PART I Fundamental Principles

The Basic Tools for Specific Treatment

CHAPTER 1

WHAT IS CONDITION-SPECIFIC MASSAGE?

Simply put, condition-specific massage refers to the application of massage techniques to treat the common contributing factors of a specific condition. Therapists may choose to supplement their basic education with advanced studies in massage techniques such as clinical, orthopedic, sports, and Thai massage; disciplines such as reflexology; and spa therapies. Regardless of the style of massage one chooses to practice or the environment in which one works, the clients we treat often suffer pain related to an injury or chronic postural imbalance. While the techniques we use to treat pain may differ, many of the treatment goals remain consistent.

Massage practitioners bring varying levels of expertise to their treatment of specific conditions. All massage therapists have expert knowledge of the musculoskeletal system. Advanced education and specialization is important for the therapist who plans to develop a practice treating complicated chronic pain and injuries. However, for uncomplicated cases of the common conditions explained in this book, basic massage therapy skills are often sufficient to minimize pain and facilitate postural balance.

This book focuses on using the basic skills learned in a core massage therapy program to treat the contributing factors involved in conditions most often seen in massage therapy environments ranging from medical facilities to spas. The emphasis on treatment goals allows you, the therapist, to apply the techniques of any modality you pursue. With an understanding of the physiological effects of techniques, you can match techniques with the treatment goals for specific conditions, as outlined in the following chapters, to develop treatment plans.

This chapter reviews the basic tools massage therapists use to design an effective treatment plan based on therapeutic goals. Each of the subjects covered in this book can be studied in much greater detail than presented here, and each tool can be used with greater specificity and for purposes beyond those learned in a basic massage curriculum. What is offered here is a way to integrate the treatment of specific signs and symptoms into general relaxation massage as well as a stepping stone toward the study of a more focused approach to treating specific conditions.

In some cases, clients with the conditions described in this book may have issues or complications that require advanced skills and training to treat them adequately. If you are unsure of whether your

skills are adequate to properly treat a client with a complicated condition, discuss it with a mentor or therapist with advanced training. It may turn out that your assessment of the client is correct and your treatment plan is perfectly appropriate. If you are still unsure after discussing the case with a more experienced practitioner, refer the client to another massage therapist or health care provider who has the training and experience necessary to manage a complicated case. Attempting to treat a client whose case is beyond your experience may hinder the client's recovery and could turn the client away from massage therapy altogether. With the client's legal consent, ask the referred provider to discuss their assessment and treatment goals with you; this is a great way to learn by experience.

BASICS OF BIOMECHANICS

In general, biomechanics is the study of how mechanical models apply to living organisms. For massage therapists, biomechanics describes the relationship between the bones and joints and the internal and external forces that act upon them to either make us move or stabilize static postures. Muscle tension is the mediator in the push and pull between anatomical structures and the forces that act upon them. Knowing the basics of musculoskeletal biomechanics can reveal how typical biomechanical functioning is stressed by a client's posture and activities and helps you plan treatment. Understanding the relationship between anatomy and force is a valuable tool for assessing pain and injury.

Figure 1-1 Isotonic and isometric contractions. An isotonic contraction produces the movement of a joint (A), while an isometric contraction does not (B).

When muscle tension is greater than the resistance against it, the length of the muscles responsible for the given action change to produce movement. This is an isotonic contraction (Fig. 1-1). Isotonic contractions are either concentric (muscle shortens) or eccentric (muscle lengthens). Concentric and eccentric contractions are described in more detail below. When we are healthy, muscle contractions are easily greater than the resistance of gravity and the weight of our own bodies, making them sufficient to produce fluid movement. The swing phase of the gait cycle, for example, is composed of isotonic contractions. The stronger the muscle is, the more resistance it can overpower.

When resistance is greater than muscle tension, the length of the muscle does not change and no movement occurs. This is an isometric contraction. The stance phase of gait involves isometric contractions. No matter how healthy we are, our muscle contractions will never be strong enough to move the planet Earth, but they contract isometrically to keep us standing.

When muscle fibers are recruited to perform an action, each myofibril contracts either completely or not at all. This is referred to as the "all or nothing" principle. The force of a contraction is generated not by the degree of contraction in each muscle fiber but by the number of fibers recruited that contract fully to produce the necessary force. For example, if gravity is the only source of resistance against a movement, such as when you flex your elbow to scratch your nose, few fibers that produce that movement need to be recruited. However, when the source of resistance to elbow flexion is a 40-pound child, many more fibers must contract. This can help explain why a specific portion of a muscle shows more signs of strain than other areas of the same muscle.

Agonists and Antagonists

Each of the movements described above require the coordination of muscles that function either as agonists, which produce the movement, or as antagonists, which oppose the movement (Fig. 1-2). All muscles can be either agonists or antagonists depending on the action being

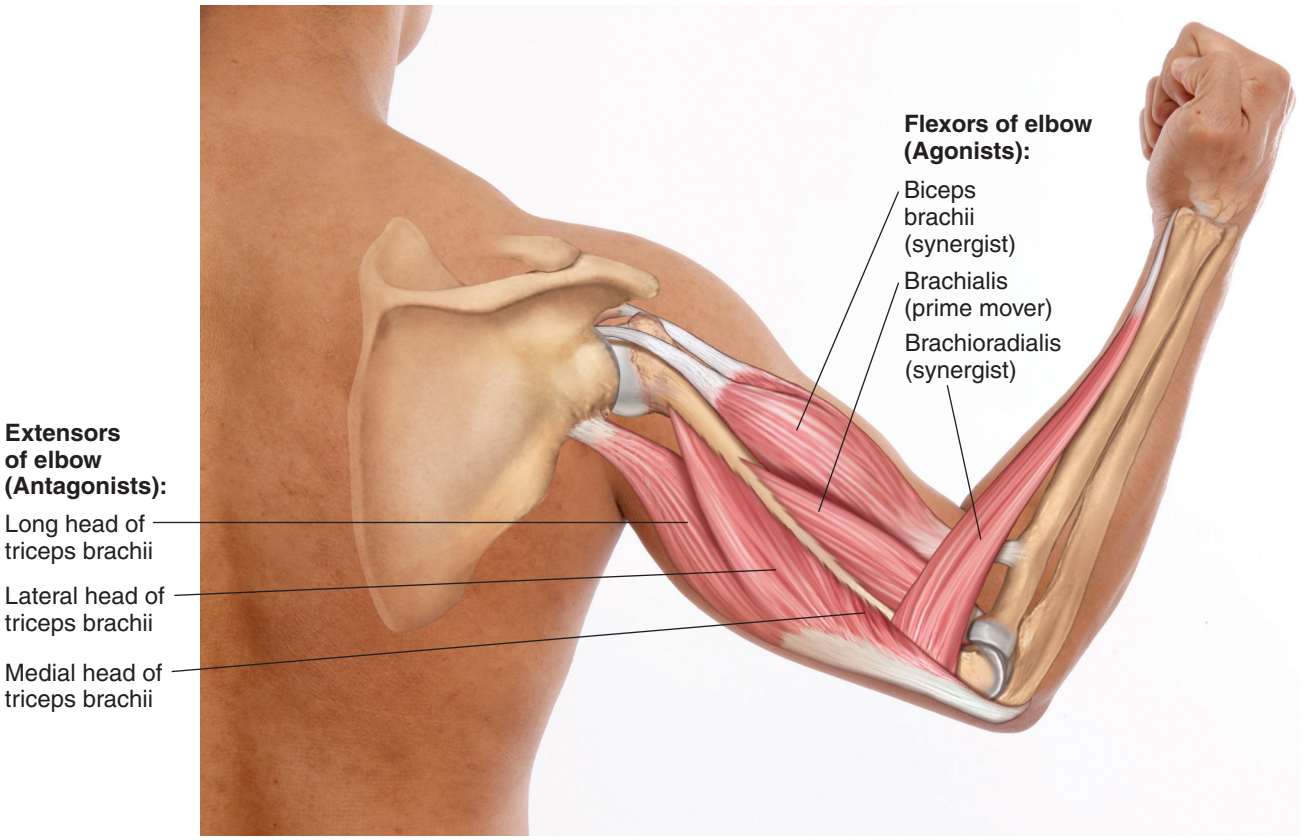


Figure 1-2 Agonist and antagonist during during flexion of the elbow. The agonist produces movement by contracting concentrically, while the antagonist controls the rate and speed of that movement by contracting eccentrically.

performed. Both agonists' and antagonists' fibers are recruited according to the "all or nothing" principle described above.

The agonists of a movement, which include the prime mover and its synergist(s), are the muscles that contract concentrically to produce movement. A concentric contraction is one in which fibers shorten to produce the force needed for action. The prime mover is the main muscle responsible for a given movement and is usually the biggest or strongest of the muscles responsible for that particular action. In flexing the elbow, for example, the brachialis muscle is the prime mover; it contracts concentrically.

Synergists are muscles that assist the prime mover when the force needed requires the concentric contraction of several muscles. Synergists are the smaller muscles capable of performing the same action as the prime mover. Frequent synergists to the brachialis for flexing the elbow include the biceps brachii and brachioradialis, although any muscle that flexes the elbow may become involved. The number of muscles and the strength required to assist the prime mover in its action depend largely on the amount of resistance involved. Lifting a pen may not require the contraction of many fibers of the prime mover for elbow flexion nor the recruitment of synergists. However, lifting a heavy box of books may require the contraction of all of the fibers of the prime mover for elbow flexion and the recruitment of all of its synergists. When the prime mover for a particular action is injured, its synergists (among other structures) often help to compensate for the dysfunction. These can become prone to hypertonicity and injury when called upon to carry out actions normally performed by the bigger, stronger, prime mover.

Antagonists are muscles that oppose agonists to ensure that movement is fluid. The antagonist lengthens against the shortening of the agonists to control the speed and rate of contraction, resulting in smooth movement. Without antagonists to control the speed and rate of contraction, a strong impulse to flex your elbow to scratch your nose could result in a black eye! The antagonists during flexion of the elbow are the triceps brachii; they contract eccentrically. An eccentric contraction is one in which fibers lengthen to keep movement fluid. The number of fibers recruited to antagonize an action depends on the amount of force needed to control the speed and rate of a concentric contraction. Flexing your elbow while picking up a pen may require the recruitment of a few fibers of the antagonists to elbow flexion, while lifting a box of books may require the recruitment of all of the antagonists' fibers. Conversely, the triceps are agonists for extending the elbow and are antagonized by the elbow flexors.

Understanding these differences is important for planning treatment because the prime mover and synergists involved in an action that contributed to an injury are prone to shortening and are likely to need lengthening, while the antagonists of that action are more prone to overstretching or microtearing and are likely to need strengthening. Once you treat the shortened muscles involved in a dysfunction, it is essential to assess their antagonists for injury and instruct the client to strengthen them when appropriate so that they become strong enough to help keep the shortening of the agonists from recurring.

Often, the coordination of agonists and antagonists is compromised not by an action that caused an injury but by a static posture that holds agonists in a shortened position and antagonists in a lengthened position. For example, a truck driver or data entry clerk is prone to developing hyperkyphosis because they spend hours with the pectorals shortened and the rhomboids lengthened. Because this client often feels pain between the shoulder blades, we rush to treat those muscles, and we should. However, if we do not also lengthen the pectorals and instruct the client on how to strengthen their antagonists, the rhomboids have little chance of performing optimally against the resistance of the chronically shortened pectorals.

Most activities are performed by a variety of muscular movements that occur in phases. For example, when we flex our elbows, we may also be pronating or supinating the forearm, flexing or internally or externally rotating the shoulder, and so on. Therefore, it is necessary to consider the agonists, synergists, and antagonists in each of the actions or postural deviations that contribute to dysfunction. In addition, while agonists and antagonists oppose each other in an isotonic contraction, such as when walking, isometric contractions affect the muscles on either side of the joint involved nearly equally. When you are standing still, both the hamstrings and quadriceps are contracting isometrically to maintain balance.

RANGE OF MOTION

Range of motion (ROM) is a general term that describes all of the possibilities of movement of a joint. ROM does not describe the functionality of muscles, although the results of ROM testing, which indicate the functionality of a joint, may lead to your examination of the muscles responsible for that movement and of other soft tissues involved. The ROM of each joint depends on the shape of the joint as well as the muscles and other tissues surrounding that joint. When referring to ROM, it is important to name the joint involved, the action involved, and whether the action is passive, active, or resisted (e.g., active flexion of the elbow). If the client feels pain during ROM testing, ask where the pain is felt so that you can begin to pinpoint the source and determine whether the agonist or antagonist, muscle or tendon, ligaments, joint capsule, or bones of the joint are primarily responsible. While a visual estimate is often sufficient to recognize dysfunction, ROM can be measured more precisely with a goniometer (Fig. 1-3).

In active ROM, the client moves the joint through its range by consciously contracting muscles (Fig. 1-4). Active ROM can be free (AF ROM: active free range of motion) when the client moves without any help, or it can be assisted (AA ROM: active assisted range of motion) if weakness makes it difficult for the client to move the joint unassisted. Since it allows the client to control the amount of movement and stay within a pain-free range, only active ROM testing should be used during the acute stage of injury to prevent undue pain or re-injury.

Passive ROM (P ROM) describes action at a joint that is produced by a force other than muscle contraction across that joint (Fig. 1-5). Gravity, a wall or other surface, another part of the client's body, and the massage therapist are external forces that can produce P ROM. To test P ROM, move the relaxed client's joint through its range without their assistance. You may choose

Figure 1-3 Goniometer. ROM can be measured precisely with a goniometer.

Figure 1-4 Active dorsiflexion of the ankle. In AF ROM, the client moves the joint through its range by actively contracting muscles without assistance or external resistance.

Figure 1-5 Passive flexion of the hip. In P ROM, the therapist moves the relaxed client's joint through its range.

Figure 1-6 Resisted adduction of the hip. In R ROM, the client actively moves a joint through its range while the therapist applies resistance. In this image, the client is moving his leg straight toward the camera, resisted by the therapist's pressure.

this option if the client is too weak to move the joint or if you want to test the joint for structural abnormalities or for the dysfunction of noncontractile tissues.

Resisted ROM (R ROM) is an active contraction by the client that is resisted by an external force such as a weight, a wall or other surface, or the massage therapist (Fig. 1-6). To test R ROM, instruct the client to move the joint actively while you resist their effort just distal to the joint being tested. You do not need to resist the action to the point of immobility or trembling, which would obscure the results. Minimal resistance is enough to engage structures and recruit receptors that are not engaged in AF or AA ROM. R ROM should not be used in the acute stage of injury.

CLIENT ASSESSMENT

It is always essential to learn as much as you can about the client's health history before proceeding with condition-specific massage. Many conditions may have underlying contributing factors—such as systemic conditions, past trauma, side effects from medication, and personal stress—that involve contraindications or require special consideration in a treatment plan. It is important to get as much detail as you can and use critical thinking to see the big picture.

Health History

OLDRFICARA (read: "Ol' Dr. Ficara") is a mnemonic to help you remember important questions to ask the client when collecting the basic, subjective information you need to make an accurate assessment and plan treatment. The answers to these questions may have different implications depending on the client's condition. These are discussed in greater detail in the chapters on specific conditions.

Onset—When did the symptoms begin?
Location—Where are the symptoms felt?
Duration—How long do the symptoms last when they occur?
Radiation—Do the symptoms radiate to another part of the body?
Frequency—How often do the symptoms occur?
Intensity—Using a pain scale, what is the level of pain with these symptoms?
Character—Describe what the symptoms feel like.

Aggravating factors—What makes the symptoms worse?
Relieving factors—What makes the symptoms diminish?
Associated factors—This includes more specific questions based on the information you have collected so far and questions about any medical diagnoses, medications, other treatments, past injuries, and any other detail that may help you plan treatment. (The following chapters list questions that are important for specific conditions.)

What do Signs and Symptoms Tell You?

A client's signs and symptoms can tell you much of what you need to know to assess a mild or moderate condition. Signs are objective and measurable by the therapist. These include postural deviations, ROM assessment, tone, temperature, and texture of soft tissues. Symptoms are subjective and are measured by the client. These include level of pain, fatigue, and quality of life. Knowing what a client feels before beginning a postural assessment or special tests helps you focus your assessment and save time. While each client's case and subjective description may vary, some general interpretations of signs and symptoms listed in Table 1-1 can be helpful.

Use a pain scale when assessing the client's symptoms. Research some of the many methods used to assess pain, and choose one that helps you make the best connections between the client's subjective description and treatment goals (Fig. 1-7). Always remember that pain is subjective and that clients' pain tolerance may vary widely. In your verbal assessment, ask the client about their level of pain during activities of daily living. A scale of 1-10 is commonly used where 10 represents a level of pain that significantly hinders or even prevents activities of daily living. A level 9 or 10 pain during activities of daily living may indicate a serious condition or a severe or acute injury. Refer these clients to their health care provider if you suspect a systemic condition or if the injury requires medical attention. In the case of a severe or acute injury that is not contraindicated for massage, even if you have received clearance from a health care provider to perform massage therapy, you may not be able to work locally, and you should not work deeply. You may opt to reschedule treatment of this client until the injury has reached the subacute or chronic stage, or refer the client to a massage therapist with advanced training. Note that all pain matters; do not underestimate the importance of even a level 2 or 3 pain, especially if it is chronic. A healthy neuromusculoskeletal system should produce no pain at all.

You also need to assess any pain a client experiences during treatment. Using a 1-10 scale again, 10 represents pain that would cause the client to pull away from your touch. Ask the client to let you know when you approach level 6 or 7, because once pain reaches a level 8, the client may not be able to remain fully relaxed. If you are going to use a technique that produces pain above a level 8, such as some trigger point techniques, explain this to the client in advance to try to keep him or her from tensing the muscles. Many clients believe that treatment is most beneficial when it is deep and painful. Explain to your clients that treatment is most effective when it is delivered slowly and deliberately, one layer at a time, with the client as relaxed as possible. The treatments described in this text should not be painful. Keeping the client calm and relaxed is crucial. Reminding the client to breathe during deep techniques may help ease pain and prevent him or her from tensing the muscles.

Range of Motion Assessment

When testing ROM to assess a dysfunction, it is best to test active ROM of the joint first. The client will likely restrict AF ROM to a range within their comfort zone. Use the client's active range as a guide when performing P ROM and R ROM testing to avoid causing the client unnecessary pain or further injury by moving beyond their comfort range. Moreover, forcing joint movement through its full range can affect the accuracy of your assessment. You want to assess what the client can achieve only up to the point of discomfort. This will give you the information you need to assess what may be keeping the client from reaching the full range. When using ROM as part of your treatment or recommending it for self-care, be careful to stay within a comfortable range and to limit resistance or repetition that may reproduce symptoms.

Table 1-1 General Interpretations of Subjective Descriptions

Subjective Description	During Activities of Daily Living	During Palpation or Treatment
Sharp pain	Recent trauma to soft tissue. Acute stage of an injury, such as torn muscle fibers, tendon, or ligament, felt particularly with movement, often relieved at rest. A condition involving an internal organ (local, deep pain). Compression or impingement of a nerve, in particular if accompanied by burning or tingling, felt at rest or with activity.	Compression of or friction to torn fibers. Compression of a bone spur, cyst, or other abnormal growth. An internal organ condition, when working on the abdomen.
Dull, aching pain, or stiffness or tightness	Trauma to the muscle in the nonacute stage. Hypertonicity. Swelling. Myofascial or joint restriction. Active trigger point. Syndrome such as fibromyalgia.	Ischemia due to the client's posture during treatment or to the technique applied. Area of accumulated metabolites. Hypertonic or fatigued muscles.
Burning pain or sensation	Compression of a nerve. Cutaneous trigger point. Damage to periosteum (local sensation).	Compression of a nerve due to the client's posture during treatment or to the technique applied.
Tingling or numbness	Nerve compression, impingement, or lesion. Holding the same posture for a long period. Ischemia. Systemic medical conditions involving nerve damage or ischemia (e.g., diabetes). Vitamin or mineral imbalance. Toxic exposure. Side effect of radiation.	Ischemia or compression of a nerve due to the client's posture during treatment or to the technique applied.
Throbbing pain	Inflammation. Acute injury. Sluggish venous or lymphatic flow.	Prolonged compression of blood vessels.
Increasing pain on movement	Active trigger point. Spasm. Torn fibers. With radiating pain, irritation of a nerve.	Active trigger point. Spasm. Torn fibers. With radiating pain, irritation of a nerve.
Decreasing pain on movement	Edema or decreased circulation relieved by increasing circulation. Latent trigger point.	Edema or decreased circulation relieved by increasing circulation. Latent trigger point.
Pain unaffected by movement	Cutaneous trigger point. Pain is referred.	Cutaneous trigger point. Pain is referred.
Weakness	Injury or condition affecting nerves, muscles, or neuromuscular junction.	Compression of a nerve or blood vessel due to the client's posture or the therapist's technique.

Table 1-1 General Interpretations of Subjective Descriptions (Continued)

Subjective Description	During Activities of Daily Living	During Palpation or Treatment
Paresthesia (prickling, itching, pins and needles sensation on skin)	Nerve involvement ranging from simple compression to tumors. Compromised circulation. Diabetes. Hypothyroid condition. Vitamin deficiency. Rheumatoid arthritis. Lupus.	Compression of a nerve. Stimulation of cutaneous reflex zone.
Hyperesthesia (abnormally high sensitivity to stimulus)	Chemical stimulants (e.g., caffeine). Trauma to head or spinal cord. Anxiety.	Stimulation of the central nervous system. Anxiety.
Heat	Inflammation.	Increased circulation resulting from repetitive stroking. Technique initiates inflammatory process.
Cold	Ischemia.	Compression of blood vessels.

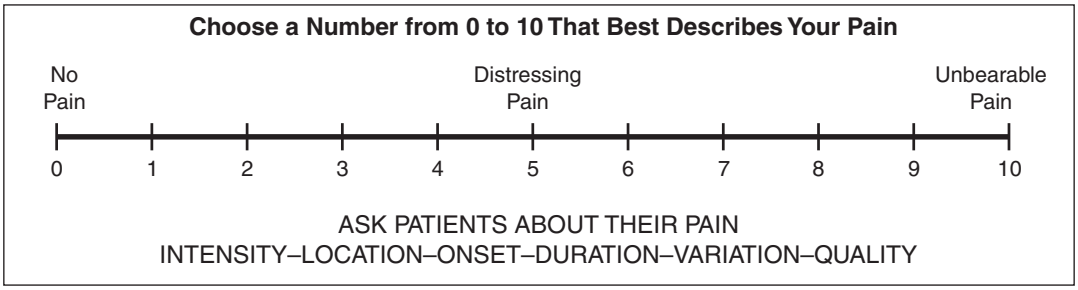
As an assessment tool, AF ROM gives you information about both contractile and noncontractile tissues in and surrounding the joint. If the AF ROM of the affected joint causes pain or is reduced compared to the same, healthy joint on the other side of the body, this could indicate trigger points, adhesions, scarring, or injuries to the agonist, synergist, or antagonist for that movement as well as possible abnormalities in bone, ligaments, bursa, menisci, or other tissues. If the client feels no pain but is unable to move the joint through its full range, this could indicate weakness in the agonist or synergists of that motion and may indicate neurological involvement. Such results should lead you to test those muscles more specifically either with R ROM to test strength or with palpation to test texture, tone, temperature, and tenderness (see Palpation section below).

