability.

Session Four

Notes: Client reports no new conditions and is feeling better in general. Massage is given according to the phase two treatment plan.

Session Five

Notes: Client is just beginning menstrual cycle. Massage follows phase two treatment plan with more emphasis on lymphatic drainage and no psoas release.

Session Six

Notes: Client is just ending menstrual cycle. Resume phase two treatment plan with no psoas release, but use muscle energy and stretching to address the achy low back.

Session Seven

Nothing new to report. Continue with massage as outlined in treatment plan for phase two. Performed psoas release.

Session Eight

Notes: Client is doing well. Continue with treatment plan for phase two.

Session Nine

Notes: Last session for phase two. Will reassess next session and begin phase three.

Reassessment. Regarding posture, client is fully weight bearing on the injured leg but is not participating in sport activity. Lordosis and hyperextension of her knees remain, but achy low back has improved. Gait is no longer limited by limping, pain, and sense of instability.

Client generally is hypermobile; this seems to be the underlying cause of injury potential. Massage is not the best modality for reversing this condition, although massage is excellent for helping short and tight structures become longer. Massage is also excellent for helping taut, dense structures become more pliable, but massage is not particularly effective in addressing long, lax structures. Client needs some sort of therapeutic exercise program with massage as the secondary modality.

Trigger point activity continues to occur in the belly of the adductors, hamstrings, and quadriceps in the injured leg. This recurrence is likely a stabilizing function. Psoas is short bilaterally. Point tenderness is absent or is substantially reduced body-wide after massage, but within a week, the postural muscles are short again.

Connective tissue structures are resilient but seem too long, with most ligaments being lax.

No change occurs in end-feel, which is not identified until joint is in hyperextension. Increased joint play continues to occur in major mobility joints. Firing patterns are normal. Gait reflex is normal.

- *Phase three: therapeutic change.* Six months of weekly full-body massage will be provided. Once healing of the injury is complete, underlying hypermobility can be addressed. Systematic frictioning can be applied to lax ligaments to introduce therapeutic inflammation and to encourage increased connective tissue fiber formation. This will be applied to the injured lateral collateral ligament and deltoid ligament, as well as to remaining connective tissue–stabilizing units of the ankle and knee. This must be done in small increments, and the area should not be excessively painful the next day. Pain to the touch with moderate pressure is appropriate, but there should not be pain with movement. This is a painful intervention and needs to be done frequently. Teaching a family member to perform the technique is appropriate. Antiinflammatory drugs should not be used, nor should ice be applied to the area, because the goal is creation of controlled inflammation to encourage collagen formation. Full-body massage with direct tissue stretching should continue. At the end of the 6-month period, the frequency of massage intervention could be reduced to a maintenance schedule of every other week. The client will be encouraged to maintain a strengthening and stretching program and to reduce exaggerated joint movements to support restabilizing of the joints.

Session Ten

Begin phase three. Client is resistant to frictioning, and the compliance potential is not good. Resume general maintenance massage to support a therapeutic exercise program. Teach ankle stability activity, that is, standing on one foot and drawing the alphabet with toes.

The Rest of the Story

Clients with this condition are difficult to treat with therapeutic massage. Massage is great for lengthening short tissue but is not good at shortening long tissue. Hypermobility results in stiffness only because the muscles are trying to stabilize the structure. Massage is difficult because as soon as the muscle relaxes a bit, the client has increased instability. Massage is much better in a support role to manage symptoms of the appropriate therapeutic exercise program. This client struggled because strengthening activities reduced her flexibility a bit, interfering with her performance. Because she was so performance-driven, she did not maintain the strengthening program but did continue with weekly massage. She continued to sprain the same ankle over and over and eventually tore her anterior cruciate ligament.

CRITICAL THINKING

1. The client has a right ankle and knee injury and complains of neck, shoulder, and low back stiffness and pain. Justify a full-body massage approach.
2. The client is 16 years old, has had multiple sprains, and is hypermobile. What is the expectation that massage can be an effective treatment for this client?
3. Referral to a physical therapist or an exercise physiologist for a sequential strengthening program is part of the treatment plan. Why?
4. The first three sessions were charted as follows: One-hour massage according to treatment plan for phase one. Is this appropriate?
5. The client has unrealistic healing expectations and likely will be frustrated with a 6-month intervention plan. Is there any other approach to the treatment plan that the massage therapist could use or suggest that would shorten expected healing time?
6. Session 10 represented the shift to phase three therapeutic change using deep transverse friction in an attempt to increase joint stability by causing local inflammation and an increase in connective tissue formation. The client is resistant. Is there enough potential for benefit to force the issue with the client?
7. This client eventually tore the anterior cruciate ligament. How might ongoing ankle sprains be a contributing factor?

CASE EIGHT

JULIA—MARATHON RUNNER

Julia is a 22-year-old competitive marathon runner. She is currently training for a marathon. She is determined to commit herself to the best performance possible. As an amateur athlete, she coordinates her own training program. She works with a running coach. She had a first-degree ankle sprain 2 years ago, experiences generalized cramping if she overtrains, and had one experience of shin splints. These symptoms improve if she drinks enough water or sports drinks and stretches. She occasionally gets side stitches. She is a student of the sport and is constantly studying the effects of diet and training protocols to enhance her performance. She is interested in incorporating massage into her program to support recovery and flexibility and to reduce the potential for injury.

Four years ago, Julia lost her left leg below the knee in an automobile accident. She has rehabilitated successfully and has been fitted with a running prosthesis and a prosthesis for general use. She is on a mission to prove to herself and others that she can accomplish this task.

Julia is a college student, studying exercise science and athletic training. Finances are secure as a result of an insurance settlement from the accident. She has determined that she can afford $150 per month to pay for massage and wants the maximum benefit from the investment.

Assessment

Observation. Julia is a slim, muscular, fit woman. Unless she is observed carefully, there is little evidence of the amputation. She does not attempt to conceal the prosthesis and speaks freely about the accident. She is more concerned about total body performance than the loss of the leg.

Interview and Goals. The client information form indicates minor muscle pain related to training. Julia experiences mild episodes of phantom pain, usually in response to an increase in training. Pain is managed with rest, massage of the stump, and stretching. Her calf gets tight, she had shin splints in her right leg 8 months ago, and she sprained her right ankle 2 years ago.

Julia has occasional fatigue and restless sleep if she overtrains or experiences the phantom pain. She has athlete's foot and currently is being treated for that. She takes performance-based supplements that encompass a well-balanced formula.

Julia's goal for massage is to gain support for a training regimen to enhance performance and help prevent injury.

Physical Assessment

Posture: Symmetric except for highly developed thigh muscles, with increased development on the left and a slightly elevated iliac crest on the left.

Gait: Normal with the prosthesis, except for increased arm swing on the right. She indicates that she underwent extensive rehabilitation to support normal gait after the amputation.

Range of motion: Normal.

Palpation

Skin surface: Damp areas are noted at the amputation site and on the medial calf on the right. No areas of inflammation, abrasion, or skin irritation from the prosthesis are noted.

Skin: Smooth and resilient; small area of bind is noted just under right clavicle in the chest.

Skin and superficial connective tissue: Normal.

Superficial connective tissue: Small bind and increased tissue density in the legs.

Vessels and lymph nodes: Normal.

Muscles: Normal with hypertrophy in legs. Decreased pliability with slight increase in density and shortening of hamstrings. Tenderness and pain radiate to three areas on the stump—two in the vastus lateralis, and one in the vastus medialis—indicating trigger point activity.

Tendons: Normal except for some shortening in right Achilles tendon.

Fascial sheaths: Plantar fascia is slightly short on the right.

Ligaments: Normal.

Joints: No evidence of inappropriate end-feel or bind. Slight decrease in dorsiflexion on the right.

Bones: Normal.

Abdominal viscera: Normal.

Body rhythms: Normal.

Muscle Testing

Strength: Normal.

Neurologic balance: Normal.

Gait: Higher degrees of facilitation between extensors and flexors on right arm and left leg seem appropriate compensation for amputation.

Interpretation and Treatment Plan Development

An understanding of the basic physical concepts involved in exercise and training protocols is important for a massage professional who works with athletes in conditioning, performance enhancement, and injury rehabilitation. To increase a sustainable power output, the athlete must follow a carefully designed training program that will improve the individual's ability to (1) produce metabolic energy by aerobic and anaerobic means; (2) sustain aerobic energy production at high levels before lactic acid accumulates excessively in the blood; (3) recruit more of the efficient slow-twitch muscle fibers in muscle groups used in competition; and (4) become more skillful by recruiting fewer nonessential muscle fibers during competition. Running a marathon requires more than 10,000 repetitions of the running steps and a continuous supply of energy via metabolic mechanisms dependent on the availability of oxygen (aerobic metabolism).

The athlete should get adequate rest—7 to 8 hours of sleep per day. A nap is beneficial.

The athlete should allow 24 hours between exhaustive training sessions to allow for total replenishment of depleted glycogen stores in the muscles before the next training session. Otherwise, the quality of the next training session may be compromised because the athlete's muscles will be depleted easily of one of their main fuels. In addition, training intensity and duration should be reduced gradually during the week before a competitive event, so that the athlete's energy reserves are fully loaded before competition.

Shin splints, side stitches, plantar fasciitis, muscle cramps, muscle strains, dehydration, and hyponatremia can quickly make running a painful experience.

Cramping of the abdomen or the side is called a *side stitch*. Several theories attempt to explain what causes this pain: a spasm or cramp in the diaphragm muscle, diminished blood flow as a result of excessive muscle contraction and dehydration, and/or micronutrient imbalance. As with shin splints, the best preventive measures are to stretch and increase flexibility and to drink plenty of fluids, such as diluted (50% water) sports drinks. One way to ease the pain is to ease the running pace. When cramping begins, the athlete should slow down and place the arms above the head until the pain subsides.

Recovery is the process that the athlete goes through to return to a state of performance readiness. Recovery involves restoration of nutrient and energy stores, return to normal physiologic function, reduction of muscle soreness, and disappearance of the psychological symptoms associated with extreme fatigue (irritability, disorientation, inability to concentrate). In training, this allows the quality of the workout to be maintained while minimizing the risks of chronic fatigue, illness, and injury. In competition, it means being able to take part in the next round or event and to perform at the same or at a higher level.

Julia is in good physical condition, with minor changes that seem appropriate compensation for amputation and use of the prosthesis.

Trigger point activity in the leg with the amputation may be causing the phantom pain. An aggressive training program may be contributing to fatigue and muscle aching.

Massage is indicated for support of sports training programs. Massage can facilitate fluid exchange in the muscles, manage symptoms of delayed-onset muscle soreness, and maintain appropriate pliability in soft tissue structures. Massage can help reduce trigger point activity in the client's left leg, support restful sleep, and encourage well-being.

Quantitative Goals

1. Reduce by 50% episodes of phantom pain.
2. Reduce by 50% post-exercise aching.
3. Increase sleep effectiveness to support recovery time.

Qualitative Goals. Julia should be able to participate in training program with minimal discomfort.

The massage will be a performance-based, full-body application and will be structured to meet the daily needs of the training regimen. Frequency is once per week with additional sessions if necessary. The massage will support rather than seek to change compensation patterns in gait in response to the amputation because overall posture and performance are good.

Trigger points will be addressed through a variety of methods, and results will be monitored to see if phantom pain episodes decrease. The massage will be scheduled in the evening, so Julia can go to bed afterward. Sleep will be supported through encouragement of parasympathetic activation.

Appropriate methods that affect the neuromuscular/connective tissue and fluid dynamics of the body will be chosen each session. Julia requires various levels of pressure, from very light pressure for lymphatic drainage to deep pressure to address the muscles of stabilization in the layer closest to the bone. The therapist will take care not to increase inflammation in any area. Julia will inform the massage therapist what she wants each session. Ongoing extensive assessment is not necessary because Julia knows her body and will determine what she needs.

Session One

S–Client requests general recovery massage–no specific intervention.

O–Full-body massage is given.

A–Client indicates that she is fine and will be able to provide more information next session.

P–Session in Week 2: recovery based.

Session Two

S–Client reports that she was satisfied with the results of the massage as provided last week. She would like a bit more attention to her foot; otherwise, repeat the session.

O–Full-body massage is given with increased attention on the foot.

A–Client reports she has seen results with the massage.

P–Session in Week 3: recovery based.

Session Three

S–Client reports that she had a difficult night with some phantom pain. Requests that the stump be assessed and treated for trigger point activity and other causal factors.

O–Observation identified an area on the stump that is warm and a bit discolored like a bruise. Client informs that there seemed to be a fit problem with her prosthesis, and she will be getting it checked. Provided only general massage to the area because mechanical irritation is likely a causal factor. Used full-body massage: recovery based, with lymphatic drainage on the irritated area of the stump.

A–Client reports that she feels fine.

P–Session next week. Remember to ask about the cause of the phantom pain and tissue irritation.

Session Four

S–Client reports that the prosthesis needs some minor fit adjustments. She has had only minor discomfort that is getting better. She requests same massage as previous sessions.

CRITICAL THINKING

1 What are the performance demands of running a marathon?

2 What are the various prostheses for below-the-knee amputation?

3 What are the rehabilitation processes for the amputation?

O–Full-body massage: recovery based.
A–Client had minor firing pattern issue in shoulders that was corrected easily. Client indicated that she noticed freer shoulder movement.
P–Session next week.

Session Five

S–Client requests recovery massage with attention to some aching of her knees and requests additional attention in this area.
O–Vastus lateralis is observably dominant during knee extension. General full-body massage is given with addition of strategies for knees, especially inhibition of vastus lateralis, and appropriate vastus medialis obliquus firing is encouraged.
A–Firing pattern normalized. Client reports that she is pleased thus far with the massage.
P–Session next week.

Session Six

S–Client reports that all is fine. Requests full-body recovery massage.
O–Full-body massage given with focus on recovery.
A–Nothing unusual. Client reports usual results.
P–Session next week.