As an assessment tool, P ROM may reveal information about joint dysfunction that is unrelated to muscle contraction. By eliminating muscle contraction as a factor in this assessment, you may be able to deduce that pain or restriction is caused by injury or inflammation that is not wholly muscular in nature. Bursitis, meniscal tears, bone spurs, ligament instability, dislocations, fascial restrictions, or other problems may then become evident.

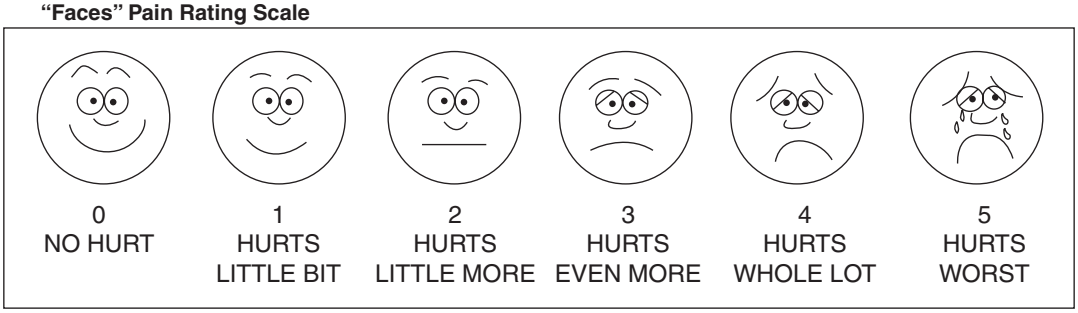
End feel is the term for the sensation the therapist feels when applying overpressure, that is, adding just a bit of pressure at the end of the client's comfortable passive range of motion. You add only enough pressure to feel if and how the joint springs back. You do not want to add enough pressure to push the joint beyond the client's comfortable ROM. A healthy end feel is one that occurs when overpressure is added to the P ROM of a joint that has full ROM and results in a gentle spring back with no discomfort. This is the normal response to overpressure when the shape of the joint and functional soft tissue surrounding the joint are the only things that limit its range. A pathological end feel, in contrast, is the sensation you feel when overpressure is added to the P ROM of a joint that cannot reach full ROM or results in discomfort because an unhealthy structure stops it short. Table 1-2 summarizes healthy and pathological end feels.

As an assessment tool, R ROM can give you information about the client's strength and the health of the nerves that send impulses to the muscles that move the joint being tested. If R ROM tests elicit pain, it is likely that there is a trigger point or a strain to the muscle or tendon crossing the joint. Depending on the degree of strain, the results may be similar to AF ROM. If R ROM reveals weakness without pain, nerves may be involved.

Visual Analogue Scale



"Faces" Pain Rating Scale



Behavioral Observation Pain Rating Scale

Categories	Scoring		
	0	1	2
Face	No particular expression or smile; disinterested	Occasional grimace or frown, withdrawn	Frequent to constant frown, clenched jaw, quivering chin
Legs	No position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, or jerking
Cry	No crying (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or talking to. Distractable	Difficult to console or comfort
Each of the five categories (F) Face; (L) Legs; (A) Activity; (C) Cry; (C) Consolability is scored from 0 to 2, which results in a total score between 0 and 10.			

Figure 1-7 **Pain scales.** Many methods are used to assess pain. Research a few, and choose one that best suits your needs and the needs of your clients. From Yeznach Wick J. Pain in a special population: the cognitively impaired. Pharmacy Times 2007. Available at http://www.pharmacytimes.com/issue/pharmacy/2007/2007-01/2007-01-6171.

Palpation

Your fingers have many sensory receptors that give you the ability to detect even the most minor inconsistencies in tissues. While developing palpation skills, be patient with yourself. You may not yet be fully able to quickly make the connections between what you read here and what you feel with your hands. It takes time and practice with many different bodies to develop accurate palpation skills.

Many of the strokes used at the beginning of treatments are excellent palpation tools that can reveal atypical properties, such as hypertonicity, in a general way. With the more local tissues involved

Table 1-2 Joint End Feel

Type of End Feel	Cause of Limitation	Healthy End Feel	Pathological End Feel
Soft tissue approximation	Normal mass of soft tissue at end of range (e.g., elbow flexion is limited by meeting of biceps and anterior forearm muscles).	Painless for client. Therapist feels soft compression of one muscle against another with spring back following overpressure.	N/A
Muscle end feel	Full length of muscle reached (e.g., dorsiflexion is limited by the length of plantar flexors).	Client feels stretch. Therapist feels tension and spring back following overpressure.	Client may feel pain if adhesions or scarring are present. Therapist feels abrupt end of range.
Capsular end feel	Joint capsule reaches full stretch (e.g., external rotation of shoulder).	Painless for client. Therapist feels firm sensation with little give as if stretching leather, with spring back following overpressure.	Soft capsular end feel is similar to healthy end feel, but client feels pain and muscle guarding. Common with sprains, acute inflammation, and stiffness, and felt throughout range. Hard capsular end feel ends in resistance and no give.
Ligamentous end feel	Ligaments surrounding joint (e.g., abduction of extended knee).	Client feels no pain. Therapist feels firm end with no give, and spring back following overpressure.	Referred to as loose ligamentous end feel. Client may feel pain. Therapist is able to move joint beyond normal range.
Bony end feel	Bony structures of joint (e.g., full extension of knee).	Client feels no pain. Therapist feels abrupt end of range with spring back following overpressure.	Client may feel pain. Therapist feels abrupt, hard stop before full range due to callus, fracture, or myositis ossificans. An end feel that is rough or gravelly may indicate chondromalacia or crepitus.
Muscle spasm	Reflexive muscle spasm to prevent further movement.	—	Client feels pain and stops movement suddenly with possible rebound due to spasm.
Boggy end feel	Joint effusion or edema (common with sprains and capsular restrictions).	—	Client may feel pain. Therapist feels soft, mushy end.
Empty end feel	Severe pain. Rare except with grade 3 sprain, impingement, dislocation, acute bursitis, or tumor.	—	Client feels severe pain. Therapist feels no restriction or no appreciable end to range, but movement is protectively stopped by client, without spasm, as contraction would cause compression and increase pain.

in specific conditions, it is important to take your time with palpation for your assessment to be comprehensive and accurate. When palpating locally for specific irregularities like scar tissue or strains, your movement should cover only 1 inch of tissue in 5-10 seconds. Slow, deliberate palpation in an area solid with adhesions and hypertonicity may also release superficial tissues and reveal deeper, more specific causes of dysfunction. Focus intently when you palpate to avoid missing subtle details. Begin superficially and work toward deeper palpation. Even when palpating deep tissues, avoid heavy pressure that may change the texture of the surrounding tissues, transfer too much information to the receptors in your fingers, and obscure your results. Ease your way into the deeper layers.

Focused palpation reveals inconsistencies in the texture, tone, temperature, and tenderness of tissues that might help explain the causes of dysfunction and pain. The norms for these characteristics may differ slightly from client to client, so you need to palpate bilaterally to make a comparison between tissues that you suspect are contributing to poor posture or pain and the tissue of the same structure on the unaffected side. Table 1-3 is a general guide to some of the characteristics you may discover.

MASSAGE THERAPY

General Principles of Massage

Once you have collected information to help you understand the client's particular situation, you can plan treatment with specific goals. A wide variety of techniques are at our disposal to achieve these goals, and we plan the sequence of these techniques to best address the factors involved in the client's dysfunction. By choosing techniques with physiological effects that match the treatment goals and by following the general principles of massage, you can plan effective treatment for the client's specific condition no matter what modality you practice. The general principles described below complement each other so well that applying one will often satisfy the others. For example, in many cases, when you begin treating generally, you will very likely also be working superficially and proximally. When treating specific structures, you are often also working deeply and distally.

GENERAL-SPECIFIC-GENERAL

The general-specific-general principle applies with all techniques for general relaxation or to treat specific conditions and is elemental for a full body massage or more localized treatment. This principle involves applying techniques generally both before and after applying them specifically. The intent is to accomplish general goals before focusing on specific goals and to work systemically before treating locally. General goals include acclimating the client to your touch, reducing sympathetic firing and engaging parasympathetic mechanisms of the nervous system, and increasing circulation. Once you have applied general techniques, you are ready to work more specifically. This could mean using a technique with a targeted physiological effect (e.g., reducing adhesions after you have increased circulation) or applying a variety of techniques to the specific tissues involved in the condition (e.g., treating the wrist to reduce adhesions, lengthen shortened tissues, and mobilize the joint after treating the body generally to open channels of circulation and attend to compensating structures). Following the specific treatment, work generally again to clear the area, move fluids and metabolites toward the heart or lymph nodes, and relax the nervous system, which may have been excited by your specific treatment.

An example of the general-specific-general principle is to apply superficial effleurage to the whole body before applying petrissage and deep effleurage to the quadratus lumborum; then follow this local treatment with clearing strokes to move the contents you have released through the proper channels toward the nearest lymph nodes. This sequence applies the principle in a general Swedish massage that incorporates specific focus on the low back. Another example is applying warming strokes and superficial myofascial release to the neck and shoulders before stripping individual neck muscles and treating trigger points, then following with clearing strokes toward the trunk. This sequence applies the principle in a treatment for tension headaches.

SUPERFICIAL-DEEP-SUPERFICIAL

The superficial-deep-superficial principle also applies with all techniques for general relaxation or to treat a specific condition and is elemental when planning a full body massage or a more localized treatment. This principle involves applying techniques to superficial tissues both before and

Table 1-3 Common Characteristics of Injured Tissue

Characteristics	How it Feels to the Therapist	Therapeutic Goals
Adhesions—tissues stick together	Superficially, it may feel as if the skin does not move freely over superficial muscles. Deeper structures may feel as if they are one. You may be unable to differentiate individual muscles or fiber directions if adhesions are present.	Release adhesion to allow tissues to move freely and independently.
Hypertonicity—increased tone in muscle belly, often accompanied by dehydration, and may be neurological in nature.	Tissue feels resistant and harder than healthy tissue. Shape is distorted. Fiber direction may be obscured. Often accompanied by adhesions and may contain trigger points.	Reduce tone—release tension with heat, massage, and lengthening.
Hypotonicity—reduced tone in muscle belly, often accompanied by fluid retention, and may be neurological in nature.	Tissue feels spongy and softer than healthy tissue. Fibers may feel inflated. Contractile strength may be reduced but functional.	When indicated, increase tone with cold, stimulating strokes, and isolated concentric contractions.
Atrophy—muscle wasting, often the result of a systemic condition or lack of use.	Tissue feels spongy and softer than healthy tissue. Contractile strength is minimal to nonexistent.	Treatment depends on the cause. If systemic, discuss with health care professional. If disuse is the cause, perform isolated contractions with gradual introduction of resistance.
Taut—overstretched or pulled tightly.	Tissues feel like tightly pulled strings, as on a guitar. Fibers are easily isolated and may strum when applying cross-fiber strokes. Often accompanied by adhesions and may contain trigger points.	Reduce adhesions and trigger points if found. Encourage activities and postures that do not add length to the muscle.
Myofascial trigger points—hyperirritable spot in a taut band of skeletal muscle.	When palpable, feels like a knot or a bump. Trigger points are often obscured by adhesions and hypertonicity and are revealed only when superficial layers are treated first.	Reduce tone, metabolites, ischemia, or other factors contributing to trigger points, followed by stretching to restore normal muscle length.
Scar tissue	An interruption in fiber direction or an uncharacteristic, immovable bump or divot in tissue with accompanying adhesions.	Break up scar tissue, and realign with healthy fiber direction.
Fibrosis—formation of tough, fibrous tissue; often part of the healing process but can become chronic.	Thick, often lumpy, moveable tissue. Sometimes feels as if fibers are inflated or swollen.	Halt fibrous formation by increasing circulation and restoring muscle function. In chronic cases, use friction to reduce nodules when not contraindicated (e.g., with rheumatoid arthritis) followed by stretching the affected fibers.
Panniculosis—fibrosis or increased viscosity of subcutaneous fascia.	Superficial. Feels coarse and granular. Skin may look dimpled.	Skin rolling or other myofascial technique to reduce viscosity.
Crepitus—crackling sound made when two rough surfaces in the body make contact.	Feels similar to adhesion but with audible and palpable crackling.	Reduce adhesions and release gasses or metabolites that contribute to crepitus. Increase circulation to flush tissues.
Inflammation—local response to injured cells characterized by dilation of capillaries, heat, and swelling.	Local, sometimes visible swelling that is often red and warm or hot to the touch.	Massage is locally contraindicated when inflammation is acute. Increase venous flow proximally to encourage removal of metabolites.
Edema—accumulation of interstitial fluid.	Skin may look swollen, stretched, or shiny. Texture may feel boggy or gelatinous.	Massage is locally contraindicated. Increase venous and lymphatic flow proximally to encourage reabsorption.

(*continued*)

Table 1-3 Common Characteristics of Injured Tissue (Continued)

Characteristics	How it Feels to the Therapist	Therapeutic Goals
Heat—dilation of blood vessels, often red, and a sign of inflammation.	Warm or hot to the touch.	Heat may be a sign of infection, which is a contraindication. If no infection is suspected, encourage venous return and lymphatic flow.
Cold—constriction of blood vessels, often pale and dry, and may result in reduced hair growth.	Cool or cold to the touch.	Cold may be a sign of ischemia and may result from a systemic condition. If no contraindications exist, increase circulation to warm the area.

after applying them to deeper tissues. Working superficially first ensures that you treat tissues layer by layer, reducing the possibility of shocking the client's tissues and causing kick-back pain (i.e., pain that occurs in the hours or days following treatment, especially when treatment progresses too deeply too quickly).

An example of the superficial-deep-superficial principle is to apply light effleurage to the whole back before applying deeper effleurage and petrissage to the erector spinae; then end with superficial clearing strokes toward the heart. Using the same sequence next with the extremities would apply all of the general principles for a full body, general relaxation massage. Another example of the superficial-deep-superficial principle is warming the tissues of the forearm, releasing superficial fascial restrictions, breaking deeper adhesions with cross-fiber friction, stripping individual muscles that cross the wrist, treating the flexor retinaculum, stretching the tissues, and ending first with deep and then with superficial clearing strokes toward the axilla. This sequence applies the principles in the treatment of carpal tunnel syndrome.

PROXIMAL-DISTAL-PROXIMAL

The proximal-distal-proximal principle also applies with all techniques for general relaxation or to treat a specific condition and is elemental for a full body massage or more localized treatment. This principle involves applying techniques closest to the trunk before applying them to the extremities, finishing with strokes back toward the trunk. By beginning treatment proximally, you open the channels of circulation so that whatever fluids you move when working distally have a clear, open path back to the lymph nodes and heart. After treating distally, it is essential to encourage circulation back toward the trunk so that metabolites and edema do not reaccumulate distally or at the site of the injury.

An example of the proximal-distal-proximal principle is beginning treatment on the back, working next on the extremities, and finishing with clearing strokes back toward the trunk. This applies the principle in a full body relaxation massage. Another example is to treat the thigh and leg before frictioning scar tissue around the malleoli, and then use clearing strokes to encourage venous return proximally. This applies the principle in the treatment of a sprained ankle in the chronic stage.

PERIPHERAL-CENTRAL-PERIPHERAL

The peripheral-central-peripheral principle applies when treating specific injuries and is elemental for planning localized treatments. This principle involves applying techniques around the periphery of an injury before working directly on it. The proximity of your treatment to the central area of an injury depends on the stage of the injury and the client's tolerance. You may not be able to treat the area of injury directly in your initial sessions but may be able to approach it gradually in subsequent sessions.

By treating peripherally, you can move metabolites that have accumulated in low concentrations around the injury to clear the area for moving metabolites in higher concentrations closer

to the specific site. Likewise, adhesions and scar tissue are likely to be less dense in the periphery of an injury than directly on it, and treating the periphery first may make it easier to approach the center. Finally, the client probably feels less pain in the periphery than at the site, so as long as working locally is not contraindicated, you can slowly approach the area and gradually ease any anxiety about having the injury touched. Ending with treatment at the periphery aids in venous return and reduces kick-back pain, possibly because the focus moves away from the injury toward tissues with more integrity.

An example of applying the peripheral-central-peripheral principle is to reduce adhesions and hypertonicity in the hamstrings on either side of torn fibers before breaking up scar tissue and realigning fibers at the site of injury; follow this with clearing strokes over the whole leg working toward the trunk to increase venous return. This applies the principle in the treatment of a hamstring strain in the subacute or chronic stage.

Physiological Effects of the Basic Strokes

Each of the strokes used in massage therapy has physiological effects that may vary depending on the depth and speed of their application. The Arndt-Shultz law explains that weaker stimuli activate physiological effects while stronger stimuli inhibit them. For example, beginning your work superficially and then gently and slowly working into deeper tissues will have a more positive physiological effect than quickly applying force. The most effective treatment includes a combination of strokes chosen and applied in a sequence specifically intended to produce a desired effect. This is especially important when using massage to treat specific conditions that have overt contributing factors. Because of its physiological effects, a massage stroke may also be contraindicated by your treatment goals or may not be appropriate for clients with certain local or systemic conditions. For example, if one of your treatment goals is to reduce local inflammation, applying friction on or near the area would be contraindicated by your goal. See Table 1-4 for more general contraindications.

The three basic effects of massage strokes are mechanical, reflexive, and chemical. A mechanical effect changes the shape or tone of the tissue and often results from force. Lengthening a shortened muscle by using deep gliding strokes is an example of a mechanical effect. A reflexive effect occurs when the stroke applied accelerates or decelerates a response, often in the nervous system, and is generally intended to restore homeostasis. Dilation of blood vessels following the release of a compressive force to a previously ischemic area is an example of a reflexive effect. A chemical effect occurs when a stroke encourages the release or absorption of chemicals in the body. Massage resulting in an increase in serotonin—a neurotransmitter that regulates mood and reduces irritability—is an example of a chemical effect.

It may not be possible to precisely identify a single effect with each use of massage strokes largely because practitioners do not always apply them in exactly the same way and because each client's physiological response may be slightly different. In addition, it may not be possible to isolate one effect from another when a stroke produces more than one effect. There is currently great interest in investigating the physiological effects of massage strokes in more detail. Organizations like the National Institutes of Health are soliciting research to help explain exactly why these techniques work. We do, however, have a fundamental understanding of how the techniques generally affect the systems of the body. Table 1-4 summarizes the basic strokes used in massage and many of their physiological effects. Consider the following general principles when choosing strokes and determining what depth and speed to use when applying them:

- If the stroke increases circulation or lymph flow, it is best to apply it in the direction of venous return (toward the heart) or lymphatic flow (toward the nearest lymph nodes).
- The depth of strokes influences the therapeutic effect. Using a stroke superficially will affect the superficial tissues, while applying it deeply will affect the deeper tissues. It is best to work the superficial tissues thoroughly before accessing the deeper tissues, to prevent kick-back pain.
- The speed of strokes influences the therapeutic effect. Applying a stroke slowly is more likely to be relaxing and may enhance the mechanical effects intended. Applying a stroke quickly is more likely to stimulate the tissues resulting in shorter reflexive effects.

Table 1-4 Physiological Effects, Therapeutic Goals, and Contraindications to the Basic Massage Strokes

Stroke	Physiological Effects	Therapeutic Goals	Cautions and Contraindications
Effleurage or gliding	Increases venous circulation. Stimulates lymph flow. Increases mobility of tissues. Dilates arterioles. Stimulates mechanoreceptors.	Mobilize fluid. Increase circulation. Increase lymph flow. Reduce edema. Increase absorption of metabolites into lymph. Reduce pain. Reduce tension. Reduce spasm. Lengthen tissue. Soften scar tissue.	Open wounds. Local or systemic infection. Varicosities (if significant enough to damage vessel). Edema (if significant enough to tear skin). Bruises. Dermatitis. Local cortisone injection. Following radiation therapy. Fever. Any diagnosis that suggests impaired cardiovascular function.
Petrissage or kneading	Softens and increases pliability of tissues. Creates space around fibers. Warms tissues. Affects muscle spindles and Golgi tendon organs to reflexively relax muscle. Increases superficial and deep circulation. Stretches scar tissue.	Increase circulation. Mobilize fluid. Mobilize tissues. Mobilize metabolites for removal. Reduce tension. Reduce spasm.	Open wounds. Local cancer. Local infections. Chronic inflammation. Gross edema. Circulatory condition (particularly local, such as thrombosis). Acute injury. Reduced tone or atrophy. Local cortisone injection. Large varicose veins.
Compression	Softens tissue. Flattens tissue. Stimulates muscle spindles to initiate reflexive muscle relaxation. Stimulates nerves. Arterioles dilate following release.	Increase circulation. Relieve trigger points. Reduce tension. Reduce spasm.	Open wounds. Local cancer. Local infections. Chronic inflammation. Gross edema. Local cortisone injection. Circulatory condition (particularly local, such as thrombosis). Nerve impairment. Acute injury.

Table 1-4 Physiological Effects, Therapeutic Goals, and Contraindications to the Basic Massage Strokes (Continued)

Stroke	Physiological Effects	Therapeutic Goals	Cautions and Contraindications
Vibration	Stimulates nerves. Stimulates mechanoreceptors. Initiates reciprocal inhibition. Reduces pain.	Loosen mucus in lungs. Reduce spasm. Reduce edema. Aid in resetting muscle function.	Open wounds. Acute injury. Local cortisone injection. On thorax: heart failure, thrombosis, or severe hypertension. Local cancer. Infections. Gross edema. Circulatory insufficiency. Following radiation therapy. Hyperesthesia. Varicosities.
Tapotement or percussion	Stimulates nerves. Stretches tendons, resulting in contraction of muscle and inhibiting its antagonist. Stimulates weak muscles. Contracts superficial blood vessels when applied superficially. Dilates vessels by releasing histamine.	Increase circulation and lymph flow. Pain relief. Aid in resetting muscle function. Loosen and move mucus in lungs.	Open wounds. Acute injury. Local cortisone injection. On thorax: heart failure, thrombosis, or severe hypertension. Local cancer. Infections. Gross edema. Circulatory insufficiency. Following radiation therapy. Hyperesthesia. Hypertonicity. Fresh scars. Varicosities.
Friction	Breaks up adhesions. Initiates inflammatory process. Provides pain relief. Helps tissue repair.	Increase inflammation to reduce adhesions and initiate tissue repair. Reduce adhesions. Break down scar tissue before realignment.	Acute injuries. Fresh scars. Local inflammation or edema. Use of NSAIDs within 4 hours of treatment. Local cortisone injection.

Hydrotherapy

Hydrotherapy, or water therapy, can be a useful therapeutic tool in massage treatments. Hydrotherapy can also be a great self-care tool when clients apply it correctly. There are numerous methods for applying hydrotherapy including baths, steam, and heat or ice packs. Study these in detail if you choose to use them or recommend them for self-care. This book focuses on moist heat and ice packs used during therapy as well as simple hydrotherapy options for self-care.

The temperature of the hydrotherapy source must be higher or lower than body temperature to have an effect. The greater the difference in temperature is, the more profound the effect will be. Hydrotherapy must be adjusted to the client's tolerance as well as for the particular condition. When using hydrotherapy during treatment, be sure to check in with the client frequently to ensure that the temperature is not extreme. If it is, add an additional layer of wrap around the source of hydrotherapy, or otherwise adjust the temperature of the source to suit the client's tolerance.

The application of heat should always be moist. Dry, electric heat can dehydrate soft tissue locally, which may result in thicker adhesions and the accumulation of metabolites. This condition could hinder the outcome of your treatment and may be painful for the client. Regardless of your source of heat—hydrocollator, thermal water pack, or other supply—be sure that the wrap you use is clean and moist.

The source of cold should also always be covered by a clean wrap, though applications of cold hydrotherapy in these chapters do not require external moisture. In some cases, as described in the following chapters, it is recommended that ice applications be maintained until the area is numb. Before reaching that point, the client may briefly experience pain from the extreme cold. Explain this to the client in advance and ask him or her to let you know if the pain becomes too much to endure the entire process. Add an additional layer of wrap if this occurs. Once the discomfort has ceased and numbness occurs, remove the source of cold to avoid frostbite.

In all cases, be sure that the weight of your hot or cold source is not so heavy that it would compress injured structures, nerves, or vessels. Table 1-5 lists the effects, goals, and contraindications for simple hot and cold hydrotherapy applications.

Contrast hydrotherapy involves alternating hot and cold applications. Contrast is best used to reduce congestion in tissues because it causes vasodilation followed by vasoconstriction, which increases local circulation and creates a flushing effect. This effect partly depends on the difference in temperature of the hot and cold applications; hot and cold applications have a greater effect than warm and cool ones. In general, the heat application should last two to three times longer than the cold application, and the contrast should be repeated two or three times. Because vasoconstriction occurs in 20–30 seconds, 60–90 seconds of heat followed by 20–30 seconds of cold, repeated two or three times, is sufficient. End contrast therapy with cold to reduce prolonged fluid accumulation.

In some cases, adding salt to a bath may improve the therapeutic outcome. By the process of osmosis, water crosses a permeable or semi-permeable membrane, such as the skin, in an attempt to balance the concentration of sodium on either side of the membrane. If the water used in hydrotherapy has a higher concentration of sodium than the body, such as when salts are added to a bath or when one is in the ocean, water exits from the body through the skin into the salted water. This effect is best used therapeutically to reduce inflammation. When the water used in hydrotherapy contains no salt, the concentration of sodium is higher in the body, so water from the bath will pass through the skin into the body. This is best used when tissues are dehydrated or to dilute a high concentration of metabolites.

Drinking water is also an application of hydrotherapy. We encourage our clients to drink water after a treatment to help flush metabolites and to rehydrate tissues. In general, we should all drink water everyday to replace lost fluids and to keep tissues well-hydrated. If you wait until you feel thirsty, dehydration has already begun. Drinking water throughout the day is key to good health.

Table 1-5 Hydrotherapy

Hydrotherapy Application	Physiological Effects	Therapeutic Goals	Local and Systemic Cautions and Contraindications
Heat	Elicit parasympathetic response. Dilate vessels locally. Increase metabolism. Increase local nutrient flow. Increase inflammation. Diminish muscle tone. Diminish muscle spasm. Diminish velocity of nerve conduction. Decrease pain perception.	Increase circulation. Soften tissues. Rehydrate tissues. Flush metabolites.	Local or systemic inflammation or edema. Infection. Open wounds. Cardiovascular disease. Overstretched or atrophied tissues. Injury in acute phase. Hyper- or hyposensitivity. Extremities of diabetics.
Cold	Elicit sympathetic response. Constrict vessels locally (primary effect in first 30 seconds or so—the body responds to this by increasing circulation in an attempt to balance temperature. With longer application, vasoconstriction returns). Decrease circulation (with long applications). Decrease inflammation. Decrease metabolism. Increase muscle tone. Decrease pain perception.	Decrease inflammation and edema. Slow the inflammatory process induced by friction.	Insufficient circulation (e.g., Raynaud's). Cardiovascular disease. Hyper- and hyposensitivity. Client feels cold. Open wounds. Tissues with increased tone.

Mobilization

As a therapeutic tool, active free ROM can reduce adhesions, restore mobility, increase circulation of blood and lymph, and reset neuromuscular function and proprioception. AF ROM can be used during massage treatment or as self-care. When using AF ROM during treatment, be sure to limit movement to the client's tolerance and use repetition only as long as the action remains comfortable. When instructing the client in self-care, it is essential to demonstrate the activity you are recommending and to tell the client to stay within a range of motion and repetition that does not reproduce symptoms. Ask the client to perform the activity in your presence and recommend adjustments to ensure that he or she will not harm himself or herself when practicing alone.

As a therapeutic tool, passive ROM has many of the same effects as active ROM: reduces adhesions, restores joint mobility, increases circulation of blood and lymph, and resets neuromuscular function and proprioception. When using P ROM during treatment, be sure to respect the client's tolerance and to use repetition only as long as the action remains comfortable. When instructing the client in self-care, it is essential to demonstrate the activity you are recommending and to tell the client to stay within a range of motion and repetition that does not reproduce symptoms. P ROM is suggested for self-care using an external force (e.g., by passively extending the wrist against a desk to lengthen shortened wrist flexors).

As a therapeutic tool, resisted ROM can be used to strengthen weak or lengthened muscles and to reset the nervous system by using resisted, voluntary contractions followed by stretching, which may encourage the lengthening of a shortened muscle. Unlike R ROM for testing, when using resistance therapeutically, the intention is to apply enough resistance to motivate the client to produce a strong contraction. Use these techniques only if the client is strong enough and willing. Some clients may feel anxious about performing resisted exercise in the early stages of healing. Be certain to stay within the client's comfort zone, and use repetition only as long as the action remains comfortable.

Post-Isometric Relaxation

Proprioceptors are nervous system receptors that detect the position and action of body parts, the relationship of one body part to the others, muscle tension and stretch, joint position, and the speed and direction of movement (Fig. 1-8). In short, proprioceptors process information that is internal to the body and convey it to the brain to help you know that you are, for example, sitting rather than standing or walking rather than running. They help you know where your arm is in relation to the rest of your body when you raise it. The main proprioceptors involved in musculoskeletal function are muscle spindles, Golgi tendon organs, and joint kinesthetic receptors. Muscle spindles are located in the muscle belly and detect the amount of stretch in the muscle fibers. Golgi tendon organs are found in tendons and in the musculotendinous junctions; they

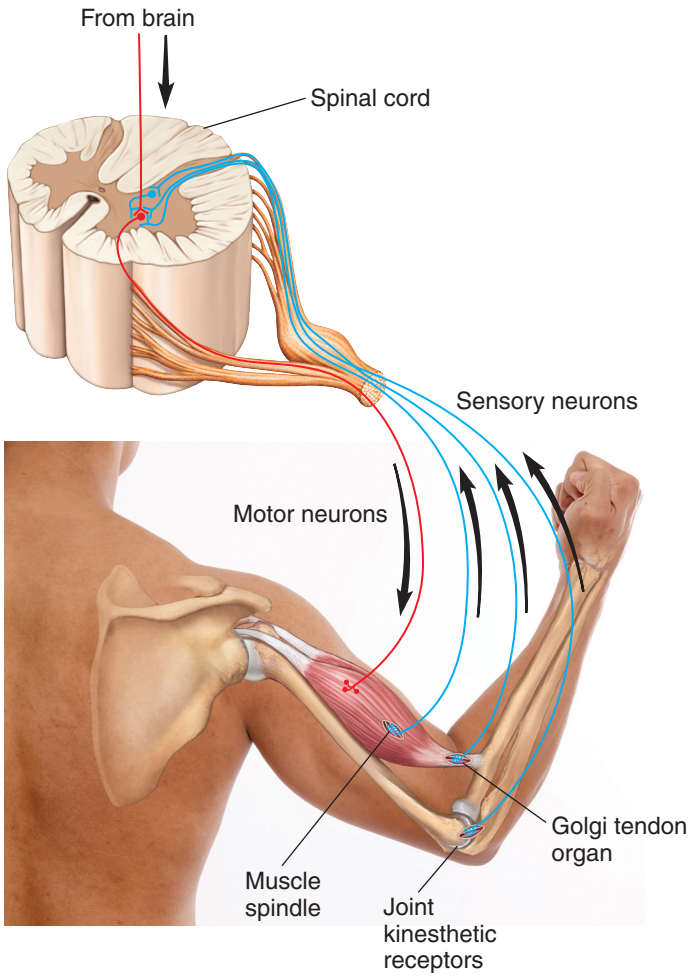


Figure 1-8 Proprioceptors. Proprioceptors process information that is internal to the body and convey it to the brain.

detect tension in those structures. Joint kinesthetic receptors are found in joint capsules; they detect pressure and movement of the joint.

When dysfunction occurs, especially if it is chronic, proprioceptors may adapt to the imbalance, compromising proper function. When muscle spindles and Golgi tendon organs misfire, resting muscle tone is set too high, which results in hypertonicity (atrophy is less likely to be associated with proprioceptor dysfunction and more likely to be associated with dysfunction of the central nervous system or the spinal roots of the peripheral nervous system). When joint kinesthetic receptors misfire, sensitivity to pressure and movement of the joint is reduced and may result in reduced ROM or chronic postural deviations. Proprioceptive neuromuscular facilitation and muscle energy technique are therapeutic methods that alternate periods of contraction and relaxation with the goal of resetting the nervous system so that a shortened muscle can lengthen more fully, the joint can move more freely, and proprioceptors can then return to normal function. For a few seconds following the contraction in these exercises, nerve impulses are repressed, which allows the muscle to be passively lengthened further. Never use these techniques with a fracture, severe or acute injury, or if the client is not receptive to or capable of resisted contractions.

There are many such exercises within each method that have slightly varying therapeutic goals. This book focuses on post-isometric relaxation (PIR) to encourage proper proprioception. Once you have studied this and other such techniques closely, you will have a variety of options better suited to the client's particular needs. All of these techniques are most effective following strokes that increase circulation, soften tissues, and initiate the lengthening of shortened tissues. You should notice the client's shortened muscle lengthen with each repetition of the steps outlined below. You may be able to reach normal resting length of the muscle with a few repetitions of PIR in a single session. If not, the client may not be ready to reach full ROM. As long as the exercise is comfortable for the client, you can repeat it in subsequent visits until normal resting length and tone is achieved. The following sequence describes PIR. It is best to explain these steps to your client before beginning so that you can coordinate movement together.

1. Position the muscle in a comfortably lengthened position. The muscle should not be lengthened to the point of a stretch.
2. Ask the client to contract the muscle against your resistance for 10 seconds. Your resistance should not require the client to use full strength but should be enough to resist full ROM. If you feel the client begin to shake or the client feels discomfort, decrease your resistance.
3. Be sure that the proximal end of the joint is securely supported in your hands as you ask the client to relax the contraction and breathe slowly and deeply. If the joint were not supported, the client would maintain a contraction to keep the structure from falling or moving too quickly.
4. Slowly lengthen the muscle as fully as you can without causing discomfort, and hold this position for approximately 15 seconds.
5. Repeat—two to four times or as indicated.

The following exercise demonstrates proprioceptive dysfunction and the benefit of massage and post-isometric relaxation in correcting it. Work with a partner. If your partner has an area of tension or pain, or if your assessment reveals a postural imbalance, apply this exercise to the affected joint. Ask your partner to close his or her eyes and adjust his or her posture unaided until he or she believes that the joint you are assessing is in anatomical position. For example, if your partner walks or stands with the hips in external rotation, ask him or her to close the eyes and adjust the hips until he or she believes that the toes are pointing forward and both hips are in anatomical position. If his or her neck is laterally flexed and rotated, ask him or her to close the eyes and point the nose straight ahead with the eyes level. If a chronic postural imbalance has affected proprioception, it is likely that his or her perception of anatomical position is skewed in the direction of the imbalance (i.e., the hips remain laterally rotated to some degree, or the neck is still somewhat laterally flexed and rotated even though your partner perceives it as balanced). Now, treat the muscles responsible for the ROM in question. In the example above, lengthen the lateral rotators of the hip or the lateral flexors and rotators of the neck, and end with a few rounds of PIR. Reassess your partner's posture, asking him or her to close the eyes and stand in anatomical position. Has the imbalance improved? If your partner has had a long

history of postural imbalance, the improvement after one treatment may be minimal. However, in some cases, a single application of massage followed by PIR can make a profound difference.

CLIENT SELF-CARE

Client self-care is important for achieving treatment goals. Massage therapy can usually help to alleviate signs and symptoms, but the client must take an active role in reducing contributing factors and prolonging the effects of treatment. Stretching, strengthening, and becoming more aware of posture and activity are some of the suggestions that may improve the treatment outcome. When educating clients about self-care, you must consider their whole situation and make suggestions appropriate for their level of strength, general health, and stage of healing. It is best to begin slowly with simple exercises and few repetitions to be certain that the client can perform self-care activities without causing further injury, fatigue, or distress. It is also essential that you demonstrate all suggested activities to ensure that the client understands them clearly, reducing the possibility of injury. If you have legal access to pictures or can create precise descriptions of self-care exercises, give them to your clients as these can be excellent guides.

The most common reason clients give for skipping self-care is lack of time. One way to encourage clients to perform self-care is to make recommendations that they can incorporate into their activities of daily living rather than having to schedule a separate time for a specific regimen. Simple, effective self-care exercises can be performed while talking on the phone, reading e-mail, watching television, or taking a shower. Some of these are described in the following chapters, and you can suggest additional self-care activities that fit nicely into your clients' lifestyles.

A client who diligently complies with self-care recommendations usually heals more quickly and remains symptom free longer than one who does not. However, as much as we want to heal clients, we cannot force them to follow our recommendations. Ask your clients if they have performed the self-care exercises you suggested. If they hesitate or admit that they have not, explain that self-care may expedite healing, but do not insist or judge. Encourage clients to perform self-care, but it is not appropriate to criticize or reprimand those who do not comply.

Stretching

A stretch is a procedure in which the distance between the bony attachment sites of a muscle is increased. Stretching is recommended after the client's mobility has increased and pain has decreased enough for you to perform ROM exercises without the client feeling intense symptoms. The target tissues for stretching exercises are those involved in the condition which have shortened due to injury, repetitive activity, or static postures. They should include compensating structures such as fascia, muscles, tendons, and ligaments unless the injury is acute and those structures have shortened or are in spasm as a protective measure to splint the joint.

Stretches should never be forced. The client should stretch to lengthen the tissue within their comfort zone. When possible, encourage the client to remain relaxed and to minimize muscle contractions once in the posture that produces the stretch. Watch the client performing the stretch. If you notice, for example, that when stretching the neck the client contracts the levator scapulae, help him or her to recognize this by using your own body to demonstrate what it looks like when he or she stretches compared to how you recommend the stretch, or by gently resting your hand on the structure that you want the client to relax while performing the stretch. One way to minimize muscle contractions during a stretch is to perform it passively with the assistance of gravity or a surface like a wall or desk.

A stretch should be steady, without force or bouncing. It takes time for soft tissues and proprioceptors to accommodate the muscle's new length. Ask the client to hold each stretch steadily for

at least 15 seconds, taking deep breaths throughout. On exhalation of a deep breath, the client may be able to reach a deeper stretch without pain.

Strengthening

Strengthening is achieved by actively contracting the targeted muscles. An active contraction occurs when one deliberately brings the bony attachment sites of a muscle closer together. Strengthening exercises are recommended only when the client is strong enough and the pain is reduced enough for the client to perform exercises without causing further injury or distress. The target tissues for strengthening exercises are those involved in the condition, which have lengthened or weakened due to injury, repetitive activity, or static postures. These should include all compensating structures unless the injury is still in an acute stage or where strengthening a muscle would adversely affect its antagonist. For example, if you were unable to reduce adhesions or spasm in the biceps brachii, attempting to strengthen the triceps could cause a reaction in the biceps or its synergists, intensifying the spasm or tearing the tissues. The client may be more capable of strengthening the muscle safely after subsequent visits when spasm has subsided.

Strengthening exercises should be performed slowly and fluidly. The client should exercise within their comfort zone. When possible, encourage the client to target very specific tissues without contracting muscles that do not need strengthening. This may not always be possible, but it is most effective when it is possible. Watch the client perform the active contraction. If you notice, for example, that when strengthening the middle trapezius and rhomboids, the client elevates the scapula or rotates the glenohumeral joint, help him or her to recognize this by demonstrating what it looks like when he or she performs the exercise compared to how you recommend doing it or by gently resting your hand on the structure that you want the client to relax.

Resisted ROM can be used to strengthen the antagonists of shortened muscles and, when followed by a passive stretch to a shortened muscle, to reorient a nervous system that has become accustomed to a postural imbalance. When instructing the client in self-care, it is essential to demonstrate the activity you are recommending and to tell the client to stay within a range of motion, resistance, and repetition that does not reproduce symptoms. Ask the client to perform this activity before leaving the clinic so you can see that he or she understands how to perform it correctly.

In all strengthening exercises, resistance and repetition should be limited to the client's comfort zone. Strengthening exercises should not cause undue fatigue or pain. One or two slow repetitions free of external resistance performed a few times a day may be most appropriate in the early stages of healing. As the condition improves, the client may become better able to perform more repetitions with greater resistance.

Hydrotherapy

Hydrotherapy can be a relaxing, effective form of self-care when the client applies it correctly. When recommending hydrotherapy for self-care, follow the guidelines in the earlier Hydrotherapy section. Explain these guidelines so that clients understand why they should use salt or not, why the application time is important, why moisture is essential, when hydrotherapy is contraindicated, and why drinking water is important. You can create written explanations for your clients to ensure that they use hydrotherapy correctly.

Breathing

Deep, diaphragmatic breathing is an essential element of overall good health. Many of us take breathing for granted. We are often so busy that we rush through our breaths as we rush through our lives. Shallow breathing contributes to anxiety, emotional distress, and pain. Helping our

clients recognize their breathing pattern and teaching them to adjust to a more relaxed diaphragmatic breathing can have a profound effect on healing. Slow, diaphragmatic breathing calms the sympathetic nervous system and delivers more oxygen through the circulatory system. When used in treatment or during self-care, deep breathing can enhance muscle relaxation and reduce the client's anxiety about their pain or about the massage techniques being used to help relieve their pain. Moreover, instructing the client to recognize their breathing can help him or her to focus on the moment instead of being distracted by where he or she has been or is going next.

Assess your client's breathing at the beginning of treatment by placing one hand on the abdomen and one hand on the sternum and observe movement in these areas as the client breathes. The abdomen should expand first and more forcefully than the sternum. If you notice that the client breathes primarily in the chest or primarily in the abdomen, help him or her to become aware of this by asking him or her to place one hand on the abdomen and the other on the chest to feel the imbalance. Explain that the abdomen should expand first, the ribs expand next, and the sternum elevate last. If this does not help the client to adjust his or her breathing pattern, add gentle pressure to the sternum to minimize the movement of the chest and encourage him or her to breathe into the abdomen, or add gentle pressure to the abdomen to minimize its movement and encourage expansion of the chest. Encourage the client to use this technique to assess and adjust breathing by practicing for 3-5 minutes each day. The goal is to adapt this pattern for normal breathing. You can instruct the client to use this exercise while he or she is being treated, particularly when you approach an area that is tender or during trigger point therapy, and while performing self-care exercises.

When assessing a client's breathing or while recommending breathing exercises, consider the health of his or her respiratory system. Not all clients are capable of practicing deep, diaphragmatic breathing. In addition, ensure clients do not hyperventilate or become dizzy; emphasize that the exercise should be slow and relaxed. Following is an example of a breathing exercise used to focus the mind, relax the nervous system, and reduce generalized pain; it can also be directed to the area you are treating and during self-care exercises:

1. The client can be seated, supine, or prone, using bolsters as desired.
2. Instruct the client to inhale gently while imagining that the breath is white like a clean coffee filter. Ask the client to send this breath (filter) to the toes.
3. As he or she exhales, ask the client to imagine that the pure white breath filters out any impurities in the toes and feet leaving the tissues pink or red with clean, oxygenated blood. The client can also imagine that the breath exhaled is grey or tinted by the impurities filtered out. If the client cannot imagine fresh pink tissue after one breath, have him or her send another breath to the area until the tissues feel clean and oxygenated.
4. The next inhalation is sent to the calves, filtering impurities there with the exhalation, leaving behind fresh, clean tissues.
5. Continue this exercise superiorly, including the upper extremities, until all tissues feel cleaned by the pure, deep breaths.

RANGE OF MOTION ASSESSMENT

Treatment Goals

Planning treatment includes assessing signs and symptoms related to a client's complaint(s) and assessing the client's general health history to determine the best course of therapy in order to achieve treatment goals within the scope of practice for massage therapy. The client and therapist work together to determine appropriate, individual treatment goals. Planning treatment sometimes requires working with a health care team to ensure that all health care providers for a par-

ticular client understand each other's treatment goals and to ensure that those goals are complementary. The primary principle in planning treatment is to "do no harm."

With your assessment of the client's signs and symptoms, health history, posture, and ROM, you are ready to put the pieces together and determine treatment goals. While each client's case requires individualized planning, there are several treatment goals common to most moderate cases of the conditions in the chapters that follow: reducing adhesions, increasing circulation, reducing tension, treating trigger points, manually lengthening shortened tissues, passively stretching shortened tissues, and clearing the area treated.

REDUCE ADHESIONS

Because adhesions are often superficial and myofascial release is best performed without emollient, reducing adhesions is a good place to begin. Fascia tends to be thick and dense around muscles that are short, while it is thin and taut around muscles that are stretched. Kneading, cross-fiber friction, and the specific myofascial release strokes explained in Chapter 2 reduce adhesions. Heat, stretching, and mobilizations may also reduce adhesions.