Session Seven

S–Client reports some difficulty with stamina. Requests that her breathing be assessed.
O–Upper chest breathing evident. Shoulder firing is synergistically dominant. General full-body massage with additional strategies for breathing pattern dysfunction. Identified trigger point activity in the serratus anterior. Client could not identify what would have caused the situation.
A–Breathing has improved to normal. Client pleased with results.
P–Reassess breathing. Session next week.

Session Eight

S–Client recalls that she carried some heavy boxes the week before and believes that is what contributed to the breathing problem. She has had no further difficulty. Requests full-body restorative massage.
O–Full-body massage.
A–Client falls asleep during massage. She gets up and goes right to bed.
P–Session next week.

Session Nine

S–Client reports that she has been overtraining a bit and has reduced training intensity. She requests a general relaxation-based massage.
O–General nonspecific massage.
A–Client falls asleep during massage. She gets up and goes to bed.
P–Usual session next week.

Session Ten

S–Client has a mild upper respiratory infection. Requests a bit more attention to sinus congestion and relaxation.
O–General massage is given with attention to headache pain. Specifically addressed posterior serratus inferior bilaterally because client has been sniffling and coughing.

CRITICAL THINKING

1 What is the difference between training and competing?

2 Because Julia is a student of the sport and is constantly studying the effects of diet and training protocols to enhance her performance, what would she expect from any of the professionals who work with her?

3 Julia has athlete's foot that is currently being treated. She also requests foot massage. What adaptations are required by the massage therapist?

4 The client's goal for massage is support for a training regimen to enhance performance and help prevent injury. How does the prior auto accident factor into this goal?

5 The case information indicates that ongoing extensive assessment is not necessary because the client knows her body and will determine what she needs. What do you think this means?

6 The client reports during the history that she has at one time or another experienced shin splints, side stitches, plantar fasciitis, muscle cramps, muscle strains, and dehydration. A condition called *hyponatremia* from consuming excessive water during exercise can quickly make running a painful experience because sodium is lost through sweat, and drinking too much water during endurance activities, such as marathons and triathlons, can dilute the sodium content of the blood. Could any of the conditions just listed be attributed to this cause? What are the signs and symptoms of hyponatremia?

7 This case is typical. The general protocol is used week after week with minor adjustments. The massage benefits are achieved from maintenance and recovery support. What are some potential mistakes a massage therapist could make with this type of client?

A–Client is tired and wants to go to bed.
P–Massage next week.

The Rest of the Story

This case is typical. The general protocol is used week after week with minor adjustments. The massage benefits are achieved from maintenance and recovery support. This client finished school, continues to run, and receives massage each week. She knows what she wants and expects to get it, regardless of who the massage therapist is.

CAREER OPPORTUNITIES

Now that you have studied all the information in this text and have integrated the information into focused massage application as presented in the case study examples, what are you going to do with it?

1. Remember that there really is not anything special about "sports massage." Therefore, these skills, as used to help all of your clients, should improve outcomes.
2. Remember that the context of this text is targeted to anyone who is involved in physical activity. Tendinopathy in a truck driver, a data processor, or a professional golfer is still tendinopathy.

Career opportunities for professionals using this information include physical therapy, orthopedic medicine, occupational rehabilitation, cardiac care, weight management, and sport-specific application.

The general practice massage therapist can incorporate these methods with clients seeking wellness and fitness, which would include exercise. Fitness facilities would be interested in a massage therapist with these skills. High school, collegiate, amateur, and professional athletes also would be interested. Most "athletes" are weekend warriors and recreational participants, not professionals.

The more "elite" the athlete, the more difficult is the process for career development. If working with the professional or with an Olympic athlete is your goal, be prepared to have a high level of persistence and commitment. The first question I would ask you is, "Why do you want to do this?" Status is a nonissue because you should not discuss clients, and therefore no one would know you work with someone famous.

- It is absolutely unethical to be a superfan or a groupie.
- Money: You really do not make enough money to justify the time, flexibility, and often the challenging circumstances.

Let me share why I work with this population:

1. They need help.
2. They are nice people.
3. They challenge my skills and keep me fresh and learning.
4. They keep me young in spirit.
5. They are really good learning subjects for my students.
6. They helped me write this book.
7. They are ambassadors for acceptance of massage by the general public.
8. I am comfortable with athletes and have enough status of my own, and do not have the need to use theirs by association.
9. I enjoy the intensity of the professional relationship.

Once you really understand your motivation, you can pursue clients. Most elite athletes find their massage therapist by referral from fellow players, coaches, or trainers. To get on the inside track is not easy. It is hard for me even to tell you how to get there because I did not seek the athletes, they found me. I am very good at therapeutic massage, have a respected reputation, and have worked hard for many years to gain that respect and experience. What are your strengths? What more do you need to learn and practice?

You really have to be good at massage. That is the first step. I suggest you get hands-on experience–at least 3 to 5 years of focused work–before you even consider working with elite athletes. A chiropractor or a sports medicine clinic; high school and collegiate athletes; corporate ball teams; and recreational volleyball, soccer, and bowling leagues are great places for gaining experience. Working at a gym, a golf course, or a fitness-focused resort will help you refine your skills. Also target local dance studios, musicians, or other entertainers to gain experience. Second, it helps to know somebody. Fair or not, it is about who you know. Even if every professional team hired a massage therapist, that would be just a few hundred positions. If you are persistent and become very skilled, and if this is truly the path of service for you, it is likely that you will meet someone who knows someone who will help you make the connection.

The 12 cases in this unit provide models for how to think through each massage session. They consist of a realistic portrayal of what it is like to work with this type of population. The cases describe cardiovascular rehabilitation and maintenance, weight loss, general wear and tear, training support, performance support, recovery, and different ages and genders. It seems possible to write cases like this forever, but other than serving as a model for you, they will not pertain to the clients with whom you will work.

The individual cases also present various professional/business practice concepts. The massage therapists discussed worked in fitness centers, with a team; independently, with close communication with the athletic trainer, the doctor, or the physical therapist; and independently, with no support. These massage therapists had individual offices and/or would go to the client's home for massage sessions.

Various schedule modifications are presented, as are situations such as the potential for eating disorders and possible boundary concerns.

None of the cases describe typical situations in which third-party insurance payment would be realistic, although in the bursitis case and in providing presurgical and postsurgical care for the baseball player, this could be possible.

Typically, massage for this population does not qualify for insurance reimbursement; therefore, the costs are the responsibility of the client. Currently, most sports teams typically do not employ massage therapists, but this may be changing. Teams that do hire massage professionals typically pay a salary of around $30,000 per year, but this is rare at this time.

Individually, athletes usually seek massage professionals through a word-of-mouth grapevine. Professional athletes can justify the cost of the massage and even may have the finances to support extensive massage care. If you look at the therapeutic change interventions in these various cases, massage was required at least twice a week and often more often. The cost burden for this can be extensive. It seems to be the cost of massage at this point that is limiting its use among the general population, including those involved in sports and fitness. These persons appreciate massage and want massage but may not be able to justify the costs.

I personally do not have any quick fixes for this situation but can share that even the most elite and highest paid athletes will notice the cost-versus-benefit ratio. Most of the elite professional athletes I have worked with (and I have worked with many in various sports) are a bit resistant to using massage extensively if the monthly cost rises above $500 per month, except in special situations where they are injured or are getting ready for a competition or for the season. Also, most of these athletes play in one location and live off-season in another, so the cash flow to the massage therapist is seasonal and erratic.

Again, after working in this area for many years with many athletes, I caution you to be realistic. Do not pay attention to massage therapists who may work occasionally with one or two professional athletes and indicate that they make $100 or more per hour. This is not really true in the sense of the special accommodations required for elite athletes. They may charge $100 per hour for massage, but it takes a lot of time to work with these athletes, and typically the actual amount made per hour is much less. Besides, I know of only a few massage therapists who are truly experienced enough and trained enough to demand that type of reimbursement, and it took them about 20 years to get there.

The clients in the cases in this text were able to pay for the massage because at some level they were financially stable, although some were making major sacrifices to receive massage. Most of your clients may not be able to do this, and this creates various challenges, such as ability to achieve sustained benefits, especially when it is best to receive massage 2 or 3 times per week, and the client can justify paying for a massage only every other week. Again, I have no quick fixes or definite answers. You just have to do the best you can, charge reasonable fees, and be really good at what you do.

I also caution you again about the “Status Factor” when working with professional athletes. It is unethical for this to be your motivation, or to talk about the clients. Always remember that the elderly lady (Marge), or the old Marine (Sam), or the client struggling with weight maintenance (Laura) is just as important as the professional football, basketball, and golf athletes described.

SUMMARY

Finally, in summarizing these case studies and all the many different persons I remembered during the writing of each one, I am yet again reminded that clients have always been my best teachers. Regardless of all the information and strategies presented in this text, clients are the ones who teach you, if you are willing to learn. May each of you be compassionate and humble enough to learn from them.

In my last few thoughts before ending this text, allow me to be your mentor.

Massage is an important and valuable career path of service. Most of my clients over the many years I have been a massage therapist have not been famous athletes. Yes, I have worked with hundreds of athletes, and I understand their world and appreciate the strain of their lifestyle. The reason these persons are comfortable with me is because to me, they are people–just people who benefit from therapeutic massage. I hope the content of this book helps you help people–just people.

The only reason I would write this book is because it is about everyday people. All the models used in the illustrations are persons who participate in physical activity–not celebrities. Please volunteer to support Special Olympics and local fund-raising events such as walks and runs for various causes such as cancer research. Pay attention to the senior citizen mall walkers and the kids in Little League. Do not shun individuals exercising to manage obesity. They are working just as hard as a football lineman.

Remember those in physical rehabilitation, recovering from accidents, war, and disease. Support those in the military and military veterans. Do not forget the athletes who did not “make it” or who blew out a knee or something, and who really need massage for the rest of their lives.

I experience contentment as I remember all the clients who felt better after the massage. I wish for you the peace of knowing you are of value in a quiet, humble way. Even if no one ever tells you how much you have helped them, you will know because you will have seen clients benefit. They can walk, run, jump, smile or cry, win, lose, or try again, and maybe even know when to quit and do something else instead.

Never forget the original “heart tug” that led you to massage in the first place, and that it is not about whom you massage, but that you remember to serve with expertise and compassion each person you touch.

evolve WORKBOOK

Visit the Evolve website to download and complete the following exercises. Answers to the case studies may also be found on Evolve.

Pick five case studies you are especially interested in.

1 For each case study, identify the specific content used to develop and implement the various treatment plans. Include assessment and treatment. List the chapters and page numbers for each.

Example: Case 12
Assessment:
Metabolic energy production:
Running sport movement patterns:
Fitness and sport training recommendations:
Trigger point methods:

Now choose five different case studies.

2 For each case, there are various questions that would need to be answered by research, discussion with the client, or observation of the client's performance or medical support group. For each case, write at least three additional questions that you would ask if this were your client.

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Glossary

Acceleration Produced by concentric muscle contraction.
Active Assisted Movement Movement of a joint in which both the client and the therapist produce the motion.
Active Assisted Stretching Both client and therapist participate in the stretching process.
Active Joint Movement Movement of a joint through its range of motion by the client.
Active Range of Motion Movement of a joint by the client with no type of assistance from the massage practitioner.
Acupuncture Point Asian term for a specific point that correlates with a neurologic motor point.
Acute Bone Fractures Condition of broken bones.
Acute Inflammation Immune reaction that occurs at the early stages of illness or injury.
Acute Pain Symptom of a disease condition or a temporary aspect of medical treatment. Acute pain acts as a warning signal because it can activate the sympathetic nervous system. Usually, it is temporary, of sudden onset, and easily localized. The client frequently can describe the pain, which often subsides without treatment.
Acute Reinjury of a Chronic Condition Traumatic event that aggravates an existing condition.
Acute Stress Adaptive demand stimulating sympathetic autonomic nervous system response.
Adaptation Response to sensory stimulation in which nerve signaling is reduced or ceases.
Adhesions Inappropriate connective tissue connections.
Adrenaline Neurochemical active during sympathetic autonomic nervous system response.
Aerobic Exercise Activity that targets cardiac function.
Aerobic Exercise Training Exercise program focused to increase fitness and endurance.
Aerobic (Oxygen) System Mechanism for fueling muscle contraction when oxygen availability exceeds demand.
Age Relates to adaptive capacity dependent on life span.
Agility Smooth, coordinated movement.
Agonist Muscle that functions in opposition to prime movement and is usually involved in deceleration and control of movement.
Anabolic Steroids Banned substances in many competitive sports.
Anaerobic Glycolytic System Mechanism for fueling muscle contraction when oxygen availability is less than demand.
Anorexia Athletica Eating disorder related specifically to reduced food intake in athletes.
Anorexia Nervosa Eating disorder involving severe limits on food intake.
Antagonism Occurs when massage produces the opposite effect, as with medications.
Antagonists Muscles that oppose the movement of prime movers.
Anxiety and Depressive Disorders Uneasiness, usually connected with neural chemical disorders.
Arnica montana Homeopathic remedy that is said to support healing of acute injury.
Aromatherapy Use of essential oils for therapeutic purposes.
Arthrokinematic Reflex Neurologic relationship between joint and muscle proprioception.
Arthroscopic Surgery Minimally invasive procedure for joints.
Articular Crepitus Grinding and crackling during joint movement.
Assessment The collection and interpretation of information provided by the client, the client's family and friends, the massage practitioner, and referring medical professionals.
Athlete Person who participates in sports as an amateur or a professional. Athletes require precise use of their bodies.
Athlete's Foot Fungal condition of the foot.
Athletic Trainers Professionals specifically trained to support athletes.
Autonomic Nervous System (ANS) Body system that regulates involuntary body functions using the sympathetic "fight-flight-fear" response and the restorative parasympathetic "relaxation response." The sympathetic and parasympathetic systems work together to maintain homeostasis through a feedback loop system.
Bacterial Infections Pathologic conditions caused by a variety of bacteria; usually treated with antibiotics.
Balance Ability to maintain position within gravity.
Balsam Fir Type of essential oil.
Backward-Tilting (Posterior) Pelvis Abnormal position of the pelvis often resulting in a reduced lumbar curve.
Banned Drug Medication that cannot be used by athletes during training and competition.
Banned Substances Drugs and other products that cannot be used by athletes during training and competition.
Bending Type of mechanical force.
Bending Loading Specific mechanical force where one side of the load is convex and under tension, and the other side is concave and under compression.