INCREASE CIRCULATION

Venous and lymphatic circulation may be compromised in areas where tissues are adhered, hypertonic, or frequently held in a flexed position. When circulation is reduced, fewer nutrients get in and fewer metabolites get out of the tissues. Areas in which circulation is reduced can become dehydrated and adhered. Gliding, kneading, and percussion increase circulation. Although compression may temporarily reduce circulation, the release of compression temporarily increases circulation. When repeated, compression and release may increase the flow of circulation through the affected area. Heat, mobilizations, and stretching also increase circulation.

REDUCE TENSION

Muscle tension increases during sustained concentric or eccentric contractions. While it is tempting to assume that short, tight muscles are more likely to develop tension than long, weak muscles, this is not always the case. For example, the long, weak erector spinae, stretched over an increased thoracic curve, contract for long periods in an attempt to balance the spine over a stable center of gravity. Although stretched and taut, they may also be tense and hypertonic. Gliding, kneading, and broad compressions help reduce tension and restore normal resting tone. Heat, mobilizations, stretching, and post-isometric relaxation may also reduce tension.

LENGTHEN TISSUE

Short, tight muscles cause and perpetuate postural imbalance and contribute to keeping opposing muscles long and weak. In addition to reducing the tension that has accumulated in these tissues, it is important to lengthen them to encourage the restoration of normal resting length. Firm and deep gliding strokes along with pin and stretch techniques are ideal for manually lengthening tissues.

TREAT TRIGGER POINTS

Trigger points perpetuate the sustained contraction of isolated muscle fibers. As long as trigger points remain activated, it is unlikely that normal resting tone or neuromuscular function can be fully restored. In general, deep gliding, cross-fiber strokes, compression, heat, and stretching help to deactivate trigger points. Chapter 3 explains trigger points and describes treatment options in more detail.

Treatment icons: Increase circulation; Reduce adhesions; Reduce tension; Lengthen tissue; Treat trigger points; Passive stretch; Clear area

PASSIVE STRETCH

After applying techniques that reduce adhesions, increase circulation, and relax contracted muscles, a full passive stretch held for 15–30 seconds helps to elongate the crimped collagen fibers found in noncontractile tissues such as tendons and ligaments (see Chapters 13 and 14). This is an important part of restoring proper posture. The full passive stretch, particularly as part of post-isometric relaxation, also helps to restore proprioception and proper neuromuscular function. A full passive stretch is achieved by increasing the distance between the attachment sites of the affected muscle while the client remains relaxed.

CLEAR AREA

Most massage therapy techniques release and mobilize metabolites that have accumulated as a result of dysfunction. Clearing strokes help move fluids containing metabolites through the circulatory and lymphatic systems where the fluids are cleansed and the metabolites are neutralized or excreted. Broad gliding strokes, both superficial and deep, are ideal for clearing locally and systemically. Mobilizations may also help increase circulation and clear the local area.

STRENGTHENING WEAKENED MUSCLES

Strengthening weakened muscles is also an important part of restoring proper posture and neuromuscular function. It is not included in the treatment goals above because even though percussion, vibration, and cold hydrotherapy may contribute to increasing muscle tone strengthening is a goal best achieved by self-care. Each of the following condition-specific chapters include recommendations for strengthening structures that are commonly weak. Recommend strengthening exercises, explain why the strengthening of weak muscles is important, and ask the client if he or she is performing self-care exercises between appointments. Remember, however, that these are recommendations that the client may or may not follow.

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CHAPTER 2

Fascia

UNDERSTANDING FASCIA

Fascia is one of the most studied tissues in the human body today. It became so significant in scientific literature worldwide that in 2007 the International Fascia Research Congress (http://www.fasciacongress.org/) was established to explore the importance of fascia for both conventional and complementary health care. Previously thought to be a passive connective tissue, research has established biomechanical and adaptive properties of fascia that are becoming widely recognized as an integral part of homeostasis and an essential element in the long-term resolution of many chronic conditions.

Fascia is soft but dense, fibrous connective tissue forming a continuous, three-dimensional matrix that provides support and shock absorption for the structures of the body; communicates vital information about tension and compression throughout the body; and facilitates the absorption of nutrients and removal of toxins and metabolites (Fig. 2-1). Fascial fibers form dense, irregular connective tissue with a multidirectional arrangement (Fig. 2-2). Fascia covers all of our organs, nerves, muscles, and bones, and while it separates one structure from another, its continuous matrix also connects the structures of the body.

There are three types of fasciae. Superficial fascia, or subcutaneous fascia, is just beneath the skin. It is composed largely of connective and adipose tissues. It connects the skin to the superficial muscles and supports the superficial nerves and blood vessels. Superficial fascia stores water and fat, which help insulate the body. Deep fascia, also called myofascia, is denser than superficial fascia and covers the muscles. It binds the individual fibers that form single muscles and connects individual muscles into groups. The types of collagen and concentrations of elastin change as myofascia reorganizes within the continuous matrix to form the denser tendons, which attach muscle to bone, and ligaments, which support the bones that form a joint. Healthy myofascia allows muscles to move independently and holds nerves and blood vessels that supply structures deep to the skin. Visceral fasciae form the sacs that hold our organs within their cavities and are named according to the organ they support: pericardia (heart), pleura (lungs), and peritonea (abdomen).

While fascia has different forms and functions depending on its location, it is all integrated into a single, continuous, three-dimensional matrix. Massage therapy often focuses on the actions of individual muscles or muscle groups for the purpose of assessing dysfunction and planning treatment. However, because they are bound together, when we assess and treat muscles, we are also necessarily assessing and treating fascia. Every muscle functions within the fascial web (Fig. 2-3). Thus, when we are successful in relaxing a muscle in spasm, the restoration of its normal resting length is unlikely if the fascia surrounding it is bound and shortened. For this reason, understanding the structure and function of fascia can have profound implications for treatment outcomes.

Fascia primarily comprises ground substance, collagen, and elastin. Ground substance—resembling a thin or diluted gel—gives fascia a fluid character. Ground substance holds cells together and allows for the exchange of substances between cells and the interstitial fluid that

Figure 2-1 Human fascia. Fascia is a three-dimensional matrix of connective tissue that provides support and shock absorption for the structures of the body. Fascia surrounds our organs, nerves, muscles, and bones. The areas in white represent regions of thick fascia. (*continued*)

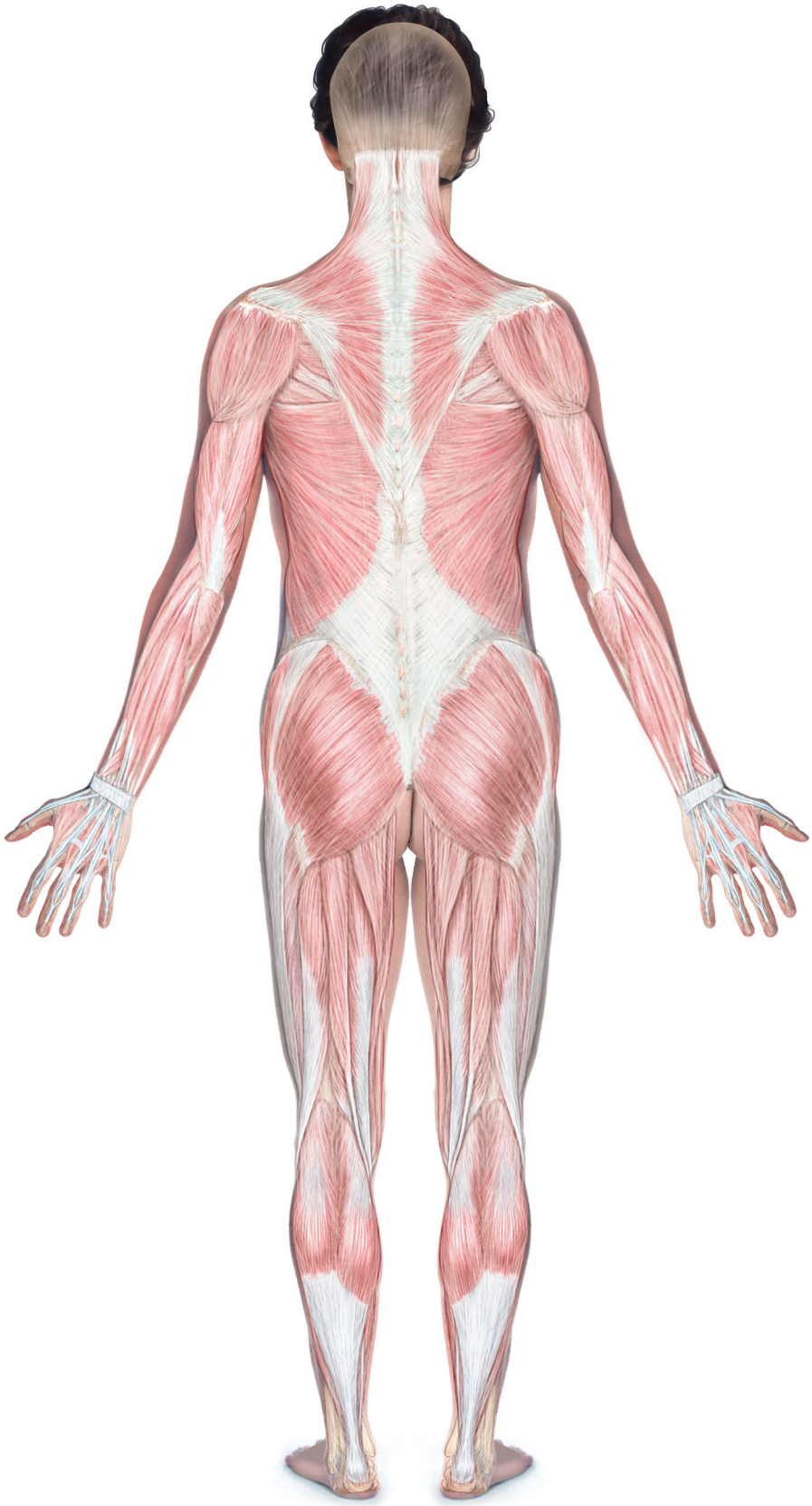

Figure 2-1 (*Continued*)

Figure 2-2 Dense irregular connective tissue. The multidirectional fiber arrangement of fascia allows for a wide range of movement. Photo copyright Ronald A. Thompson, Ida P. Rolf Research Foundation; used by permission.

bathes them, letting nutrients in and metabolites and toxins out. Ground substance can change in density according to the tissue's needs—a characteristic referred to as thixotropy. Movement, heat, and hydration keep it fluid, and this fluidity in muscles allows for freer movement. Lack of movement, cold, and dehydration cause it to thicken, and thickening inhibits free movement. This is much like what happens to a can of paint. When left alone, particularly in a cool environment, the paint becomes thicker and less mobile. Stir it up, and it begins to liquefy. During the initial healing stage of an acute injury, restricted movement may help prevent re-injury. However, in the subacute and chronic stages, or when a chronic dysfunctional pattern results from postural imbalance, fascia becomes tight and bound, and the thicker, more viscous ground substance is less effective in exchanging substances. Fewer nutrients make it into the cells, and metabolites and toxins are more likely to accumulate locally. Reducing the viscosity of ground substance is one of the goals of myofascial release. Shearing forces, as applied in many massage strokes, reduce viscosity.

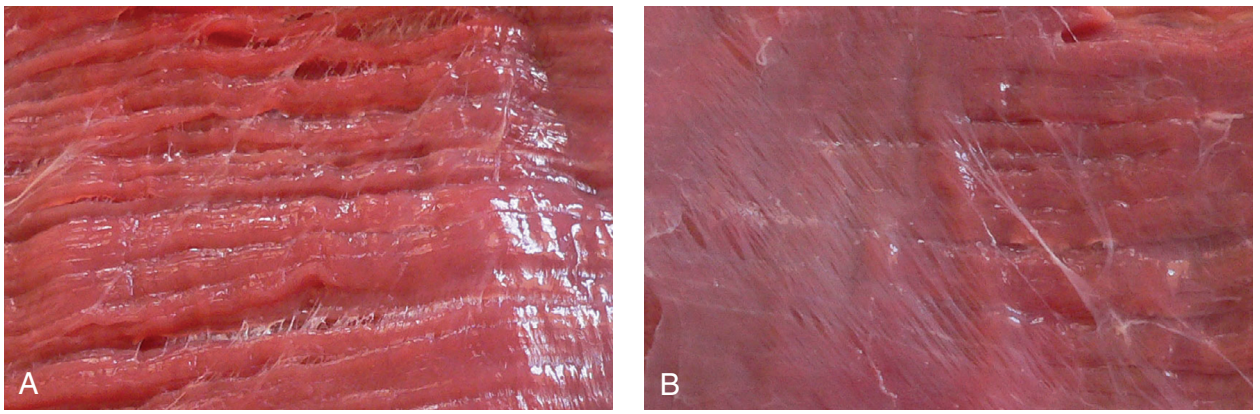

Figure 2-3 Fascial web. The fascial web weaves between muscle fibers (A) and surrounds groups of fibers (B). Photos provided courtesy of www.terrarosa.com.au.

Collagen, a protein that easily binds and forms fibers or threads, gives fascia its strength and resilience. Many different types of collagen are found in the human body, each contributing slightly differently to the capabilities of the tissues it forms. The combinations and concentrations of these different collagen fibers allow for the wide variation of connective structures in the body. Collagen makes fascia highly resistant to overstretching and tearing. However, because collagen fibers are so prone to binding, when dysfunction begins, collagen plays a key role in the development of adhesions and is the main component of scars. Elastin—another protein—makes fascia flexible and stretchy, allowing it to reshape as the body moves in every possible direction. When movement allows fascia to stretch slowly, these changes are gradual and fluid. However, when dysfunction puts fascia in a constant stretch, it lengthens and cannot recoil as muscles do. As it stretches, it loses fluid and becomes rigid, dehydrated, and adhered. In time, with proper healing that includes reducing adhesions, restoring the fluidity of ground substance, and removing the offending action or posture, new fibers can form to reestablish the fascia's strength and elasticity.

Fascia is also packed with integrins—receptors that detect tension and compression outside the cells they surround and then communicate this information directly into those cells. This gives fascia the remarkable ability to adapt and instruct the cells it covers to adapt to the body's needs at any given time. Under strain, the primary cells of fascia, called fibroblasts, secrete cytokines, which are immune-responsive substances that encourage inflammation. This suggests that fascia has immunological properties. Cytokines are also communicative. When functioning optimally, these communicative properties of fascia encourage adaptation and healing of the injured structures it is connected to. However, when integrins are overloaded and fibroblasts become hyperactive, the once adaptive response can become chronic and pathological. Recent studies have explored the hyperactive inflammatory response as a factor contributing to fibromyalgia.

It was recently discovered that fascia is also embedded with smooth muscle cells that aid in its adaptation to tension and the demands of the structures it surrounds. When stretched abruptly or for an extended period, fascia increases resistance, actively contracting against the stretch. This may explain the increased tone and fibrotic texture of stretched fascial tissue. Fascia is thoroughly innervated by mechanoreceptors such as Golgi receptors, Ruffini and Pacini corpuscles, and miniscule nerve endings, providing both sensory and motor functions that serve as receptors for pain as well as tension and pressure. Deliberate pressure, whether slow and steady or fast and variable, stimulates these individual receptors. This initiates a cascade of changes in autonomic functions that range from local changes in viscosity and metabolism to more systemic adaptations such as muscle relaxation and emotional calming, depending on the receptor's functions. This may explain why myofascial release to one area of the body can have profound healing effects in distant areas and why treating dysfunctional fascia can be an effective way of restoring healthy muscle tone.

Myofascial dysfunctions tend to follow patterns along what are referred to as myofascial lines (also called myofascial meridians), described in detail in Thomas Myers' (2008) *Anatomy Trains*. These lines are tracks of myofascia within the matrix, which support the common lines of pull (muscle actions) along which strain and tension are transmitted through the body to move the skeleton. These lines of fascia continue past the insertion of a single muscle, linking it to structures that experience tensile stress in similar directions. For example, a myofascial line links the plantar muscles to the calf muscles, hamstrings, gluteals, erector spinae, and suboccipitals all the way up to the galea aponeurotica (Fig. 2-4). Local strain at any point along that line may be transmitted along the whole line, often producing symptoms and dysfunction somewhere other than at the original site of strain.

To understand myofascial lines and the tendency of dysfunctional patterns to develop along them, we must first understand the concept of tensegrity. Tensegrity (tensional integrity) describes the character of a structure, the integrity of which depends on balanced tension across its rigid parts (Fig. 2-5). Tension in one part of the structure must be balanced by tension in another. In the human body, the rigid parts are our bones. By themselves, the bones would simply stack upon each other, compressed by gravity, eventually collapsing under their own weight. The skeleton is stabilized by the constant tension of muscles, tendons, and ligaments—our tensile structures. And fascia, which binds these structures, distributes tensile stress throughout its

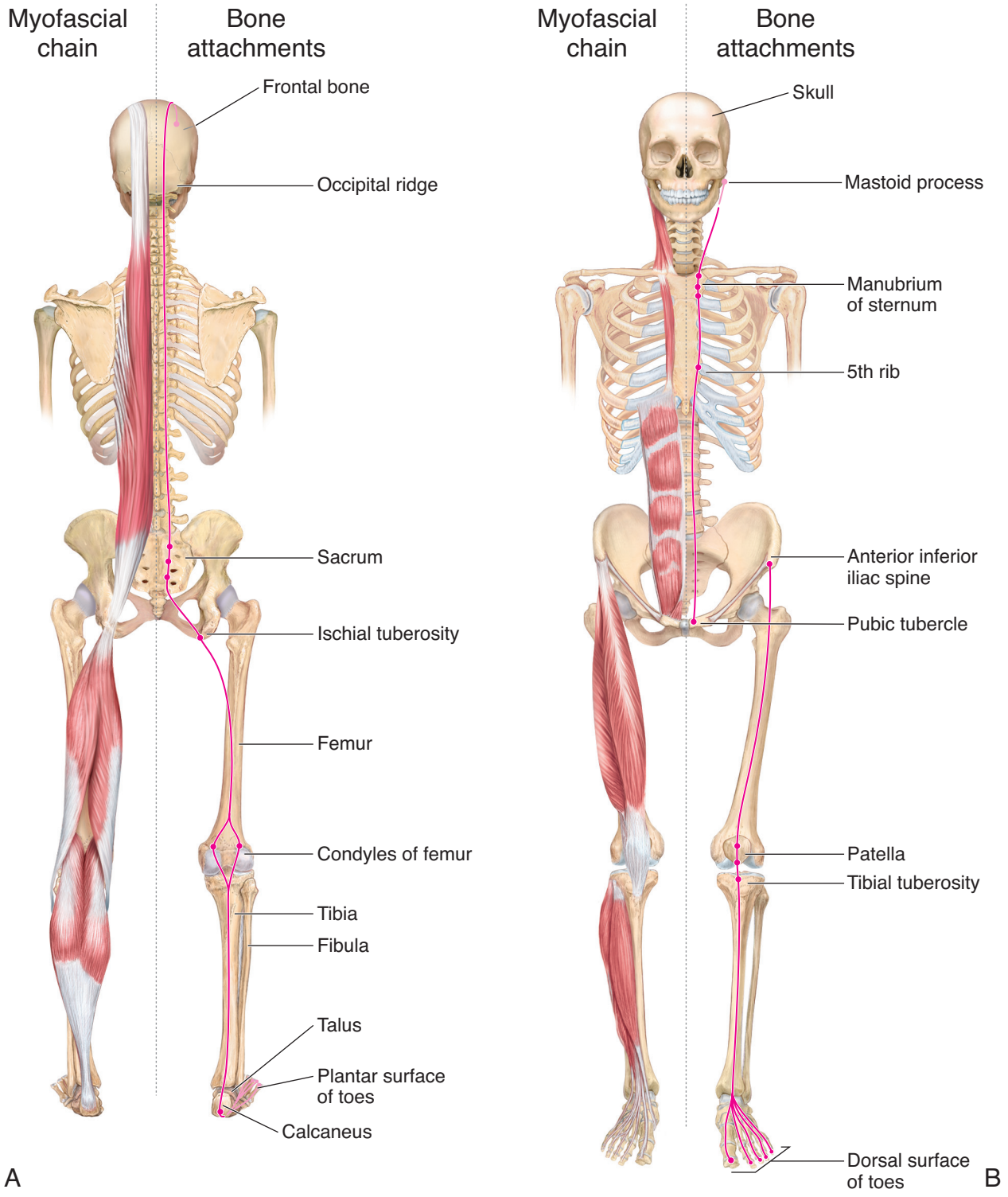

Figure 2-4 **Myofascial lines.** The superficial back line (A) and the superficial front line (B) connect the head to the feet through the body.

webbing to prevent any single, localized area from being subject to the full force of a movement or gravity.