Beta Blocker Type of medication that influences heart rate.
Bind Point of resistance to movement.
Black Pepper Type of essential oil.
Body Mechanics Use of the body in an efficient and biomechanically correct way.
Bodywork Term that encompasses all the various forms of massage, movement, and other touch therapies.
Bone Injuries A variety of traumatic injuries to bones, including fractures and contusions.
Bulimia Nervosa Type of eating disorder involving binge eating and then purging.
Bursitis Inflammation of a bursa.
Breathing Mechanism of bringing air into the lungs.
Breathing Dysfunction Impairment of the breathing process.
Breathing Pattern Disorders Complex sets of behaviors that lead to overbreathing in the absence of a pathologic condition. These disorders are considered a functional syndrome because all parts are working effectively; therefore, a specific pathologic condition does not exist.
Caffeine A stimulant.
Cannabinoid A banned substance.
Capsulitis Inflammation of the joint capsule.
Cardioprotection Lifestyle and dietary measures to support cardiac function.
Cardiorespiratory Fitness Ability to perform aerobic activity at a level that supports optimal activity.
Cardiovascular/Respiratory Disease A collection of conditions affecting breathing heart function and blood flow.
Cartilage Type of flexible connective tissue.
Catching Activity involving eye/hand/body coordination to intercept and hold objects moving toward the person.
Central Nervous System Hypersensitivity Neurochemical changes in the central nervous system causing overreaction and usually painful sensation to stimuli.
Cervical Lordosis Backward curve of cervical spine.
Chamomile German Type of essential oil.
Charting Documentation of the therapeutic process.
Chronic Inflammation Nonproductive persistent inflammatory response.
Chronic Joint Injuries Ongoing conditions usually involving joint deterioration.
Chronic, or Overuse, Trauma Repetitive movement or injury that can cause multiple microtraumatic injuries.
Chronic Pain Pain that persists or recurs for indefinite periods, usually for longer than 6 months. It frequently has an insidious onset, and the character and quality of the pain change over time. It frequently involves deep somatic and visceral structures. Chronic pain usually is diffuse and poorly localized.
Chronic Stress Long-term demand on adaptive mechanisms.
Circuit Training Form of conditioning program.
Circuit-Interval Training Form of condition program that incorporates breaks into the cycle.
Clinical Reasoning Cognitive process involving a system for problem solving.
Co-Contraction Concentric action of muscles in both agonist and antagonist function.
Combined Loading Creating more than one mechanical force during massage application.
Comfort Barrier The first point of resistance short of the client's perceiving any discomfort at the physiologic or pathologic barrier.
Comparative Weakness Assessment finding when one function is compared with another.
Complete Rupture Total breach of connection such as a ruptured tendon.
Compression Pressure into the body to spread tissue against underlying structures. Also, exertion of inappropriate pressure on the nerves by hard tissue (e.g., bone).
Compression Loading Application of compressive force.
Compressive Force The amount of pressure exerted against the surface of the body to apply pressure to deeper body structures; pressure applied in a particular direction.
Concentric Muscle action where shortening and pulling occur.
Condition Management Use of massage methods to support clients who are unable to undergo a therapeutic change but who wish to function as effectively as possible under a set of circumstances.
Conditioning Training program to prepare for athletic activity.
Connective Tissue Methods Application of mechanical forces to the tissues to specifically address connective tissue changes.
Continuous Training Form of conditioning program in which no breaks are involved.
Contract and Stretch Muscle energy method that involves concentric action on the target and then lengthening.
Contract Antagonist and Stretch Muscle energy method that involves using opposing muscle action to support tolerance to stretch.
Contract-Relax-Antagonist-Contract Muscle energy method that uses agonist and antagonist contraction before stretching.
Contracture Tissue shortening.
Cool-Down Aspect of the workout/conditioning program that occurs after the specific protocols.
Coordination Ability to integrate balance and agility to perform activities.
Coping Skills Behaviors used to deal with stress.
Core Strength Measure of function of antigravity muscles, especially in the trunk.
Core Training Conditioning activities to improve and maintain core function.
Coronary Artery Disease (CAD) Variety of conditions that impede blood flow to the heart muscle.
Cortisol Stress hormone produced by the adrenal glands that is released during long-term stress. An elevated level indicates increased sympathetic arousal.

Counterirritation Superficial stimulation that relieves a deeper sensation by stimulating different sensory signals.

Counterpressure Force applied to an area that is designed to match exactly (isometric contraction) or partly (isotonic contraction) the effort or force produced by muscles in that area.

Creatine Substance used by athletes to increase muscle bulk.

Cross-Directional Stretching Tissue stretching that pulls and twists connective tissue against its fiber direction.

Cutting Activity that involves abrupt deceleration, changing directions, and quick acceleration.

Deceleration Slowing of movement using eccentric action.

Deconditioning Reduction in fitness.

Deep Vein Thrombosis Contraindication for massage where clots form in the deep veins, typically in the leg.

Degenerative Joint Disease Pathology of the joint primarily due to wear and tear.

Dehydration Lack of water.

Depth of Pressure Compressive stress that can be light, moderate, deep, or varied.

Diabetes Disease in which insulin production or use is impaired.

Diastasis Separation of parts of the body that are normally joined together, such as adjacent bones without fracture.

Direct Tissue Stretching Application of tension force in a local tissue area.

Direct Trauma Injury resulting from a direct impact.

Direction Flow of massage strokes from the center of the body outward (centrifugal), or from the extremities inward toward the center of the body (centripetal). Direction can include circular motions; it can flow from the origin to the insertion of the muscle, following the muscle fibers, or it can flow transverse to the tissue fibers.

Direction of Ease Position the body assumes with postural changes and muscle shortening or weakening, depending on how it has balanced against gravity.

Disk Herniation Condition whereby the cushion that sits between the spinal vertebra is pushed outside its normal position.

Dislocation Traumatic injury of the joint when the bone ends move out of alignment.

Disordered Eating Irregular eating behaviors.

Diuretics Substances that increase urine output.

Dopamine Neurochemical that influences motor activity involving movement (especially learned fine movement, such as writing), conscious selection (what to pay attention to), mood (in terms of inspiration), possibility, intuition, joy, and enthusiasm. If the dopamine level is low, the opposite effects, such as lack of motor control, clumsiness, inability to decide what to attend to, and boredom, are seen.

Drag The amount of pull (stretch) on the tissue (tensile stress).

Duration Length of time a method lasts or stays in the same location.

Dynamic Stretching Active movements that move tissue into and out of stretch position.

Dynorphins Family of endogenous opioid peptides.

Eating Disorders Abnormal eating habits that may involve insufficient or excessive food intake.

Eccentric Muscle lengthens as force exceeds concentric action.

Edema Observable swelling in certain parts of the body.

Elevation Part of PRICE. To lift above the heart.

End-Feel The perception of the joint at the limit of its range of motion. The end-feel may be soft or hard. (*See* Joint end-feel.)

Endangerment Sites Any area of the body where nerves and blood vessels surface close to the skin and are not well protected by muscle or connective tissue; therefore, deep, sustained pressure into these areas could damage these vessels and nerves. The kidney area is included because the kidneys are loosely suspended in fat and connective tissue, and heavy pounding is contraindicated in that area.

Endocannabinoid (eCB) Endogenous neurotransmitters that appear to play a major role in generating these rewards by activating cannabinoid receptors in the brain.

Endorphins Neurochemicals that elevate mood, support satiety (reduce hunger and cravings), and modulate pain.

Endurance A measure of fitness. The ability to work for prolonged periods and the ability to resist fatigue.

Energy Ability to do work.

Energy Systems Physiologic processes that provide fuel for body function.

Enkephalins Neurochemicals that elevate mood, support satiety (reduce hunger and cravings), and modulate pain.

Entrainment Coordination of movements or their synchronization with a rhythm.

Entrapment Pathologic pressure placed on a nerve or a vessel by soft tissue.

Ephedrine A banned substance.

Epinephrine/Adrenaline Neurochemical that activates arousal mechanisms in the body; activation, arousal, alertness, and alarm chemicals of the “fight-or-flight” response, and all sympathetic arousal functions and behaviors.

Eucalyptus Type of essential oil.

Evaluation Another term for assessment.

Exercise Activity that enhances or maintains physical fitness and overall health and wellness.

Exercise Intensity How much energy is expended when exercising.

Exercise Physiologists Medical professionals specializing in exercise for rehabilitation and physical fitness.

Fascia Layer of fibrous tissue.
Fatigue Lack of energy and motivation.
First-Degree Distortion in Functioning Beginning stage in deterioration of functional movement.
Fitness General term used to describe the ability to perform physical work.
Flexibility Ability to move joints and muscles through their full range of motion.
Force Influence that causes an object to undergo a certain change.
Force Couples Two equal, but oppositely directed, forces acting simultaneously.
Force Stability Joint stability produced by muscle contraction.
Form Stability Joint stability due to the shape of the bone and the joint capsule.
Forward-Tilting (Anterior) Pelvis Abnormal position of the pelvis usually resulting in increased lordosis.
Frequency The number of times a method is repeated over a given time period.
Friction Specific circular or transverse movements that do not glide on the skin and that are focused on the underlying tissue.
Frostbite Localized damage caused to skin and other tissues as the result of extreme cold.
Functional Movement Development Activity used to correct physical imbalances, limitations, and weaknesses within the body.
Functional Stress Stage two classification of dysfunction in the body.
Functional Tension Stage one classification of dysfunction in the body.
Functional Training Activities used to support optimal functional movement.
GABA Gamma-aminobutyric acid, the chief inhibitory neurotransmitter.
Gait Assessment Assessment of walking and running.
Gait Cycle Walking action that begins when one foot contacts the ground and ends when that foot contacts the ground again.
Gauss Unit of measurement of a magnetic field.
General Contraindications/Cautions Factors that require a physician's evaluation to rule out serious underlying conditions before any massage is indicated. If the physician recommends massage, the physician must help develop a comprehensive treatment plan.
Geranium Type of essential oil.
Gliding Massage method that creates tension force.
Global Muscles Muscles that cross multiple joints.
Glucocorticosteroids Class of steroid hormones.
Glucosamine A Substance that is thought to support joint function.
Growth Hormone Hormone that promotes cell division; in adults, it is implicated in the repair and regeneration of tissue.
Guarding Contraction of muscles in a splinting action, surrounding an injured area.
Healthy Diet Diet that supports body function and is low in saturated fats and artificial ingredients.
Heart Rate Variability (HRV) A measure of the continuous interplay between sympathetic and parasympathetic influences on heart rate.
Heat Cramps Symptom of hyperthermia.
Heat Exhaustion Symptom of hyperthermia.
Heat Rash Symptom of hyperthermia.
Heat Syncope (Heat Collapse) Fainting as a result of overheating.
Heatstroke Life-threatening condition with symptoms of high body temperature, rapid pulse, difficulty breathing, and confusion.
Helichrysum Type of essential oil.
Herpes Simplex Virus Causes a common viral infection.
History Information from the client about past and present medical conditions and patterns of symptoms.
Hitting Activity during sports where an instrument or a body part strikes an object.
Holding Position Static touch used during massage.
Hormone Messenger chemical in the bloodstream.
Hot and Cold Contrast Hydrotherapy Alternating hot and cold water applications.
Hyperstimulation Analgesia Diminishing the perception of a sensation by stimulating large-diameter nerve fibers. Methods used include application of ice or heat, counterirritation, acupressure, acupuncture, rocking, music, and repetitive massage strokes.
Hyperthermia Heat-related condition.
Hypothermia Cold-related condition.
Ice Aspect of PRICE treatment of acute injury.
Ideal Performance State State of mind that each athlete learns to achieve consistently in competition.
Illness State of poor health.
Immune Function Mechanisms of the body combat pathogenic invasion.
Inappropriate Training Activities that hinder performance.
Indirect Trauma Injury that is not the result of a direct blow. Can be considered overuse injury.
Inflammation Normal mechanism, characterized by pain, heat, redness, and swelling, that usually speeds recovery from infection or injury.
Insomnia An individual's report of sleeping difficulties.
Integrated Approach Combined methods of various forms of massage and other bodywork styles.
Intercompetition Massage Massage provided during an athletic event.
International Olympic Committee Official source of Olympic Games.
Interval Training Type of physical training that involves bursts of high-intensity work interspersed with periods of low-intensity work.
Isometric Contraction in which the effort of a muscle or group of muscles is exactly matched by a counterpressure, so that no movement occurs–only effort.