When stress to one part of a structure is increased, especially when the stress is repetitive, myofascial fibers reorganize and stiffen along the direction of applied stress (Fig. 2-6). Under maximum strain, as when chronically lengthened, this alignment of fibers can become virtually linear, losing the multidirectional character that allows for remarkable freedom of movement

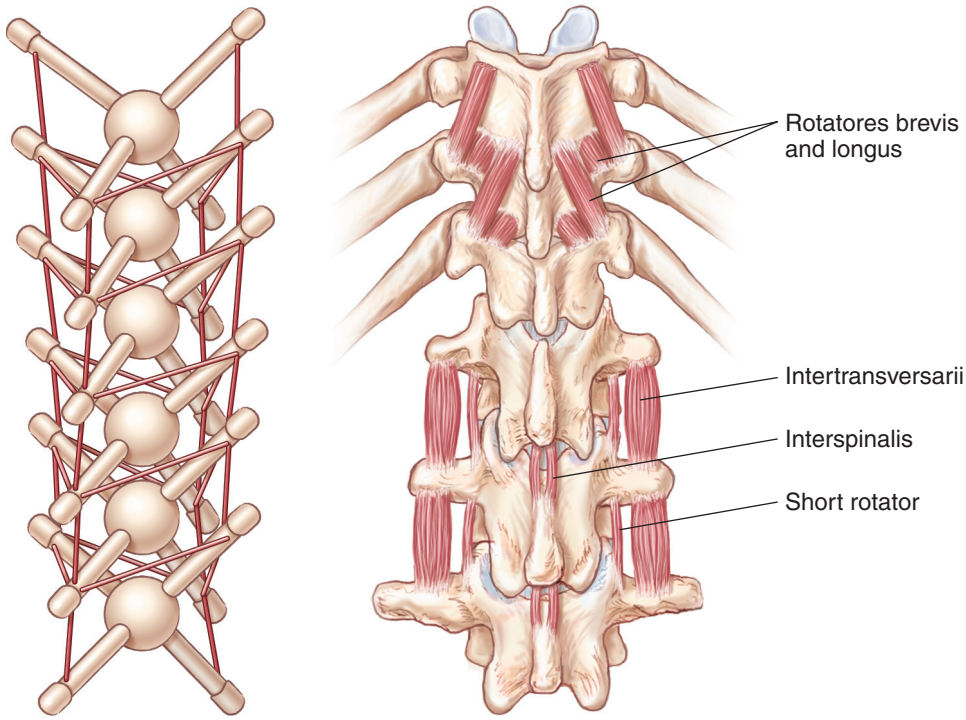

Figure 2-5 **Tensegrity.** A tensegrity structure depends on balanced tension across its rigid parts. The stellated tetrahedron on the left and the spine on the right are flexible yet stable structures. They can move in multiple directions and bear a load in any position. In the spine, tension is balanced across the rigid bones by muscles and fascia.

and resilience against stressors. This is much like what happens when you pull the ends of a cotton ball. In a relaxed state, the fibers of a cotton ball are arranged in multiple directions, like a loosely knit mesh. When you slowly pull the ends, you can see the fibers straighten and reorganize along the line of the stress (stretch) you are applying. As you continue to pull, most of the fibers reorganize into this longitudinal alignment. The rigidity of those aligned fibers provides protection against the stress you are applying (you have to pull with more force to lengthen them fur-

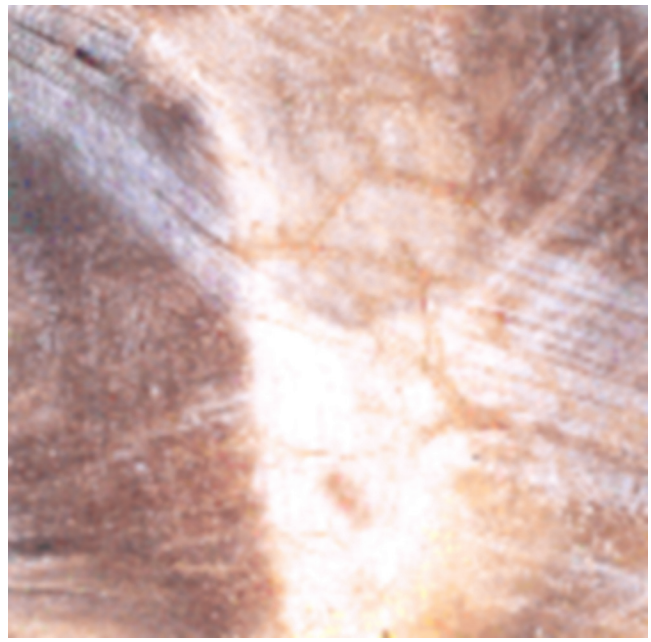

Figure 2-6 **Pectoral fascia under stress.** Myofascial fibers of this pectoralis major have reorganized diagonally, from upper left to lower right, stiffening along the direction of applied stress. Photo copyright Ronald A. Thompson, Ida P. Rolf Research Foundation; used by permission.

ther), and makes the fibers more efficient against stress aligned in that direction (as when cotton is spun into yarn or thread). However, when aligned to accommodate stress in a single direction, the fibers also lose the freedom of random movement. Conversely, if you squeeze a cotton ball tightly, its fibers become compressed, changing the density of the once fluffy ball. To restore its fluff, you would loosen the fibers slowly and gently, uncrimping the densely packed fibers and increasing the spaces between them.

When one area of the body is repeatedly subject to a pattern of tension or stress in the same direction, the muscles that contract in that direction often shorten and their antagonists lengthen. The fascial webbing surrounding those structures follows, becoming short, thick, and compressed or long, narrow, and stretched. In either case, function is compromised, restricting movement and reducing pliability. If the local fascia loses function within the tensegrity model, stress is distributed along the fascial line that contains that structure to compensate for the weakness. Left untreated, tensegrity along that line falls out of balance. Ultimately, adhesions, hypertonicity, trigger points, and chronic pain syndromes may develop.

For example, a client with hyperlordosis (see Chapter 8) often presents with shortened hip flexors and lumbar extensors and lengthened hamstrings and abdominal muscles. The fascia surrounding the shortened soft tissues bunches up and becomes dense and bound to the shortened muscles and other local structures. This fascia needs to be released and lengthened to restore free movement of each structure individually and to allow the muscles to regain a normal resting length and tone. The fascia surrounding the lengthened structures stretches, with fibers aligning virtually linearly in the direction of tension, and creates a belt-like band that binds to the surrounding soft tissues. That band of virtually unidirectional fibers initially serves to prevent tearing and to protect the structure from more dramatic misalignment, but in doing so, it restricts free and random movement, ultimately weakening the structure. In both cases, adhesions and compromised function affect the circulation of fluids that feed the soft tissues and remove toxins and metabolites. Toxins accumulate; nutrition is diminished; function is compromised; and trigger points, pain, and weakness develop. Since a tensegrity structure distributes stress along the direction of tension, such dysfunction can occur anywhere distant from the site of strain along the line of tension.

The remainder of this chapter focuses on myofascia, with particular attention to its superficial layers, its contribution to chronic pain, and the role massage therapy can play in restoring proper function. However, untreated fascial restrictions can have a profound effect not only on the function of the musculoskeletal system but also on any organ within all systems of the body. Applying myofascial release to treat structures other than the musculoskeletal anatomy requires advanced training in myofascial release. The References and Selected Readings section at the end of this chapter includes articles with more clinical detail than presented here, and many continuing education offerings focus on the finer details of fascial health and homeostasis.

Possible Causes and Contributing Factors

Mechanical overload, whether caused by an acute incident, repetitive misuse, or postural imbalance, is a primary contributing factor in the development of myofascial restrictions. Immobility following an injury or as a result of static postures held for long periods may also cause the thickening of ground substance, which contributes to myofascial adhesions and compromises the exchange of nutrients and waste products. Daily exercise reduces the risk of developing broad myofascial restrictions, and studies have shown that injuries heal better when activity is reintroduced as soon as possible. Chilling the fascia, whether directly—such as with prolonged use of an ice pack—or indirectly—such as when sitting near an air conditioning vent, may also cause a thickening of ground substance, reducing fascial mobility and its ability to transfer nutrients and metabolites. Prolonged compression of myofascia by external sources, such as the straps of a bag or a utility belt, may reduce fluid content and contribute to adhesions.

Scar formation binds fibers together and increases adhesions. In the initial 24–48 hours following injury, the inflammatory process aids in providing nutrients and clearing the area to promote healing. Fibroblasts become very active, producing ground substance and collagen to

reestablish integrity in the injured structure. These fibers are laid down more randomly than when fibroblasts actively restore and reinforce healthy tissue. As the scar matures, the collagen fibers bind tightly and harden to prevent further damage from tensile stress. Untreated, scar tissue shrinks and tightens, ground substance diminishes, adhesions solidify, and both the structure and function of the injured tissue are compromised. The period of scar tissue maturation is an ideal time to apply myofascial techniques to soften and reorient fibers, reduce local adhesions, and minimize the risk of spreading dysfunction throughout the matrix.

Pathologies including chronic inflammation, infection, hormonal imbalance, and nutritional deficiencies can also affect the normal functioning of fascia, though dysfunction may not be apparent until weeks, months, or even years later. Trauma, fatigue, and physical or emotional stress can perpetuate myofascial dysfunction. Congenital conditions such as bone length discrepancies may encourage compensatory patterns that include myofascial restrictions.

Each of the conditions described in this book will likely involve myofascial restrictions because the postures or traumas that contribute to these conditions can also contribute to tensile stress and adhesions. Releasing myofascial restrictions that contribute to these conditions is necessary to fully resolve the signs and symptoms associated with them.

Contraindications and Special Considerations

First, it is essential to understand the cause of the client's pain. Refer the client to his or her health care provider if symptoms are severe or significantly reduce his or her activities of daily living. These are a few general cautions:

- **Infection.** Fascial restrictions can be associated with chronic infections that cause inflammation. Massage is systemically contraindicated until the infection is resolved.
- **Acute injury.** Do not treat local to an acute injury. Performed without advanced training, myofascial release may be too aggressive for newly injured tissues. Wait until the subacute or chronic stage, when the tissues are more stable.
- **Producing symptoms.** Take care to keep the level of pain within the client's tolerance. Explain the process of treatment and the sensations your client may experience before you begin so that the client is aware and prepared. Understanding may keep the client from tensing up.
- **Hypermobile joints and overstretched muscles.** It is best not to fully stretch a muscle or fascia that is already lengthened or crosses a hypermobile joint. Fascial restrictions found in such areas should be treated with strokes that bring the joints on either end of the stretched fascia closer together, releasing only the affected fibers.
- **Treatment duration and pressure.** If the client is elderly, has degenerative disease, or has been diagnosed with a condition that diminishes activities of daily living, you may need to adjust your pressure as well as the treatment duration. More frequent, half-hour sessions may suit the client better.
- **Friction.** Do not use deep friction if the underlying tissue is at risk for rupture. To avoid reinjury, allow time for scarring and tissue regeneration before applying friction. Do not use deep friction if the client is taking anti-inflammatory medication or anticoagulants. Friction initiates an inflammatory process, which may interfere with the intended action of anti-inflammatory medication. Recommend that the client refrain from taking such medication for several hours before treatment if his or her health care provider is in agreement. Because anticoagulants reduce clotting, avoid techniques that may cause tearing and bleeding.

Assessing and Treating Myofascia

Pain and reduced ROM resulting from musculoskeletal injury or postural imbalances will almost certainly involve some degree of myofascial dysfunction. A client will not likely complain specifically about fascial restrictions but will likely refer to a general or specific area of pain or tension. If your client has been evaluated by a health care professional to rule out more serious contributing

factors and has had a variety of treatments targeting muscles but continues to experience pain, fascial restrictions may be preventing the return of normal resting length and tone. In general, where muscles are short and tight, the myofascia is likely to be bulky, fluid filled, and adhered to the affected muscles and surrounding tissues in the shortened position. Where muscles are lengthened and weak, the myofascia will likely be stretched, flat, narrow, dehydrated, and adhered in the long, strap-like form.

As a general rule, you want to move fascia in the direction that you want the affected structure to move. For example, if the pectoral fascia is bound in the shortened position due to internal rotation of the shoulder, lengthen the pectoral fascia from the clavicle and sternum toward the humerus to encourage external rotation. If the fascia of the upper back is stretched along with the erector spinae due to an increased curve of the thoracic spine, move the fascia inferiorly to help reduce the kyphosis (Fig. 2-7). Take care not to use techniques that stretch fascia that is already lengthened due to injury or postural imbalance.

Once you have completed a postural assessment that helps indicate which structures may be contributing to the client's symptoms, palpation will give you the most direct and accurate picture of the client's myofascial health. One key to accurate palpatory assessment is distinguishing between muscle fibers and fascia and recognizing the musculotendinous junctions where fascia tends to be thickest. Density and mobility will provide clues. Hypertonic muscle fibers feel broadly dense, knotty, or crunchy but can usually be identified individually. Apply pressure to a hypertonic muscle until you feel resistance, and as it releases, you can palpate more deeply before you feel the next level of resistance. Fascial restrictions require more focused assessment. A hand that is too heavy may push past the superficial fascia, and you might miss those restrictions. Moreover, myofascial restrictions can be small and localized and easily passed by if you are not focused. A myofascial restriction will slow or even stop your stroke if you move along it slowly and intently.

Figure 2-7 **Myofascial release.** Treat myofascial tissues in the direction that you want the structure to move. For example, if the pectoral fascia is shortened due to internal rotation of the shoulder, lengthen the tissues from the clavicle and sternum toward the humerus to encourage lateral rotation of the shoulder. If the fascia of the upper back is stretched along with the erector spinae due to an increased curve of the thoracic spine, move the fascia inferiorly to help reduce the kyphosis.

It is best to assess and treat myofascial restrictions before applying emollient to prevent gliding over the restrictions. Check the skin, muscles, attachment sites, and any ligaments in the area for immobility and adhesions. Assess the texture, temperature, tone, and tenderness of the tissues in the affected areas as well as distant structures known to contribute to pain in those areas. Restriction is indicated by an inability of a superficial structure, such as skin, to glide smoothly over a deeper structure, such as muscle. Cross fiber strokes are an effective way of initially breaking up adhesions and increasing space between structures or fibers. Skin rolling is an excellent technique for both assessing and treating superficial myofascia (Fig. 2-8). Using both hands, grasp a piece of skin between your thumbs and the index and middle fingers, and gently push the skin away from you with your thumbs while your fingers walk across the skin to gather and roll it. Begin your roll in an area where tissue is easy to grasp, and move toward the area you suspect to be adhered. Rolling a wad of tissue between your fingers will become more difficult and tender over myofascia that is dense or adhered. The texture of the affected tissue may feel gritty or fibrotic. When gripping the affected superficial tissues, you may see dimpling similar to the texture of orange peel (Fig. 2-9). Repeating skin rolling several times over the affected area may be sufficient to release restrictions.

Restrictions may also be recognized as tissues that do not spring back after compression or stretching. Gently compress and hook into the tissue and, without gliding, try to move it in all directions. Tissues that do not move freely or do not spring back when released are likely adhered. For a large area of restriction, a broad stretch is a good beginning (Fig. 2-10A). Place the flat palms and fingers of both hands over the restricted area. It is helpful to begin with your hands close to, or even touching each other so you can monitor the stretch by watching the space between you hands increase. Without gliding over the skin, move your hands away from each other in the direction you intend to stretch the fascia until you feel movement. For example,

Figure 2-8 Skin rolling. Skin rolling is an effective technique for both assessing and treating myofascial restrictions. Notice the red streaks superior to the therapist's hands indicating vasodilation and increased circulation as a result of skin rolling.

Figure 2-9 Orange peel texture. Dimpling of the skin suggests superficial fascial restrictions.

Figure 2-10 **Myofascial release.** Broad release (A), focused release (B), C strokes (C), and S strokes (D) are all effective methods of releasing myofascial restrictions.

if you are reducing restrictions along the latissimus dorsi, begin with your hands over the area of restriction, and move them so that one is moving toward the ilium and the other is moving toward the axilla. Use only enough pressure to make contact with the fascia and move it, without compressing the underlying structures.

If the restriction is more localized, a more focused technique is recommended (Fig 2-10B). The number of fingers you use depends on the size of the area of the local restriction. Begin with the fingers close to or touching each other so you can monitor the amount of stretch achieved. If you are working deeply, treat the superficial tissues first to ease access to the deeper structures. Use only enough pressure to access and maintain contact with the affected tissues. Without gliding, move your fingers away from each other in the direction you intended to stretch the fascia until

Figure 2-11 Assessing and treating deep myofascia. Press gently into the tissue at an angle and use short strokes to assess deeper myofascia. Once you have entered the area, if you need to work more deeply, adjust the angle of your compression vertically, perpendicular to the target tissue.

you feel movement. For example, if you are releasing an adhesion along the superior fibers of the pectoralis major, place a finger or two of each hand along those fibers. Move the fingers of one hand toward the clavicle, while the others move toward the humerus.

Superficial and deep fascial restrictions can also be released by distorting the shape of the tissue. Use only enough pressure to access the affected tissues. A C-stroke is performed by placing one hand in the area of restriction with the thumb and index finger creating the C shape, while one or two fingers of the other hand push the tissues into the curve of the (Fig. 2-10C). An S-stroke is performed by placing the thumbs or fingers of one hand parallel to those of the other, and then moving the hands in opposite directions to form the S shape (Fig. 2-10D).

Assessing deeper tissues requires even more focused palpation. Begin by gently pressing your fingertips at an angle toward the tissues to be assessed (Fig. 2-11). Once you have entered the area, if you need to work more deeply, adjust the angle of your compression vertically, perpendicular to the target tissue. For example, to access the fibers of the brachialis that are deep to the biceps brachii, enter the area at an angle via the edge of the distal biceps until you make contact with the brachialis. Once you feel it, if you need to gain even more direct access, adjust your angle, approaching perpendicular contact, moving the biceps further out of the way, allowing you to treat the deeper fibers of the brachialis. Move your fingers across a small area of the fibers to release adhesions and along the fibers to lengthen them as necessary.

When assessing the deeper myofascia, feel for independent mobility of each affected muscle, and note the texture of the connective tissues around it. Myofascial restrictions will reduce independent mobility. For example, when you find a taut band of fibers that indicates the possible presence of a trigger point (see Chapter 3), palpate around the edges of the taut band. You will likely feel a thread of dense connective tissue that not only encapsulates the taut band but also adheres it to the surrounding tissues, preventing these tissues from moving freely and independently. Slow, cross-fiber strokes are a good assessment tool for deeper myofascial restrictions and an excellent tool for releasing them. If you find a deep restriction, maintain contact with it through the superficial layers, and hook and stretch it until you feel release. Follow this with slow, firm longitudinal strokes to lengthen shortened fascia.

During your assessment and treatment, the client may report sensations such as burning, itching, scratching, or pinpricks. These sensations indicate the presence of myofascial restrictions during assessment and the release of myofascial restrictions during treatment. Instruct your client to breathe deeply while you are treating areas that are painful, and take care not to

cause a level of pain that keeps the client from relaxing. As the tissues release, the level of discomfort should decrease. The client may report a calming sensation in an area distant from where you are working, which is likely the result of stress being released along the affected fascial lines.

To get the best results, hold a myofascial stretch until you feel the tissue release. This can take up to a minute or longer. Be patient and take care to use only as much pressure as you need to access the affected tissue. These strokes may leave a dent or other distortion in the tissue when you release it. In most cases, this will last for only a few seconds, but in extreme cases, the distorted shape caused by your compression may last longer due to pitting edema. Chronic edema and large areas of pitting edema should be assessed by a medical professional.

Massage Therapy Research

What follows is a small sampling of the research describing the effects of massage therapy techniques for the treatment of myofascial dysfunction. The references at the end of this chapter include additional studies, and even those represent only a small sample of the literature on massage treatment for myofascial dysfunction. Several of the following chapters also include references to research in which myofascial release is central to positive outcomes.

In a study titled "Tensegrity Principle in Massage Demonstrated by Electro- and Mechanomyography," Kassolik et al. (2009) tested the electrical and mechanical activities of muscles that are distant from but indirectly connected to the muscles being massaged. Thirty-three men received either a massage to the brachioradialis while the middle deltoid was tested for activity or a massage to the peroneals while the tensor fasciae latae was tested. Although no significant electrical activity was noted in the middle deltoid during the massage of the brachioradialis, electrical activity in the tensor fasciae latae increased with the massage to the peroneals. Mechanical activity increased in both scenarios. The authors conclude that the tensegrity principle applies during the use of massage techniques, an observation that has great implications for the treatment of muscle tension.

LeBauer et al. (2008) produced a case report titled "The Effect of Myofascial Release (MFR) on an Adult with Idiopathic Scoliosis," describing the treatment of an 18-year-old female with significant curves in the thoracic and lumbar spine. Her complaints included low back pain and bilateral hip pain. The subject had worn a brace for approximately 6 months when she was 12 years old and reported that before using the brace she had no pain related to her scoliosis. Posture and gait were assessed, pain was measured using a Visual Analog Scale (VAS), and the subject completed questionnaires assessing her self-reported pulmonary function as well as her quality of life, both before and after MFR. She received 6 weeks of treatment consisting of 45-minute sessions twice per week. Comparison of pre- and post-treatment data revealed improvements in pain, thoracic and lumbar rotation, and posture. VAS, pulmonary function, and quality of life all had significant improvements following MFR. The authors concluded that a single case study cannot confirm that such results are typical and encouraged further investigation of MFR for the treatment of idiopathic scoliosis.

In the case report titled "Efficacy of Myofascial Release Techniques in the Treatment of Primary Raynaud's Phenomenon," Walton (2008) describes the results of the treatment of a 35-year-old female who had been suffering symptoms including pallor and decreased temperature in the extremities due to vasoconstriction, followed by numbness and throbbing pain as blood returned to the extremities for 12 years. Baseline information was collected for 3 weeks before treatment and 3 weeks following treatment. The subject kept a log describing the frequency, duration, and severity of symptoms and the number of digits affected. Five 45-minute myofascial treatments were administered to the upper back, neck, and arms, along the myofascial meridian, over a 3-week period. The duration and severity of symptoms improved over the course of treatment, although the frequency of symptoms and number of digits affected varied little compared to pretreatment measurements. The author notes that while these findings are encouraging, further study including a larger sample size, longer observation period, and a control group is necessary.

PROFESSIONAL GROWTH

CASE STUDY

Maria is a 28-year-old horticulturalist. She is very fit and very flexible. She maintains an active lifestyle, participating in sports and martial arts. She has pain in her right heel.

Subjective

Maria reported feeling intense pain in her right heel, which was constant when she was using the foot. She felt less pain at rest, but it returned with each step throughout the day. She stated that her foot sometimes felt "full" or swollen. She pointed to a spot on the medial, anterior, inferior calcaneus, explaining that at its worst she felt severe pain in that spot, and at times she felt a "buzzing" around the area and up the ankle, a few times reaching the middle of her calf. The pain does not decrease after walking or other activities of the foot. She has no pain in the left foot or elsewhere on the body. Maria stated that until approximately 2 years ago, she had walked primarily on the balls of her feet. After developing chronic low back pain, she had begun a regular, intensive stretching program and began practicing yoga regularly to get her heels to touch the floor, and to reduce the low back pain. She was successful in both, walking flat on her feet without back pain, but had developed a gradually increasing pain in her heel beginning approximately 6 months ago. She has seen her primary care provider and was referred to an orthopedist who then referred her to a podiatrist. X-rays showed no bone spurs or fractures to the bone. All three health care providers diagnosed plantar fasciitis and recommended wearing a boot to prevent plantar flexion when she sleeps. She was unsatisfied with the diagnosis because when she researched plantar fasciitis, she did not think her symptoms matched those in the literature. After practicing all of the recommended self-treatments and exercises, her symptoms were not relieved, and on some days, felt worse. It has become so intense that she has had to discontinue practicing yoga, Hapkido, and working out. She is terribly concerned about being sedentary and is eager to get back to these activities.

Objective

Maria appears healthy and vibrant. When talking about her heel pain, she looks stressed.