Isotonic Contraction in which the effort of a target muscle or group of muscles is partly matched by a counterpressure, allowing a degree of resisted movement.
Joint Mobilization Movement of the joint through its normal range of motion.
Joint Movement Methods Methods that support joint movement through its normal range of motion.
Joint Oscillation Rhythmic shaking of the joint structure.
Joint Play Inherent laxity present in a joint.
Joint Stability Ability of a joint structure to maintain appropriate position.
Jumping Action where both feet lift off the ground.
Juniper Berry Type of essential oil.
Kicking Using the leg to apply force to move an object.
Kinesiology Study of movement.
Kinetic Chain Process by which each individual joint movement pattern is part of an interconnected aspect of the neurologic coordination pattern of muscle movement.
Kneading Massage method that twists tissues.
Kyphosis Abnormal curve of the thoracic vertebrae.
Lavender Type of essential oil.
Lemongrass Type of essential oil.
Local Anesthetics Substances that interfere with sensation such as pain; used in a local area.
Local Muscles Muscles that affect only one joint.
Longitudinal Tissue Stretching Stretch applied along the fiber direction of connective tissues and muscles.
Lower Crossed Syndrome Pattern of dysfunction wherein lumbar area structures are short and abdominal tissues are weak.
Lumbar Lordosis Inward curvature of the lumbar vertebrae.
Luxation Dislocation of an anatomic part.
Lymph Nodes Small, bean-shaped organs located throughout the lymphatic system that function as filters.
Lymph System Specialized component of the circulatory system; responsible for waste disposal and immune response.
Lymphangions Functional units of a lymph vessel that lie between two valves.
Magnet Object or substance that possesses an attraction to metals that involves positive and negative charge.
Massage The scientific art and system of assessment of and manual application of certain techniques to the superficial soft tissue of skin, muscles, tendons, ligaments, and fascia, and to structures that lie within the superficial tissue. Hand, foot, knee, arm, elbow, and forearm are used for systematic external application of touch, stroking (effleurage), friction, vibration, percussion, kneading (pétrissage), stretching, compression, or passive and active joint movements within the normal physiologic range of motion. Massage includes adjunctive external applications of water, heat, and cold for the purposes of establishing and maintaining good physical condition and health by normalizing and improving muscle tone, promoting relaxation, stimulating circulation, and producing therapeutic effects on the respiratory and nervous systems, and subtle interactions among all body systems. These intended effects are accomplished through physiologic energetic and mind/body connections in a safe, nonsexual environment that respects the client's self-determined outcome for the session.
Mechanical Forces Forces that create a push or a pull.
Mental Toughness Collection of attributes that allow a person to persevere through difficult circumstances.
Mentor Someone who uses his or her personal excellence and professional experience to help others succeed.
Methods How massage is applied.
Microtrauma Microscopic injury, usually affecting connective tissue.
Mobilization With Movement Method of addressing joint function with traction and client movement.
Motor Tone Nervous system control of how long or short a muscle is by regulating the degree of muscle contraction.
Movement Strategies Coordinated movements of the body, innate or learned.
Multiplanar Movement Movement that happens in different planes of motion.
Muscle Energy Techniques Neuromuscular facilitation; specific use of active contraction in individual muscles or groups of muscles to initiate a relaxation response; activation of proprioceptors to facilitate muscle tone, relaxation, and stretching.
Muscle Firing Pattern Recruitment sequence of muscle activation.
Muscle Organ Collective tissues and structures that form a muscle, including connective tissue, muscle tissue, nerves, and vascular structures.
Muscle Relaxer Medication used to decrease motor tone.
Muscle Tone Density and tautness of a muscle organ based on fluid content and pliability of connective tissues.
Muscle Weakness Decreased ability of a muscle to generate force.
Myofascial/Connective Tissue Dysfunction Nonproductive changes in the muscle organ and associated connective tissues.
Myositis Ossificans Bony growth that develops within a muscle after a contusion or a strain.
Narcotics Natural opioid drugs.
Nerve Compression Harmful pressure on a nerve (especially on nerves that pass over rigid prominences).
Nerve Entrapment Repeated and long-term nerve compression usually by soft tissues that are subject to inflammation or swelling.
Nerve Impingement Pressure against a nerve by skin, fasciae, muscles, ligaments, or joints.
Nerve Injury Damage caused by pressure, stretching, or cutting.
Nerve Root Compression Nerve roots in the spinal cord are irritated or pinched.

Neuroendocrine Regulation Combined effects of neurotransmitters and hormones for maintaining homeostasis.

Neuromuscular Control/Proprioception/Kinesthesis Conscious control of a specific movement; the interplay and reflex connection between sensory and motor neurons and muscle function.

Neutralizer Prevents unwanted motion during muscle action.

Nociceptor Sensory receptor that responds to pain.

Nonsteroidal Antiinflammatory Drugs (NSAIDs) Class of drugs that work to decrease blood levels of prostaglandins, which are chemicals that promote inflammation and pain.

Noradrenaline Neurochemical that functions in a manner similar to epinephrine but is more concentrated in the brain.

Norepinephrine/Noradrenaline Neurochemical that functions in a manner similar to epinephrine but is more concentrated in the brain.

Nutritional Supplement Preparation intended to supplement the diet and provide nutrients.

Orthopedic Massage Massage targeting joint function and associated structures.

Oscillation Massage method involving rhythmic movement.

Osteochondrosis Any disease that affects the progress of bone growth by killing bone tissue.

Outcome Goals Intended results of massage application.

Outcome-Based Massage application designed to achieve specific goals.

Overload Principle Stress on an organism that is greater than that regularly encountered during everyday life.

Oxytocin Hormone implicated in pair or couple bonding, parental bonding, feelings of attachment, and care taking, along with its more commonly known functions in pregnancy, delivery, and lactation.

Pain and Fatigue Syndromes Multicausal and often chronic nonproductive patterns that interfere with well-being, activities of living, and productivity.

Pain Threshold The point at which pain begins to be felt.

Pain Tolerance Maximum level of pain that a person is able to tolerate.

Palliative Care Care intended to relieve or reduce the intensity of uncomfortable symptoms but that cannot effect a cure.

Palpation Assessment Assessment through touch.

Passive Joint Movement Movement of a joint by the massage practitioner without assistance of the client.

Pathomechanics Biomechanical alterations.

Peak Performance Ability to do one's best; one's best physical state.

Peppermint Type of essential oil.

Percussion Massage application involving rhythmic application of compression.

Performance Carrying out of specific physical activities influenced by a combination of physiologic, psychological, and sociocultural factors.

Performance Enhancement Variety of methods used to maximize performance.

Periostitis Also known as periostalgia; medical condition caused by inflammation of the periosteum.

Peripheral Nerves Nerves and ganglia outside the brain and spinal cord.

Pharmacology Study of drugs.

Phasic/Mover Muscle Group Muscles made up mostly of fast-twitch muscle fibers.

Phosphagen System Anaerobic system that allows for the highest levels of exercise intensity.

Physical Assessment Evaluation of body balance, efficient function, basic symmetry, range of motion, and ability to function.

Physical Fitness Program Activity that supports cardiac health and well-being.

Physical Therapist Health care professional who works with patients who have impairments, limitations, disabilities, or changes in physical function and health status.

Physiologic Massage effects that relate to body function.

Piezoelectricity Production of an electrical current by application of pressure to certain crystals such as mica, quartz, Rochelle salt, and connective tissue.

Pin and Stretch Method that uses focused pressure to lengthen the tissue while the client performs specific motions.

Pine Type of essential oil.

Pivoting Changing direction by spinning on one foot.

Positional Release Method of moving the body into the direction of ease (the way the body wants to move out of the position that causes the pain); proprioception is taken into a state of safety and may stop signaling for protective spasm.