A postural assessment revealed head slightly forward, elevated right shoulder, severe hyperlordosis with anterior pelvic tilt, elevated left ilium with slight rotation of the pelvis toward the left. She has a slight valgus of the calcaneus bilaterally. When she lies supine, her non-weight-bearing posture reveals extension of the toes, pes cavus, and significant plantar flexion. The right ankle joint is very flexible; she feels a stretch but no pain with passive dorsiflexion. Palpation produced pain only at the anterior inferior, medial calcaneus, near the attachment of the abductor hallucis, and along the inferior tendons of the tibialis posterior, flexor digitorum longus, and flexor hallucis longus. The fascia of the entire right lower leg is extremely dense and adhered. Compressing the tissues in any area of the leg created significant dimpling, particularly along the superior, medial aspect of the calcaneal tendon. Further palpation revealed fascial restrictions along the whole superficial back line. The fascia is dense and strap-like along the thorax, and slightly tender with skin rolling. The fascia is thick and bound in the thoracolumbar area, surrounding the anterior iliac crest, tensor fasciae latae, and into the iliotibial band. There was a trigger point in the medial, inferior aspect of the soleus, which referred into the heel, reproducing the pain she feels when walking.

Action

Began supine, releasing fascia of the anterior hip and lengthening hip flexors. Maria was able to tolerate only minimal to moderate stretching of this fascia in the beginning. I applied cross-fiber strokes followed by lengthening the hip flexors. I did not treat iliopsoas today because of the time restriction and to avoid combining the intensity of iliopsoas treatment with intense myofascial release. Turning the client prone, I stretched the hip flexors. I performed myofascial release to the full superficial back line. Treatment of the thorax was pleasant for the client, but minimal to moderate stretching of the thoracolumbar fascia caused intense burning and itching. Fascia of the lateral thigh is thick and adhered bilaterally, and myofascial techniques produced intense burning and itching near the iliotibial band. Fascia of the lower leg is particularly thick with much dimpling upon even minimal compression. I focused the majority of my time on broadly loosening the super-

ficial fascia of the legs, progressing to deeper, more specific fascial stretches to the deep tissues of the posterior leg where accessible. Maria felt extreme burning and pinching with a moderate myofascial stretch along the right medial calcaneal fascia. Deeper palpation along the tibia was extremely painful, which raised concerns of medial plantar and tibial nerve involvement, so I worked only superficially in those areas, gently stretching it, and will revisit the area as layers of fascia release. I applied muscle stripping and lengthening strokes to the gastrocnemius and soleus, treating a trigger point in the right soleus. In the initial seconds of compression, Maria stated that the pain intensity had increased from level 6 to 8 and the pressure felt deeper, although I had not increased the pressure I was applying. Over the course of approximately 30 seconds, the pain reduced from level 8 to 4. I applied broad lengthening strokes to the plantar fascia of the right foot, taking care not to reproduce pain in the heel, followed by a deep stretch and post-isometric relaxation to the plantar flexors.

Maria reported feeling looser and freer in movement, although she still feels moderate pain in the heel.

Plan

I demonstrated deep stretches to the hip flexors. If these do not begin to reduce the resting length of the hip flexors, I will treat iliopsoas in subsequent visits. I also demonstrated deep stretches to the plantar flexors and superficial kneading of the iliotibial band. I suggested treatments twice per week with a focus on releasing thoracolumbar fascia, hip flexors, and plantar flexors. I will reassess for trigger points in the quadratus lumborum, lumbar erector spinae, hip flexors, and deep plantar flexors as superficial tissues release.

CRITICAL THINKING EXERCISES

1. Become more familiar with the texture of muscle compared to fascia by slowly and gently palpating a few of the large muscles (gastrocnemius, biceps brachii, and rectus femoris) in your partner, with the goal of finding their musculotendinous junctions. Look at photos while you palpate if it helps you locate the junction. When you find it, move an inch toward the muscle belly, then an inch toward the tendon, and identify the differences in tone and texture. Try this on both healthy tissues and those you think may be contributing to your partner's postural deviations or pain. The more sensitive your fingers become to these differences, the more success you will have with identifying fascial restrictions.
2. Begin by finding an area of superficial myofascial restriction on a partner. Place your two index fingers over the restricted area with the fingers as close together as possible. Slowly pull them in opposite directions without gliding on the skin. Watch and feel as the space between your fingers increases and the tissue releases.
3. The area surrounding the superior angle of the scapula is often dense, painful, and adhered. Muscles with a wide variety of fiber directions emanate from that general area. How should you proceed in releasing the layers of tissue? Describe the order of tissues that you will treat, the techniques you will use, and the direction of force that you will apply to reduce restrictions and adhesions.
4. Conduct a short literature review to learn about the relationship between myofascial dysfunction and one or more of the following:
   - Neurotransmitter imbalance
   - Chronic infections
   - Thyroid dysfunction
   - Diabetes
   - Stress

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CHAPTER 3

Myofascial Trigger Points

UNDERSTANDING MYOFASCIAL TRIGGER POINTS

There has been much recent research into myofascial trigger points. While this research continues to investigate theories about them, to date, there is no single agreed-upon explanation for the pathophysiology of trigger points and no universally accepted diagnostic criteria. *Myofascial Pain and Dysfunction: The Trigger Point Manual* by Simons and Travell (1999) is a seminal resource for the study of trigger points and is a primary source of information in this book. This chapter presents an overview of myofascial trigger points, their contribution to chronic pain, and the role massage therapy can play in relieving the symptoms they cause. Many continuing education offerings focus on the finer details of trigger point therapy for those interested in advanced training.

Trigger points may be found in epithelial tissue, connective tissue, nerves and muscles. Trigger points in muscles and fascia are called myofascial trigger points, and these will be the focus of this chapter. The term *trigger point* is used throughout this text to refer to myofascial trigger points.

A myofascial trigger point is a spot in a skeletal muscle that shows evidence of an excessive, prolonged response to stimuli. The spot is palpated as a nodule within a taut band of muscle fibers (Fig. 3-1). Trigger points refer pain to a location distant from the nodule in predictable patterns. When chronic pain is not relieved by manual manipulation of the symptomatic area, it is possible that the pain is referred from a trigger point in another area. For example, a trigger point in the upper trapezius often causes headache pain (Fig. 3-2). Several of these referral patterns are shown in Chapters 4 to 11. Trigger points can also cause other referred reactions including spasm; dilation or contraction of blood vessels; or secretion of fluids, such as tears or saliva, and can cause the referred inhibition of another muscle.

Trigger points are frequently found at the neuromuscular junction. The neuromuscular junction is the site of synaptic contact between the motor neuron and muscle fibers, where an action potential spreads from nerve to muscle to initiate a contraction (Fig. 3-3). In most human muscles, the neuromuscular junction occurs in the middle of the muscle fiber. At the neuromuscular junction, a synapse depends on the presence of the neurotransmitter acetylcholine (ACh), which is released locally to activate only those fibers recruited to produce a contraction. In a normal muscle contraction, the production, use, and breakdown of ACh happens quickly, limiting the duration of the contraction as well as the energy required for this process. The contracted muscle fibers are quickly released and are ready to respond to another action potential.

Circumstances including injuries, overuse, misuse, or systemic conditions can cause dysfunction at the neuromuscular junction, which results in a sustained contraction of the affected muscle fibers, creating the contraction knot we call a trigger point. The sustained contraction ini-

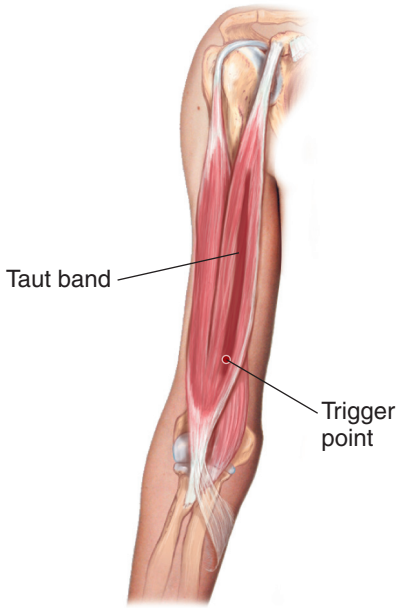
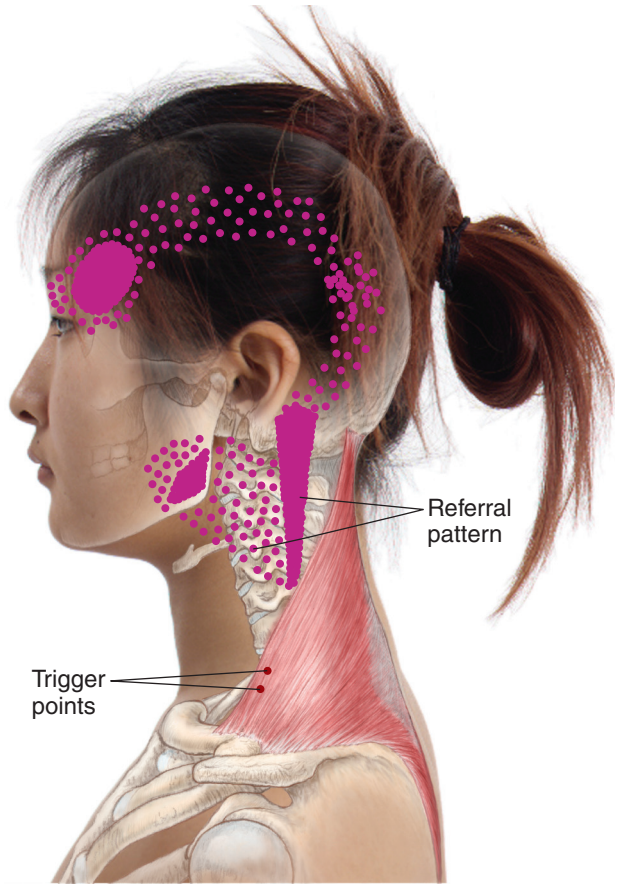


Figure 3-1 **Myofascial trigger point.** A myofascial trigger point is a hyperirritable spot in a skeletal muscle palpated as a nodule within a taut band of muscle fibers.

Common areas of tension headache pain



Common referral pattern for upper trapezius trigger points

Figure 3-2 **Referred pain.** Trigger points refer pain into areas distant from the nodule.

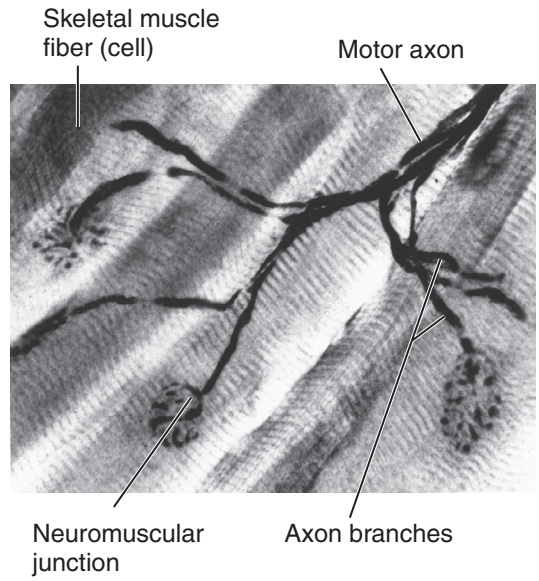


Figure 3-3 Neuromuscular junction. Nerves meet the muscle at the motor endplate to form a neuromuscular junction. From Cormack DH. *Essential Histology,* 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins, 2001.

tiates a cycle that perpetuates the contraction through a number of actions that may occur in variable order:

- Metabolic demand is increased because the sustained contraction requires energy.
- The contraction knot reduces circulation and the supply of oxygen and nutrients needed to meet the metabolic demand while promoting the accumulation of metabolic waste products that disturb local nociceptors and cause pain.
- Reduced circulation and increased metabolic demand depletes adenosine triphosphate (ATP) locally, which prevents the inhibition of ACh release and impairs the function of the pump that returns calcium to the sarcoplasmic reticulum.
- The continual imbalance of calcium, ACh, and ATP sustains the contraction.

The sustained contraction shortens muscle fibers and reduces their action potential, both of which affect the function of the muscle as a whole.

Studies suggest that a trigger point is actually a mass containing many dysfunctional motor endplates. Biopsies from cadavers have revealed that the diameter of the shortened muscle fibers containing trigger points is considerably greater than the diameter of healthy muscle fibers. This makes the knot feel bigger and denser than the healthy tissue around it. A taut band may occur because the contraction pulls fibers toward the knot, leaving them taut on either side of the knot (Fig. 3-4). The degree of dysfunction and irritability in the trigger point influences the intensity of pain more than the size of the muscle does. Active trigger points in small, minor muscles are just as likely to cause severe pain as trigger points in big, major muscles.

Trigger points are categorized as active, latent, or satellite. An *active trigger point* causes symptoms with normal activities of daily living and at rest. The referred sensation elicited by compressing an active trigger point will likely replicate the client's pain during daily life (i.e., the client will be familiar with this sensation). A *latent trigger point* is painful only on compression. While it is also found within a taut band of muscle and produces referred sensation that is characteristic for that trigger point, a latent trigger point does not cause pain during activities of daily living or rest, and the referral elicited by compression may not be familiar to the client. A latent trigger point can become active with overuse or other irritating factors. A *satellite trigger point* is one that develops within the referral area of an active trigger point, in an overloaded synergist, or in the antagonist of the muscle containing a trigger point. Satellite trigger points are often deactivated when the primary trigger point that induced it is deactivated.

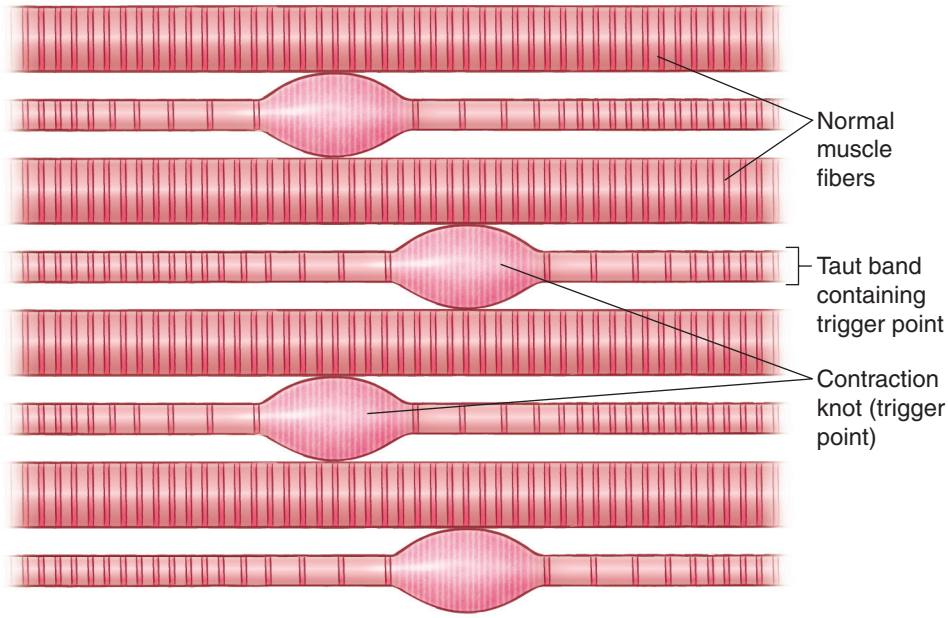


Figure 3-4 **Taut band of muscle.** Note how the contraction knot increases tension on either side of the knot, pulling the affected fibers taut and making them thinner.

Common Signs and Symptoms

Clients with trigger points often initially report pain in a general area. For example, a trigger point in the scalenes may refer pain around the medial aspect of the scapula, which the client will often call neck or shoulder pain. Trigger points rarely produce sharp or easily localized pain unless the point is directly compressed. Symptoms such as numbness, tingling, or prickling are sometimes reported. Compression of a trigger point causes predictable, referred pain or tenderness in an area either surrounding or distant from the trigger point. Active trigger points produce pain with activity, while at rest, and when compressed. The pain may be felt at the site of the trigger point or in its referral zone. Reducing the factors that contribute to an active trigger point can cause it to become latent, but it can become active again when improper use of the affected muscle or involvement of another factor aggravates it. Referred pain can become chronic unless the active trigger point is deactivated. Chronic, painful trigger points can disturb sleep. Lack of sleep can consequently increase sensitivity to pain, exacerbating symptoms. A break in this cycle is necessary to relieve the chronic condition.

It may be difficult for the client to relax a muscle containing a trigger point. Muscle tension, hypertonicity, and spasm may develop in muscles containing active or latent trigger points. This may cause the client to perform actions clumsily. Affected muscles may be short and tense, may fatigue quickly, and may not lengthen fully without pain. Pain may be worse with passive lengthening than with an active contraction because the client will limit active motions to avoid pain. Limiting the function of the prime mover containing a trigger point can lead to overloading of its synergists and antagonists, which may in turn cause trigger points to develop in those muscles. Reflex inhibition caused by trigger points may lead to weakness in muscles that show no sign of atrophy. Clients may be less aware of the dysfunction caused by trigger points than they are of pain.

Referred autonomic phenomena including dilation or constriction of blood vessels, changes in local temperature, sweating, goose bumps, and production of tears or saliva may be caused by trigger points. Proprioceptive irregularities including dizziness, ringing in the ears, and problems maintaining balance may also result from trigger points in some muscles. Strumming a taut band at the site of a trigger point may shorten the affected fibers, eliciting a local twitch response (Fig. 3-5). This twitch response, which feels like a quick flutter of the muscle fibers, is often used as a diagnostic criterion for assessing trigger points.

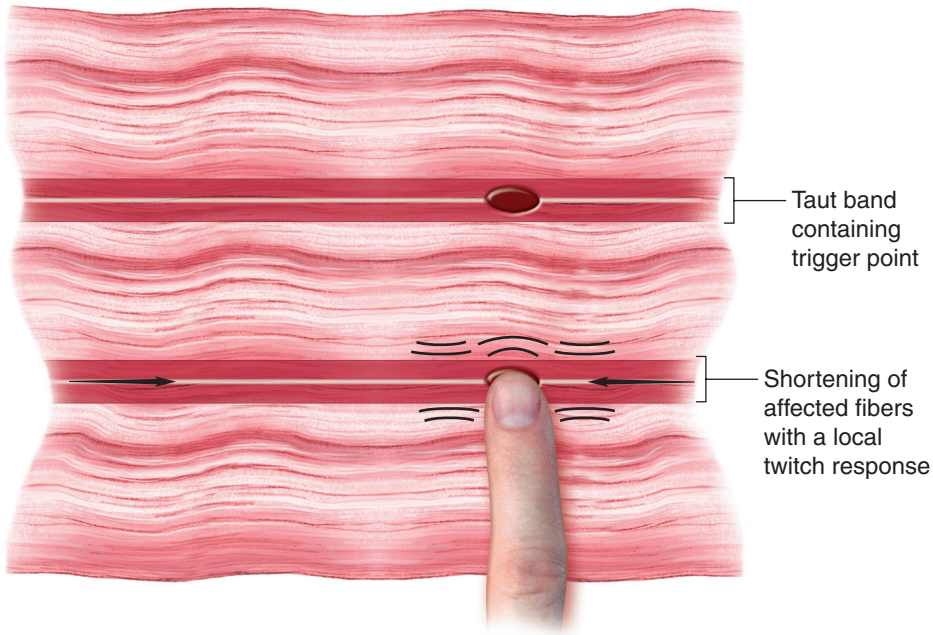


Figure 3-5 Local twitch response. Strumming a taut band at the site of a trigger point may shorten the affected fibers, eliciting a local twitch response. Adapted from Simons et al. (1999).

Possible Causes and Contributing Factors

Mechanical overload of a muscle, whether by acute incident or repetitive misuse, is a primary contributing factor to the development of trigger points. Active trigger points in muscles that are held in a shortened position will cause pain in the area of the trigger point or its referral zone. Latent trigger points in muscles that are regularly held in a shortened position may become active. Muscle contraction, particularly from the shortened position or against resistance, aggravates trigger points.

Muscles that are shortened due to postural imbalance are prone to developing trigger points. Postures that hold affected muscles in a shortened position, such as during sleep, sitting at a desk or in a car, or holding other inactive postures, may exacerbate pain. Actively lengthening a muscle containing a trigger point shortens its antagonist. Performing this stretch too quickly or forcefully can activate a trigger point in the antagonist. People who exercise their muscles daily are less likely to develop trigger points than those who are generally sedentary but occasionally participate in short bouts of intense activity.

Chilling a muscle, whether directly when using an ice pack or indirectly, such as when sitting near an air conditioning vent, may activate a trigger point. Compression of muscles by external forces, such as the strap of a bag or a utility belt, may contribute to the development or activation of trigger points. Nerve compression may encourage the development of trigger points in the muscles it innervates. Pathologies including organ insufficiency and inflammatory conditions such as arthritis can activate trigger points. Trauma, fatigue, and physical or emotional stress can also activate and perpetuate the symptoms of trigger points.

Conditions that affect metabolic, endocrine, or chemical homeostasis including thyroid conditions, diabetes, gout, and clinical depression can be perpetuating factors. Deficiency in vitamins or minerals including B, C, folic acid, magnesium, calcium, and iron can contribute to or delay the healing process of trigger points. Chronic bacterial or viral infections and some allergies may lead to chronic trigger points. Regular exposure to toxic chemicals, such as those in environmental pollution and pesticides, or heavy metals, such as mercury, may also play a role.

Most of the conditions described in this book will likely involve trigger points because the postures or traumas that contribute to these conditions can also contribute to the development of

trigger points. Deactivating trigger points that contribute to these conditions is often necessary to fully resolve the signs and symptoms associated with them.

Because trigger points can occur in any muscle and are perpetuated by factors that include chronic infections and visceral disease, they can contribute to and be confused with many other conditions throughout the body. For example, pain in the pectoral area may result from a trigger point but can also be a symptom of cardiac disease, while trigger points in the abdominal muscles can mimic as well as contribute to digestive distress. Travell and Simons suggest that trigger points may contribute to a wide variety of chronic conditions to a much greater degree than is currently recognized by health care professionals. Table 3-1 lists some of the general conditions commonly confused with or contributing to trigger points. Because it may be difficult to distinguish pain referred by a trigger point from pain that results from a more serious condition, it is particularly important to understand the client's health history, precipitating events, and other possible causes for pain before initiating treatment. Consult your pathology book for more detailed information. If you are unsure and the client's signs and symptoms resemble those of a more serious condition, particularly if the client has other risk factors, refer him or her to a health care provider for a medical assessment.

Contraindications and Special Considerations

First, it is essential to understand the cause of the client's pain. Because trigger points refer pain and other autonomic symptoms that may also result from serious conditions, refer the client to his or her health care provider if symptoms are severe or significantly reduce activities of daily living. These are a few general cautions:

- **Infection.** Trigger point pain can be associated with or may mimic pain related to local or systemic infections. Massage is systemically contraindicated until the infection is resolved.
- **Acute injury.** Do not treat trigger points local to an acute injury such as a strain or sprain. Trigger point therapy may be too aggressive for recently injured tissues. Wait until the subacute or chronic stage, when the tissues become more stable.
- **Producing symptoms.** Compressing a trigger point will produce local or referred pain. Take care to keep the level of pain within the client's tolerance. Explain the process of treatment before beginning so that the client is aware and prepared to experience this pain during treatment. Knowing what to expect may keep the client from tensing up. Instructing the client to breathe through the technique may help reduce pain.
- **Kick-back pain.** Treating a taut band or trigger point too vigorously may cause the client to experience symptoms within hours or days following treatment. Work slowly, one layer at a time, to prepare the deeper tissues for treatment. Avoid treating one area too intensely, and avoid treating several trigger points in the same area in one session. Always follow frictions and compressions with a full, passive stretch within the client's tolerance. Heat may also help to release the trigger point and reduce the possibility of kick-back pain.
- **Hypermobile joints and overstretched muscles.** It is best not to fully stretch a muscle that crosses a hypermobile joint or one that is already overstretched. When treating a trigger point in these circumstances, use a localized pin and stretch or muscle stripping to lengthen only the affected fibers.
- **Treatment duration and pressure.** If the client is elderly, has a degenerative disease, or has been diagnosed with a condition that diminishes his or her activities of daily living, you may need to adjust your pressure as well as the treatment duration. Frequent half-hour sessions may suit the client better.
- **Friction.** Do not use deep frictions if the health of the underlying tissues is at risk for rupture. Allow time for scarring and tissue regeneration to avoid re-injury. Do not use deep frictions if the client is taking antiinflammatory medication or anticoagulants. Friction initiates an inflammatory process, which may interfere with the intended action of antiinflammatory medication. Recommend that the client refrain from taking such medication for several hours before treatment if his or her health care provider agrees. Because anticoagulants reduce clotting, avoid techniques such as friction that may cause tearing and bleeding.

Table 3-1 Differentiating Conditions Commonly Confused with or Contributing to Myofascial Trigger Points

Condition	Typical Signs and Symptoms	Testing	Massage Therapy
Myofascial pain syndrome	Persistent muscle aches or pain Muscle or joint stiffness Muscle tension Trigger points Pain interrupts sleep	Physical exam Palpate for trigger points Referred pain or twitch response Other tests may be performed to rule out other sources of pain	Massage therapy is indicated.
Fibromyalgia	Constant, dull, widespread aching or pain Tender points Fatigue Sleep disturbances Signs and symptoms of possible coexisting conditions including chronic fatigue syndrome, depression, headaches, irritable bowel syndrome, and post-traumatic stress disorder	Physical exam Pain lasting at least 3 months 11 of 18 points positive for tenderness Blood tests to rule out other conditions	Massage is indicated. It is important to distinguish the tender points of fibromyalgia from trigger points that refer pain elsewhere. Fibromyalgia is often exacerbated by deep pressure and may require a soft touch.
Angina Pectoris	Chest pain Pain in arms, neck, jaw, shoulder, or back Nausea Fatigue Shortness of breath Anxiety Sweating	Physical exam Risk factors Blood test Electrocardiogram Stress test Chest x-ray Echocardiogram CT scan	Trigger points in pectoralis major may mimic some symptoms of angina pectoris. If the client presents with risk factors or the symptoms listed here, refer him or her to a health care provider prior to treatment. When risk factors are present, massage is indicated only if cleared by a primary health care provider and if the client is able to perform normal activities of daily living.
Migraine	Episodic or chronic Moderate or severe Often unilateral Pulsating or throbbing Aggravated by physical activity Aura, nausea, vomiting, sensitivity to light and sound	Diagnosed by signs and symptoms, familial history, and response to treatment MRI or CT to rule out other causes EEG to rule out seizures	Trigger points in SCM, temporalis, and the posterior cervical muscles may mimic the symptoms of migraines. Massage may not be appropriate during a migraine but may reduce intensity and frequency when performed regularly between headaches.
Tension headache	Dull, aching, vice-like pain Pain in neck and shoulders Scalp tenderness Loss of appetite Fatigue Insomnia Mood changes Trouble concentrating	Often self-assessed Physical exam Blood tests, CT, or MRI to rule out other conditions	Massage is indicated. See Ch. 5. Trigger points in the SCM, muscles of mastication, posterior cervical muscles, suboccipitals, and upper trapezius may contribute to tension headaches.

(*continued*)

Table 3-1 Differentiating Conditions Commonly Confused with or Contributing to Myofascial Trigger Points (Continued)

Condition	Typical Signs and Symptoms	Testing	Massage Therapy
Dysmenorrhea (severe menstrual cramps)	Throbbing or cramping in low abdomen Pain radiating to back and thighs Nausea Dizziness	Assessed only when cramps are severe enough to disrupt activities of daily living, suggesting other contributing factors Ultrasound CT or MRI Laparoscopy	Trigger points in the lower rectus abdominis can mimic the pain of dysmenorrhea. It is best to wait until the menstrual cycle is over and swelling and tenderness in the abdomen have subsided before assessing and treating trigger points.
Earache and tinnitus	Ear pain Ringing in ears Hearing loss Fever Irritability	Physical exam of ear, mastoid, nose, and throat	Pain in or around the ear and mastoid may indicate infection. Massage is contraindicated until infection is resolved. Trigger points in the deep masseter can cause earache or tinnitus. Trigger points in the lateral pterygoid and SCM may also cause tinnitus.
Temporomandibular joint disorder (TMJD)	Pain in the jaw, face, ears, or neck Stiffness in jaw Difficulty chewing Reduced ROM Locking of jaw Clicking in jaw Uneven bite Headaches	Physical exam X-ray of teeth CT scan of bones MRI of joint's disc	Massage therapy is indicated for TMJD. Advanced training is necessary. Some states have restrictions against working intra-orally. Trigger points in the masseter or lateral pterygoid may cause TMJD pain.
Infant colic	Predictable bouts of crying Inconsolable crying Changes in posture including flexed hip, clenched fists, and tense abdominal muscles	Physical exam Diagnostic test to rule out other causes	Massage is indicated to relieve the symptoms of colic. Training in infant massage is advised. Trigger points in the abdominal muscles may contribute to the pain of colic.
Spasm/cramp (contracture)	Sudden, often sharp pain in affected voluntary muscle Palpable and often visible mass of hypertonic muscle tissue	Often self-assessed X-ray or MRI may be used to assess extent of damage	Massage is indicated. Discuss with health care provider if repeated spasm may be related to an underlying condition or side effects of medication.
Bursitis	Pain, especially with activity or palpation Heat, redness, swelling, or tenderness	Physical exam ROM tests X-ray or MRI if conservative treatment is not successful	Massage is systemically contraindicated if bursitis is due to infection and is locally contraindicated in the acute stage to avoid increased swelling. In the subacute stage, massage to structures surrounding the joint is indicated.
Diabetes	Frequent urination, frequent thirst, increased appetite, fatigue, nausea	Physical exam Fasting blood sugar test	Massage is indicated when tissues are not compromised, and circulation and nerve conduction are healthy.
Gout	Redness, heat, and swelling Sudden, intense pain—often at night—that diminishes gradually over a couple of weeks	Physical exam Blood and urine uric acid concentration tests Synovial fluid test	Massage is contraindicated during acute attacks. Gout may indicate other systemic conditions. Work with the health care team.

Massage Therapy Research

What follows is just a small sampling of the research describing the effects of massage therapy techniques commonly used for the treatment of trigger points. Trigger points have been studied in great detail by practitioners in fields ranging from massage therapy, physical therapy, and chiropractic care to anesthesia, cardiology, and neurology. Each of the condition chapters in this book also includes references to research in which trigger point therapy is central to the positive outcomes described.

For the studies described here, the pressure pain threshold (PPT) represents the least amount of pressure that causes the subject to perceive pain, which is measured using an external instrument called an algometer. The visual analog scale (VAS) represents the results of a questionnaire answered by each subject.

The study "Effectiveness of a Home Program of Ischemic Pressure Followed by Sustained Stretch for Treatment of Myofascial Trigger Points" (Hanten et al., 2000) tested the possibility that a home care program designed, demonstrated, and monitored by a trained practitioner could help alleviate the pain associated with trigger points. Forty subjects diagnosed with one or more trigger points in the neck or upper back were randomly divided into two groups. One group was instructed to apply gradually increasing pressure to their trigger point using a Thera Cane® until they felt release, followed by a 30–60 second stretch, at least twice a day for 5 days. The control group was assigned a 5-day home program of active ROM exercises to be performed 10 times each, at least twice a day, for 5 days. Both groups were instructed not to perform any treatment on days 6 and 7. PPT and VAS were reported before treatment and on the third day after treatment. Subjects also reported the duration of their pain over a 24-hour period. The subjects performing compressions reported greater improvement in PPT and VAS. Functionality was not studied in this trial. The authors concluded that a home program of compression and stretching, occasionally monitored by a trained clinician, reduces pain and the number of visits to a clinic, although it is not clear whether this provides any improvement in function.

In 2006, Fernández-de-las-Peñas et al. published "The Immediate Effect of Ischemic Compression Technique and Transverse Friction Massage on Tenderness of Active and Latent Myofascial Trigger Points: A Pilot Study." Forty subjects with neck pain for at least 2 consecutive weeks, who had received a diagnosis of either latent or active trigger points in the upper trapezius, were randomly divided into two groups. Subjects in Group A received a single treatment in which the therapist applied gradually increasing pressure to the trigger point in the lengthened upper trapezius fibers until the subject felt pressure and pain. This amount of pressure was maintained until the subject reported a 50% decrease in pain. The pressure was then increased until the subject felt pain again, and the process was repeated for 90 seconds. The subjects in Group B received 3 minutes of continuous transverse friction to the relaxed upper trapezius fibers, applied slowly, using pressure that approached the PPT. Both PPT and VAS were assessed before treatment and 2 minutes after treatment. In both groups, there was a significant improvement in the PPT and VAS. There was no remarkable difference in outcomes between the two groups, nor was there any remarkable difference in results after treatment for a latent trigger point versus an active trigger point. The authors noted that positive results are obtained when the therapist applies only enough pressure to feel an increase in tissue resistance, and that there may be no clear reason to use pressure that causes pain or ischemia. They suggested that while ischemic compression and friction reduce pain resulting from trigger points, further study is needed to determine whether the amount of pressure applied to a trigger point during treatment affects the results.

In 2009, Ibáñez-García et al. published a comparative study titled "Changes in Masseter Muscle Trigger Points Following Strain-Counterstrain or Neuro-muscular technique." Seventy-one subjects, aged 20 to 65 years, who had received a diagnosis of latent trigger points in the masseter muscle, were divided into three groups. Group A was treated with neuromuscular therapy. The therapist used the thumb to apply six to eight muscle stripping strokes to the masseter. Each stroke lasted 4–5 seconds. Group B was treated with strain-counterstrain. The therapist located the trigger point in the masseter muscle, then applied gradually increasing pressure until the subject felt pain. The subject's position was then changed until pain was reduced by approximately 75%, and the new position was held for 90 seconds. The subject was then passively moved into the

neutral position. Group C, the control group, received neither treatment nor a sham procedure. Each participant lay supine in a neutral position for 5 minutes and was assessed after treatment. Each group participated in one session per week for 3 consecutive weeks. PPT, VAS, and ROM for active opening of the mouth were measured prior to and 1 week after treatment. Both the neuromuscular and strain-counterstrain groups showed significant improvement compared to the control group. Differences between the neuromuscular and strain-counterstrain groups were insignificant. The authors noted limitations in their study, which reported only the immediate effects of treatment. Studies analyzing long-term effects are needed. In addition, while the subjects had received a diagnosis of masseter trigger points, all were asymptomatic and their results may be different from subjects who are presenting with pain. However, latent trigger points are clinically relevant and can become active. Finally, because the control group received no treatment, the study cannot rule out a placebo effect in the other groups that showed improvement. The authors recommend a trial that includes a sham technique to validate the improvements shown with neuromuscular therapy and strain-counterstrain.

WORKING WITH THE CLIENT

Client Assessment

Assessment begins at your first contact with a client. In some cases, this may be on the telephone when an appointment is requested. Ask in advance if the client is seeking treatment for specific pain so that you can prepare yourself.

Table 3-2 lists questions that may aid your assessment.

POSTURAL ASSESSMENT

The client's description of the location of his or her pain will help you to determine which muscles may harbor the trigger point(s) that refer pain to that location. This will also help you to determine which muscles are short, weak, or otherwise inhibited. Allow the client to enter the room ahead of you while you assess his or her posture and movement. Clients may avoid postures or movements that lengthen or overload a muscle containing a trigger point. Look for imbalances in movement or patterns of compensation that may give additional clues about the location of trigger points. For example, a client with low back or leg pain may have a trigger point that shortens the piriformis, which may cause the client to stand with the hip laterally rotated. A client with shoulder pain may have a trigger point that shortens the scalenes on one side, which could cause the client to hold the head in slight lateral flexion to the same side and slight rotation to the opposite side to avoid lengthening the shortened scalenes. Look for reduced mobility or a favoring of one side. If the lower body is affected, watch as the client walks, climbs steps, sits, and stands from sitting. If the upper body is affected, watch as the client opens the door, takes off his or her coat, or picks up a pen. Notice if the client rotates the trunk to avoid rotating the head when turning to talk to you. Notice if he or she is able to perform these activities without assistance or if he or she avoids lengthening or loading certain muscles.

When assessing standing posture, be sure that the client stands comfortably. If he or she deliberately tries to stand in the anatomic position, you may not get an accurate assessment of his or her posture in daily life. When trigger points affect the lower body, the client may stand in a position that keeps resistance off the affected muscles. This, in turn, may initiate imbalances in posture from the feet up to the spine. Check for irregularities in the ankles, knees, hips, and low back. When the upper body is affected, the client may hold the joint in a position that keeps the injured muscle from stretching. This may initiate compensating patterns that protect the affected muscle. Look for imbalance in the shoulders and rotations in the arm, forearm, and cervical or thoracic

Table 3-2 Health History

Questions for the Client	Importance for the Treatment Plan
When did the symptoms begin?	Onset of symptoms may help you determine whether trigger points are the result of a recent injury or recent episode of misuse or if the condition is chronic or recurrent.
Did you receive an injury or surgery to this area?	An explanation of prior injury to the area may help you determine the contributing factors. Surgery and resulting scar tissue may increase the risk of developing trigger points.
Do you have a history of chronic infection, metabolic disorders, or other chronic health conditions?	Chronic health conditions may be a contributing factor in the client's pain or may be a predisposing factor in the development of trigger points.
Have you seen a health care provider for this condition? What was the diagnosis? What tests were performed?	Medical tests may reveal the condition contributing to trigger points. If no tests were performed to make a diagnosis, use the tests described in this text for your assessment. If your assessment is inconsistent with a diagnosis, ask the client to discuss your findings with his or her health care provider or ask for permission to contact the provider directly.
Where do you feel symptoms?	The pain reported by a client may either indicate the site of the trigger point or its referral zone or may result from restricted ROM because a muscle crossing the joint contains a trigger point.
Describe what your symptoms feel like.	Active trigger points usually cause steady, aching pain that is somewhat diffuse. Trigger points rarely produce sharp, pinpointed pain. Remember that clients are not likely to realize that a spot in one part of the body can refer symptoms to another part of the body, so it is important for you to make that connection.
Describe your posture during sleep, work, or other activities of daily living.	Holding a muscle in a shortened position may contribute to trigger points.
Do any movements make your symptoms worse or better?	This may help you locate weakness in structures producing such movements. Resisted activity or activities that lengthen the muscle containing a trigger point are likely to increase symptoms. Adding slack or reducing tension in the muscle may decrease symptoms.
Are you taking any prescribed or over-the-counter medications or any herbal or other supplements?	Medications of all types may contribute to symptoms or have contraindications or cautions.
Have you had a corticosteroid or analgesic injection in the past 2 weeks? Where?	Local massage is contraindicated. A history of repeated corticosteroid injections may affect the integrity of muscle and tendons, increasing the risk of injury. Use caution when applying pressure or cross-fiber strokes. Analgesics reduce sensation and may cause the client to allow you to work too aggressively.
Have you taken a pain reliever or muscle relaxant within the past 4 hours?	The client may not be able to judge your pressure and may allow you to work too aggressively.
Have you taken anti-inflammatory medication such as NSAIDs (e.g., aspirin or ibuprofen) within the past 4 hours?	Deep friction causes inflammation and should not be performed if the client has recently taken an anti-inflammatory medication. Regular use of anti-inflammatories may also contribute to collagen degeneration.

spine. You may not be able to attend to all of the compensating patterns in the early treatments, but may be able to return to them once the primary trigger point(s) are deactivated.

ROM ASSESSMENT

ROM assessment may reveal limitations that the client was unaware of. Clients with trigger points are often more conscious of pain than they are of limitations. Because the pain of trigger points is often referred, ROM assessment, particularly against resistance or in a full passive stretch, will help you pinpoint the muscle containing a trigger point that is referring pain. Since it

allows the client to control the amount of movement and stay within a pain-free range, only active ROM should be used during the acute stage of injury to prevent undue pain or re-injury.

Active ROM

Compare your assessment of the client's active ROM in the affected joints to the values listed in the Average ROM boxes in Chapters 4 to 11.

- **Active ROM of the affected joint** may be limited but may not cause pain if the movement is slow and steady, whereas a quick or forceful active contraction of a muscle containing a trigger point will be limited and likely painful. The client may limit movement to the pain-free range.

Passive ROM

Compare the client's P ROM on one side to the other when applicable. Note and compare the end feel for each range (see Chapter 1 for an explanation of end feel).

- **P ROM of the affected joint** may produce no symptoms or restriction when that movement shortens the muscle, but is often restricted and produces pain on a full passive stretch. The location of pain during a full passive stretch of the affected joint may reveal the referral pattern for that trigger point and help to determine the location of the trigger point.

Resisted ROM

Use resisted tests to assess the strength of the affected muscle. Compare the strength of the affected side to the unaffected side when possible.

- **R ROM of the affected joint** may reveal weakness in the affected muscle and will likely produce pain local to the trigger point or in its referral zone. Pain is most likely when the resisted contraction is initiated with the muscle in a shortened position.

SPECIAL TESTS

Numerous orthopedic tests are specific for trigger points in individual muscles. These specific, named tests largely comprise combinations of compression, passive lengthening, and resisted contractions of the affected muscles. It is important to learn these tests in advanced training that is focused on clinically oriented treatments or research. For now, length and strength assessment, a full passive stretch of the affected muscle, and palpation are sufficient tools for assessing trigger points. Use ROM testing as described above, and refer to Chapters 4 to 11 for special tests of the muscles affected by those conditions.

PALPATION ASSESSMENT

Place the muscle in a fully relaxed and comfortably lengthened position when palpating for trigger points. If a muscle can be grasped between the fingers, a pincer grip may be a good option for palpating trigger points (Fig. 3-6). For muscles that cannot be gripped, compress the area between your finger and the muscle or bone deep to the affected muscle. When palpating for trigger points, it is essential to work slowly, with full concentration. They can easily be missed when working broadly or quickly. Locate the taut band first. A taut band feels something like a guitar string, pulled tight, that rolls under your finger when you strum across it using pressure. Palpation along the length of the taut band may reveal a nodule—the trigger point. Compression of this nodule causes more local or referred pain than pressure to any other part of the taut band. This spot can be very small—even the size of a pinhead—so it is important to palpate slowly and to stay focused. If the nodule is mobile and does not seem to be embedded in a muscle or fascia, it may be a lipoma. Lipomas are fatty nodules that should not be directly compressed or treated with friction.

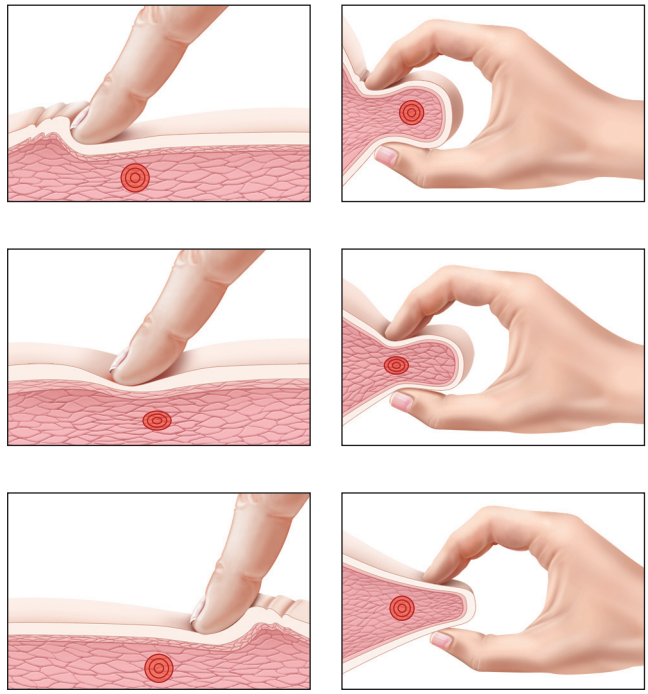


Figure 3-6 Palpating trigger points. Begin your flat finger (left images) or pincer grip (right images) palpation on one side of the suspected trigger point, moving slowly and deliberately over it to the other side of the trigger point. The client will likely feel a higher level of pain when you make direct contact with the trigger point than when palpating the fibers that surround it. Adapted from Simons et al.

Applying direct pressure to the trigger point often elicits pain or other referred sensations. This sensation may occur immediately upon pressure or 10 or more seconds later. If the trigger point is active, this sensation will be familiar to the client, resembling the pain he or she experiences during activities of daily living. Strumming the taut band or applying pressure to the precise trigger point may cause a local twitch response, which feels like a brief flutter of the muscle and is likely due to a spinal reflex. The local twitch response supports an assessment of the presence of a trigger point. The local twitch response may be momentarily painful for the client. It may also reduce tension in the muscle. The tissue surrounding the trigger point may be dense and adhered and have the rough, granular texture of panniculosis.

It is essential to adequately warm the tissues and reduce adhesions and hypertonicity in order to palpate a small or deep trigger point. The area around the affected trigger point may be cool due to ischemia. Repeated rubbing or scratching of the area containing trigger points may cause the skin to become red and itchy, possibly due to overly sensitive mast cells releasing histamine, which causes the blood vessels to dilate upon minor trauma. It is unclear why this condition, called dermographia, occurs or if it is directly related to trigger points.

Some trigger points cause symptoms other than pain or weakness. For example, trigger points in the sternocleidomastoid (SCM) may cause dizziness, ringing in the ears, or the production of tears. Several books, including *Travell and Simons' Trigger Point Manual*, and much continuing education are dedicated to detailed explanations of these individual responses. In this book, each condition chapter contains an illustration of the relevant trigger points and their referral patterns.