Post-Event Massage Massage provided after an athletic event.

Postsurgical Care Care provided after surgery.

Post-Traumatic Stress Disorder Disorder characterized by episodes of flashback memory, state-dependent memory, somatization, anxiety, irritability, sleep disturbance, concentration difficulties, times of melancholy or depression, grief, fear, worry, anger, and avoidance behavior.

Postural Deviations Alterations of normal posture.

Postural (Stabilizer) Muscles Muscles that support the body against gravity.

Posture Position of the body or of body parts.

Presurgical Care Care provided before surgery.

PRICE Acronym for basic first aid therapy, which stands for *p*rotection, *r*est, *i*ce, *c*ompression, and *e*levation.

PRICE Therapy Use of PRICE to treat an injury.

Primary Movements Fundamental movement skills (e.g., flexion, extension) that are combined for specific movement.

Professionalism Adherence to professional status, methods, standards, and character.

Progressive Relaxation Technique for reducing anxiety by alternately tensing and relaxing the muscles.

Promotional or Event Massage Massage provided at sporting events that promotes massage benefits.

Pronation Distortion Syndrome Postural and movement alteration when the feet roll too far inward, resulting in overpronation with body-wide compensation.

Psychological Function of the mind.

Pulsed Muscle Energy Procedures that involve engaging the barrier and using minute, resisted contractions (usually 20 in 10 seconds); introduces mechanical pumping as well as post-isometric relaxation and reciprocal inhibition.

Range of Motion (ROM) Movement of joints.

Reaction Time Length of time the body takes to react to a stimulus.

Reciprocal Inhibition (RI) Effect that occurs when a muscle contracts, obliging its antagonist to relax to allow normal movement to take place.

Recovery Massage Massage structured primarily for the uninjured athlete who wants to recover from a strenuous workout or competition.

Reduced Range of Motion Less than normal joint movement; can also be called *hypomobility*.

Reflex Response Fast, often involuntary response to a stimulus.

Regional Contraindications Contraindications that relate to a specific area of the body.

Rehabilitation Massage Massage used for severe injury or as part of intervention after surgery.

Remedial Massage Massage used for minor to moderate injuries.

Rescue Remedy Homeopathic preparation used for shock and trauma.

Restorative Sleep Quality sleep that supports healing.

Rhythm The regularity of application of a technique. If a method is applied at regular intervals, it is considered even or rhythmic. If it is choppy or irregular, it is considered uneven or not rhythmic.

Ringworm Fungal infection of the skin.

Rosemary Type of essential oil.

Rotated (Left or Right) Movement on the transverse plane.

Rotation or Torsion Loading Force that is applied by twisting.

Running Aspect of gait cycle where both feet are off the ground.

ruta graveolens Type of homeopathic preparation.

Second-Degree Distortion in Functioning Pattern of dysfunction whereby movement becomes labored and painful.

Serial Distortion Pattern Misalignment that exists in one segment of the kinetic chain resulting in predictable patterns of dysfunction throughout the entire kinetic chain.

Serotonin Neurochemical that regulates mood in terms of appropriate emotions, attention to thoughts, and calming, quieting, and comforting effects; it also subdues irritability and regulates drive states.

Shear Mechanical force that moves within the same physical plane.

Shear Loading Method of creating shear stress.

Skin Rolling Method that lifts the skin.

Specificity Principle Highly general training to highly specific training.

Speed Rate of application (e.g., fast, slow, varied).

Sport-Specific Demands Strain on the physical and mental capacity of an athlete.

Sports Medicine Physicians Medical professionals who specialize in the unique needs of the athlete.

Sports Psychologists Medical professionals who support the mental function of the athlete.

Stability Property of a body that causes it, when disturbed from a condition of equilibrium, to develop forces that restore the original condition.

Stabilizers Structures and muscles that maintain stability.

Steroid Injection Form of medical treatment that treats local inflammation.

Stimulant Substance that increases sympathetic autonomic nervous system output.

Strain-Counterstrain Use of tender points to guide positioning of the body into a space where muscle tension can be released on its own.

Strength Bodily or muscular power.

Strength Training Activities that increase physical strength.

Stress Fracture A small crack in a bone. Stress fractures often develop from overuse, as from high-impact sports.

Stretching Mechanical tension applied to lengthen the myofascial unit (muscles and fascia); types include longitudinal and cross-directional stretching.

Structural Massage effects primarily targeting anatomy.

Subluxation Incomplete or partial dislocation.

Substance P Neurotransmitter related to the sensation of pain.

Swelling Buildup of fluid in the tissues.

Swinging Quick movements that pass through many planes of motion and create rotational and torsional forces on numerous joints.

Synergistic Dominance Dysfunctional activation of muscles whereby the helper or synergist muscle becomes the first to activate and produce more of the force.

Synovitis Inflammation of the synovial membrane.

Tea Tree Type of essential oil.

Teacher Person who presents new information and skills while refining and targeting previous learning.

Tendonitis Type of tendinopathy with active inflammation.

Tendonosis Type of tendinopathy without active inflammation.

Tension Type of mechanical force that pulls ends apart and lengthens.

Tension Loading Methods used to apply tension force.
The Zone State of consciousness wherein skills become excellent performance.
Therapeutic Exercise Exercise used as medical treatment.
Therapeutic Inflammation Controlled introduction of acute inflammation to reverse a pathologic condition.
Therapeutic Taping Use of stiff or elastic tape for corrective purposes.
Third-Degree Distortion in Functioning Patterns of physical decline whereby connective tissue changes occur, and movement is labored and painful enough to limit activity.
Throwing Propelling through the air by a forward motion of the hand and arm.
Thyme Type of essential oil.
Tonic/Postural/Stabilizing Muscles Muscles that have a high content of slow-twitch fibers and are able to maintain contraction.
Torque Influence that tends to change the rotational motion of an object.
Torsion Mechanical force exposed to torque that causes twisting.
Trauma Physical injury caused by violent or disruptive action, toxic substances, or psychic injury; results from a severe long- or short-term emotional shock.
Traumatic Injury Outcome of trauma.
Traumatic Osteoarthritis Joint disease due to trauma.
Tumor Abnormal tissue growth.
Turning Movement whereby the body rotates.
United States Anti-Doping Agency National anti-doping organization for the Olympic movement in the United States.
Upper Crossed Syndrome Pattern of dysfunction whereby tissues are short in the upper anterior torso but are long and weak in the upper posterior torso.
Vascular Tissue having blood flow.
Vestibular Apparatus Structures of the inner ear responsible for special orientation and balance.
Visceral Pain Organ pain or pain originating from the inside of the body.
Visualization Formation of a mental image.
Walking Act of moving; involves the gait cycle.
Warm-Up Activities that prepare the body for a specific activity.
Weight Control Diet and activity to maintain a desired weight.
Weight Transfer Aspect of body mechanics involving moving the center of gravity forward.

Index

Page numbers followed by “f” indicate figures, “t” indicate tables, and “b” indicate boxes.

Q

R