Condition-Specific Massage

Trigger points often contribute to musculoskeletal injuries or chronic pain conditions. For example, plantar fasciitis may have origins in a trigger point that shortens the gastrocnemius. Trigger points should always be considered when assessing chronic pain conditions. When trigger points contribute to the symptoms of musculoskeletal conditions, the following recommendations are incorporated into treatment to aid healing and reduce the risk of further injury. Releasing the contraction knot of a trigger point, restoring proper circulation through the

muscle, and restoring normal muscle length and neuromuscular function are the basic goals of treating trigger points.

Because trigger points can occur in any muscle, the descriptions of techniques here do not specify locations since they are described more fully in later chapters. Use the resources in the following chapters when needed to determine the muscle fibers' direction, joints that have been crossed, tissues that are superficial versus deep, and so on. In some cases, such as with myofascial pain syndrome, trigger points can cause systemic symptoms and significantly reduce the client's activities of daily living. In addition, trigger points may be complicated by other conditions such as infection, metabolic insufficiency, or complex nerve lesions. A complicated case involving trigger points should be supervised by a professional with advanced training or referred to a primary health care provider.

It is essential for the treatment to be as relaxing as possible. Strumming or compressing a trigger point may cause pain at the upper end of the client's tolerance. Explain this to your client, asking him or her to let you know when your pressure approaches the upper end of his or her tolerance. Ask the client to breathe deeply during the application of the technique to help relax the muscle and nervous system, which may allow you to use more pressure when necessary. As the trigger point is deactivated, the referral pain will also diminish. Because treatment to the affected muscle can be uncomfortable, it is best to alternate treatment directly to the trigger point with more general treatment, stretches, and joint mobilizations. In addition, treating aggressively or attempting to resolve several trigger points in one session may cause kick-back pain. You may not be able to fully resolve chronic symptoms related to trigger points in one session. Do not try to do so by treating aggressively. Remember that you are working on tissue that is compromised. Ask the client to let you know if any part of your treatment reproduces symptoms, and always work within his or her tolerance.

There are many methods for treating trigger points including vapocoolant spray, moist heat, stretching, and muscle energy techniques. The following suggestions for treating pain, weakness, and limited ROM caused by trigger points are easily incorporated into the treatments suggested for the specific conditions described in other chapters of this book. The following description is generalized for any affected muscle. Refer to Chapters 4 to 11 for images and treatment suggestions pertaining to specific muscles.

- The area of pain reported by the client will give you clues about the possible location of an active trigger point. Use the illustrations of trigger point referrals in the following chapters or a more detailed trigger point chart, such as Travell & Simons' Trigger Point Flip Charts, to match the client's complaint with the referral area of a trigger point.
- Positioning and bolstering depends on the area to be treated. The muscle containing a trigger point should be comfortably lengthened, but not stretched.
- If you find edema, apply superficial clearing strokes toward the nearest lymph nodes and, when possible, bolster the area to allow gravity to draw fluid toward the thorax.

- If swelling is minor or absent, apply brief moist heat to the affected area to soften adhesions and increase circulation. If inflammation is present, do not use heat.


- Use your initial warming strokes to increase superficial circulation, soften tissues, and assess the tissues broadly surrounding the suspected trigger point and those that may be compensating. You should be able to initially assess tissues for adhesions, hypertonicity, protective muscle spasm, and tensile stress, all of which will help you to determine how to focus your treatment.

- Before applying emollient, assess and treat fascial restrictions around the affected muscle(s).

Treatment icons: Increase circulation; Reduce adhesions; Reduce tension; Lengthen tissue; Treat trigger points; Passive stretch; Clear area

- Soften the tissues peripheral to the trigger point, beginning proximally (closest to the trunk). Pay special attention to the affected muscle and its synergists. If the antagonists are accessible, treat these now, or return to this step when the client changes position. Circular kneading and cross-fiber strokes are effective for both softening tissues and reducing adhesions.


- Once the superficial tissues are pliable enough to allow for deeper work, apply friction strokes to reduce the remaining adhesions and apply lengthening strokes to peripheral tissues that are short and tight, beginning proximally. Muscles with fiber direction and actions in common with the injured muscle may have shortened to protect the injured muscle from further injury. If you find taut bands within these peripheral muscles, assess for additional trigger points.

The following steps describe treatment options for trigger points. In the following chapters, this treatment is represented by the icon to the left.

- Locate the taut band. It is easiest to find the taut band when the muscle is relaxed in a comfortably lengthened position. Shortening the muscle adds slack, which reduces tension, and makes the taut band more difficult to palpate. Feeling a twitch in the muscle as you palpate is a good indicator that you have found a taut band and possibly a trigger point.
- Begin with slow lengthening strokes along the taut band. Muscle stripping is sometimes sufficient to release a trigger point. If this happens, the taut band may also release and become slack.
- If muscle stripping is sufficient to resolve a trigger point, apply a full stretch to the muscle.
- If lengthening strokes do not release the taut band, slowly palpate along it to find the trigger point. This will be the most tender spot within the taut band. You may feel a nodule. Because a trigger point can be very small and obscured by adhesions and hypertonicity, this step requires slow and deliberate palpation. A good general rule is to take 6 seconds to palpate 1 inch of muscle.
- Once you have found the trigger point, compress it slowly. Your pressure may cause discomfort but should not cause pain. Remind the client to use the pain scale you described at the beginning of treatment to let you know when your pressure approaches a level of pain that keeps him or her from relaxing. Slow, deep breathing may make the treatment more comfortable and may improve the outcome of trigger point therapy.
- While compressing the trigger point, ask the client to let you know if the level of pain decreases. In addition, ask the client to describe any referred sensations.
- The compression can be held for as little as 10 seconds or as long as 1 minute. As you apply pressure, the fibers may begin to lengthen and become slack. Increase your pressure slightly to take up that slack so that you can maintain direct contact with the nodule. If you feel the resistance in the tissue decrease during compression, increase your pressure slightly until you feel the resistance again. If you feel the nodule move, do your best to follow it. This may require using one hand to stabilize the taut band while the other compresses the trigger point.
- While applying pressure to the trigger point, it may help to change the direction of your pressure slightly by making tiny movements around the nodule. This may give you more direct access to the contracted fibers.
- If you hold the compression for 10–20 seconds and the trigger point does not release, follow with lengthening strokes and Swedish techniques to the surrounding area. You can return to the trigger point, applying a few short rounds of compression followed by lengthening. The client's pain level may reduce with each application.
- If you apply compression for 20–60 seconds and the trigger point does not release, do not apply another round. Prolonged compression is an aggressive form of treatment that causes ischemia, and repeated applications may result in kick-back pain. You can return to this spot in a subsequent session.
- If you did not feel the trigger point or taut band release sufficiently, perform postisometric relaxation to the affected muscle. Assess muscle length and the taut band following postisometric relaxation.

- Follow any of the above methods with a slow, passive stretch of the affected muscle. Ask the client to remain as relaxed as possible. Hold the stretch for 15–30 seconds.
- Heat may be applied directly to a trigger point or taut band that did not fully relax. Heat increases circulation, softens adhesions, and may allow the muscle to lengthen more fully.

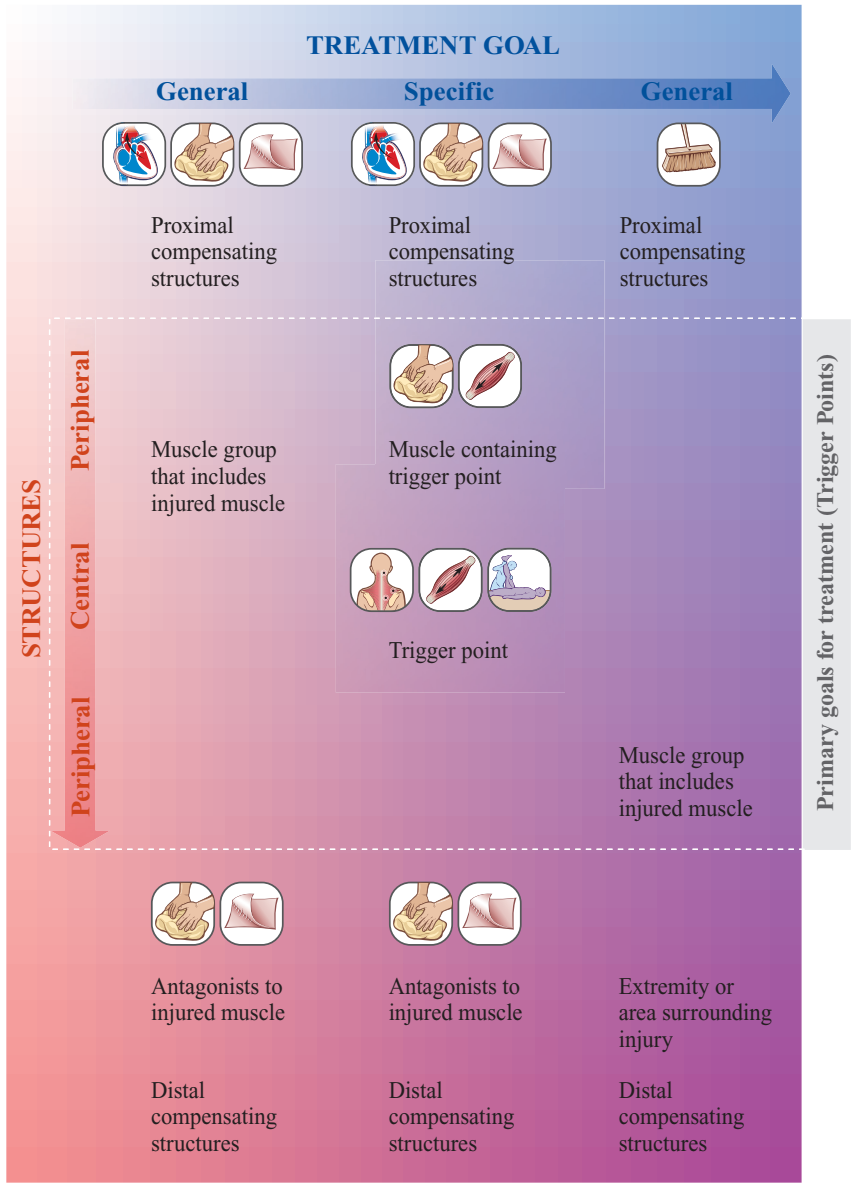


Figure 3-7 **Trigger points treatment overview diagram.** Follow the general principles from left to right, or top to bottom, when treating trigger points.

- If you were unable to address the antagonists of the injured muscle, reposition the client and address them now.
- Clear the areas treated.

The Treatment Overview diagram summarizes the flow of treatment (Fig. 3-7).

CLIENT SELF-CARE

Avoiding further injury is a primary concern when recommending self-care. Reducing or eliminating habitual offending activities and other perpetuating factors is crucial for long-term relief from trigger points. The client must learn to recognize when he or she is holding the affected muscle in a shortened position and which of his or her activities of daily living are putting undue stress on muscles that have developed trigger points. You can help clients learn

how to modify such activities to avoid overstressing the muscle. In many cases, the most important modification is simply slowing down to avoid the reflex responses that shorten muscles. The following are intended as general recommendations for stretching and strengthening muscles involved in the client's condition. The objective is to create distance between the attachment sites of muscles that have shortened, and to perform repetitions of movements that decrease the distance between the attachments of muscles which have weakened. If you have had no training in remedial exercises and do not feel that you have a functional understanding of stretching and strengthening, refer the client to a professional with training in this area.

Clients often neglect self-care due to time constraints. Encourage them to follow these guidelines:

- Instruct the client to perform self-care throughout the day, such as while talking on the phone, reading e-mail, washing dishes, or watching television instead of setting aside extra time.
- Encourage the client to take regular breaks from stationary postures or repetitive actions. If the client's daily activities include hours of inactivity, suggest moving for at least a few minutes every hour to prevent adhesions and reduced circulation. If the client's daily activities require repetitive actions that contribute to trigger points, suggest resting for at least a few minutes every hour or reducing the offending activity as much as possible.
- Demonstrate gentle self-massage of the muscles containing trigger points to keep adhesions and hypertonicity at bay between treatments. Applying moist heat may also help alleviate symptoms of trigger points. Instruct the client to follow self-massage and moist heat with a full passive stretch.
- Demonstrate all strengthening exercises and stretches to your client and have him or her perform these in your presence before leaving to ensure that he or she is performing them correctly and will not harm himself or herself when practicing alone. Stretches should be held for 15–30 seconds and performed frequently throughout the day within the client's limits. The client should not force the stretch or bounce. A stretch should be slow, gentle, and steady, keeping every other joint as relaxed as possible.
- Recommend stretching and strengthening exercises according to your findings in ROM testing and palpation.

Stretching

Maintaining proper length and tone of the affected muscle, its synergists, and its antagonists is essential to resolving trigger points and reducing the risk of further injury. For the contraction knot of a trigger point to be released, the affected fibers must be fully lengthened. Each stretch should be relaxed while reaching the full range possible within the client's tolerance. Stretches should be performed throughout the day, particularly before and after intense activity. Take care to instruct the client to begin slowly, gradually increasing the stretch as symptoms diminish and ROM improves. Stretching an injured muscle too quickly or too deeply may initiate a reflex response, which may result in spasm. In addition, when the affected muscle is lengthened, its antagonists are shortened. If the antagonists are involved in protective splinting, contracting them too quickly or too deeply may also result in spasm.

The results of ROM testing and palpation will determine which muscles have shortened and need to be stretched. In general, stretching occurs when the distance between the attachment sites of the muscle is increased. Refer to Chapters 4 to 11 to find stretches for specific muscles or groups of muscles.

Strengthening

A muscle with trigger points may not function efficiently, which may affect the ROM of the joint it crosses. While it is important to lengthen the affected fibers to eliminate a trigger point and keep it from returning, the client may also need to restore strength to a muscle affected by trigger points. In addition, strengthening the antagonists of muscles harboring trigger points may help keep the affected muscle from reflexive shortening. Strengthening weakened muscles is equally important

for restoring proper function to the affected joint. The results of ROM testing and palpation will determine which muscles have weakened and need to be strengthened. In general, active or resisted contractions strengthen muscles. As with stretching, a strengthening program should progress gradually. Pain-free, active ROM is effective for gradually restoring strength to weakened muscles. These exercises should be introduced slowly and increased in intensity only within the client's tolerance. As healing progresses and the risk of re-injury diminishes, add resistance to active ROM. Refer to Chapters 4 to 11 for exercises to strengthen specific muscles or muscle groups.

SUGGESTIONS FOR FURTHER TREATMENT

Treatment duration and frequency can vary widely when trigger points are a contributing factor in the client's condition. New trigger points resulting from a recent injury or newly developed pattern of activity or inactivity may be resolved in a single treatment. An acute trigger point that has been unrecognized or ignored may have become chronic. Chronic trigger points may lead to other factors, such as adhesions, hypertonicity, or weakness, that require more attention. When treating specific conditions such as those described in other chapters, it may be necessary to include assessment and treatment of trigger points in each session. As the client learns new postures and methods for performing pain-free activities, other muscles may respond to these changes. A trigger point treated in the last session may have resolved, while another one may become active.

There should be some improvement with each session. If this is not happening, consider the following possibilities:

- There is too much time between treatments. It is always best to give the newly treated tissues 24–48 hours to adapt, but if too much time passes between treatments in the beginning, the client's activities of daily living may reverse any progress.
- The client is not adjusting his or her activities of daily living or is not keeping up with self-care. As much as we want to fix the problem, we cannot force a client to make the adjustments we suggest. Explain the importance of his or her participation in the healing process and encourage the client to follow your recommendations, but be careful not to judge or reprimand a client who does not.
- The condition is advanced or involves other musculoskeletal complications that are beyond your basic training. Refer this client to a massage therapist with advanced training. Continuing to treat a client whose case is beyond your training could hinder his or her healing and turn the client away from massage therapy altogether.
- The client has an undiagnosed, underlying condition. Discontinue treatment until the client sees a health care provider for medical assessment.

If you are not treating the client in a clinical setting or private practice, you may not be the therapist who takes this client through the full program of healing. Still, if you can bring some relief in just one treatment, it may encourage the client to discuss this change with his or her primary health care provider and seek manual therapy rather than more aggressive treatment options. If the client agrees to return for regular treatments, the symptoms are likely to change each time, so it is important to perform an assessment before each session.

PROFESSIONAL GROWTH

CASE STUDY

Todd is a 58-year-old bank executive. He has pain in his left shoulder that was intermittent until about 6 weeks ago, when it became constant. Todd spends many hours working at a computer and talking on the telephone. He stays fit by rock climbing and playing basketball and other sports on the weekends and some

evenings. Todd stated that he has been athletic since childhood and has been well trained to warm and stretch his muscles before and after strenuous activity.

Subjective

Todd reported feeling pain in his left shoulder that used to come and go but has become fairly constant over the past 6 weeks. He has also noticed that from time to time he feels pain radiating down his arm and into his thumb. When asked if he had any injuries, he replied "No" but quickly added that he had been in a side-impact car accident approximately 3 years ago. He had been taken to the hospital following the accident, but no injuries were found. Twenty-four hours later, he had told his health care provider that he felt a little stiffness in his neck, although it was not debilitating. His provider prescribed a neck brace, which Todd wore for approximately 3 days until the aching stopped. He has had no manual or physical therapy since the accident. Todd stated, with frustration, that he has been taking ibuprofen nearly every day for the past month, and while this helps him get through the workday, he is concerned that it will cause stomach problems. When asked, Todd stated that his shoulder does not hurt when he is playing basketball, but he has stopped climbing because the symptoms are intense when he bends his head back to look up. He feels the worst pain when he straightens his neck after holding the phone between his left ear and shoulder. He also feels pain when riding his bike. When asked, he described that he leans forward to reach his handlebars with his neck bent back to look forward while riding his bike. When asked, he stated that he feels no numbness, tingling, or weakness in his arm or hand.

Objective

Todd appears healthy and vibrant. He had no difficulty turning the doorknob or taking off his coat. I noticed that after filling out his form, he lifted his head very slowly and had a brief, pained expression on his face. I asked if he felt pain at that moment, and he said he did not notice anything.

Postural assessment revealed left lateral flexion of the neck and right rotation of the neck. The left shoulder is elevated. Trunk is slightly flexed toward the left. Rotating the neck to the left produced pain in the shoulder after 3 seconds. Todd stated that he felt like it was about to hurt in his arm too. Extension of the neck produced pain along the levator scapula after 5 seconds. Vertebral artery test was negative for circulation deficiency. Adson's test was negative for compression of neurovascular bundle.

Tissues of the neck, particularly the left anterior neck, are dense and adhered. Crepitus was both felt and heard with superficial cross-fiber strokes. Gentle pincer grip to the left SCM was instantly tender. No referred pain. Trigger points were found in the anterior scalene, approximately 1 inch superior to the clavicle. Pressure on the trigger point produced pain in the shoulder instantly, and into the arm within 5 seconds. Palpation of the area around the scapula and down the arm caused no pain; Todd stated that it felt good. Levator scapula and upper trapezius are hypertonic and tender. No trigger points were found here, although this may be because the tissues are dense and adhered. I will reassess in a follow-up treatment.

It is possible that the side-impact car accident resulted in whiplash that was not properly treated.

Action

We began in the supine position. I performed myofascial release from the skull toward the ribs anteriorly, toward the acromion process laterally, and toward the scapula posteriorly. I applied more specific superficial techniques to release fascia surrounding the left SCM and scalenes. The tissue is dense and adhered and may contain minor scar tissue. Crepitus was evident during cross-fiber strokes across scalenes. I applied emollient and general Swedish techniques to the neck and shoulders to warm and lengthen the superficial muscles. I applied pincer grip kneading to the full length of the SCM. This produced pain at level 5 initially. Pain reduced to 1 after three repetitions. With the SCM softened, I accessed the scalenes. I began with three rounds of slow muscle stripping to the full length of the anterior scalene. The client reported pain at a level 5 along the muscle, increasing to level 7 as the stroke approached a nodule in the muscle. No twitch response was felt. After the third round of muscle stripping, the pain remained at level 6 at the most tender spot. I applied direct pressure to the nodule for 10 seconds. The client reported familiar pain referred into the shoulder at level 4 and less so into the arm. I increased the length of the scalenes slightly by laterally flexing the neck toward the right before each round of compressions. By the third round, local pain in the anterior scalene reduced to 4 and referred pain was described as "a shadow of the pain I felt in the beginning." I felt what may have been a twitch response, although it was minor and could have been a movement of the muscle related to breathing. I

continued muscle stripping to the middle and posterior scalene. I found nothing other than hypertonicity in the middle scalene. The posterior scalene was locally painful at level 4 but produced no referred pain. I applied a full passive stretch to the left scalenes by laterally flexing the neck toward the right with a slight rotation toward the left for 20 seconds.

I performed general deep tissue techniques to neck extensors and pectorals. I then turned the client prone and continued general deep tissue techniques to the upper back. I found taut bands between the scapula and spine. Due to hypertonicity and adhesions, it is unclear whether these are the rhomboid or serratus posterior superior. Deep forced breathing did not help to distinguish between the rhomboid and serratus. I focused on releasing adhesions between the scapula and spine and on reducing hypertonicity in the levator scapulae and upper trapezius.

Plan

Todd rescheduled for one week from today. I will assess the scalenes, the rhomboid/posterior serratus, the trapezius, and the levator scapula again during the next session.

I demonstrated a gentle massage to the neck to keep adhesions at bay until the next session. I suggested that he do this while lying down so that the neck and shoulder are cradled and the muscles do not need to actively contract. I demonstrated scalene stretches. I recommended that Todd perform a full, slow, gentle rotation of the neck for 20 seconds out of each hour that he sits at his computer, followed by a full stretch to the scalenes. I suggested using a speaker phone or ear buds to avoid holding the phone with his shoulder.

CRITICAL THINKING EXERCISES

1. Your client reports chronic pain in the gluteal area that has not been relieved by massage. You suspect that the pain may be referred by a trigger point in the quadratus lumborum. The area around the quadratus lumborum is dense and adhered, and it is difficult to distinguish the individual muscles in the area. Discuss methods for getting to the small trigger point in a deep muscle obscured by adhesions and hypertonicity. Create a self-care plan and a plan for future treatment.
2. Using books, Web sites, and other sources that describe trigger points in detail, find possible sources for pain in the following areas, keeping in mind that there may be more than one:
   - Around the eye
   - In the upper row of teeth
   - The thumb and index finger
   - The fourth and fifth fingers
   - The elbow
   - Across the iliac crests and sacrum
   - Near the greater trochanter
   - Down the posterior leg
   - At the patella
   - In the arch of the foot
3. Conduct a short literature review to learn about the relationship between trigger points and one or more of the following:
   - Vitamin deficiency
   - Chronic infections
   - Hypothyroidism
   - Hypoglycemia
   - Depression

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