3

SECTION II:

CLINICAL APPLICATION

Lumbosacral Spine

Problems with the **lumbosacral spine,** or low back, are some of the most common complaints that clients present to the massage therapist. **Low back pain** (**LBP**) is the second leading symptom for which patients consult their physicians.[1] Disorders of the low back are the leading cause of disability in people younger than 45 years of age.[2] Every year 50% of the adult population in the United States experiences at least a day of back pain, and yet 80% of LBP is nonspecific, meaning the cause is unknown.[3] It has been estimated that mechanical disorders of the spine, that is, problems of function and not pathology, represent at least 98% of LBP.[4]

Anatomy, Function, and Dysfunction of the Lumbosacral Spine

GENERAL OVERVIEW

- The spine consists of 33 bones divided into five regions: **cervical, thoracic, lumbar, sacral,** and **coccygeal** (Fig. 3-1).
- There are 24 distinct vertebrae: seven cervical, twelve thoracic, and five lumbar.
- Five vertebrae are fused to form the **sacrum,** and four are fused to form the **coccyx.**
- The lumbopelvic region consists of five lumbar vertebrae, the right and left innominate **bones,** which function as lower-extremity bones, and the sacrum, which functions as part of the spine. The pelvis has three joints: a **symphysis pubis** and two **sacroiliac joints.**

Primary and Secondary Curves

When the body is viewed from the side, there are three visible curves: the lumbar, the thoracic, and the cervical. The sacrum and the coccyx, which is not visible, form a fourth curve. The thoracic and coccygeal curves are called **primary curves** because the vertebral column at birth has one curve that is convex posteriorly. The cervical and lumbar curves are convex anteriorly and are called **secondary curves** because they develop after birth in response to the infant's lifting his or her head and standing upright, respectively.

The degree of curve in the healthy spine represents the balance between stability and mobility. With too little curve, the spine is stiffer. With too much curve,

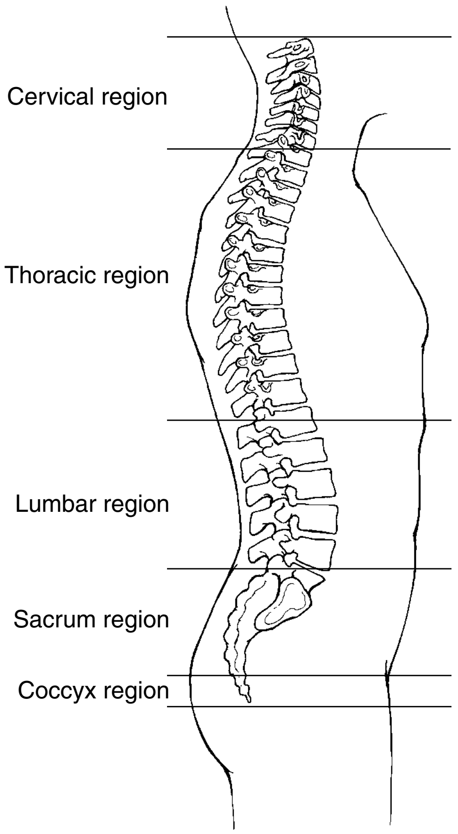

Figure 3-1. Lateral view of the spine showing the five regions and the four curves.

the spine is often hypermobile and unstable. However, an increase in the thoracic curve, which is often caused by bony changes such as osteoporosis, represents bony degeneration.

Pelvic rotation determines the amount of curve in the spine (Fig. 3-2). Anterior rotation of the pelvis creates an increase in the lumbar curve, and all other curves are increased to keep the body in gravitational balance. Posterior rotation of the pelvis creates a flattening of the lumbar curve and a decrease of the thoracic and cervical curves. As is discussed in this chapter, many muscular factors contribute to the amount of pelvic rotation.

Posture

Posture is determined by many factors, including genetics, structural abnormalities caused by disease, habits of work and play, mimicking parents and peers, compensations resulting from injury, emotional and psychological factors, and gravity.[5]

General Anatomy of the Vertebrae

Each vertebra consists of an anterior and a posterior portion (Fig. 3-3).

- The anterior portion is composed of the **vertebral body** and **intervertebral disc,** which forms a **fibrocartilaginous** or **amphiarthrodial joint.**
- The posterior portion is composed of two vertebral arches formed by a pedicle and lamina; two transverse processes; a central spinous process; and paired articulations, the **inferior** and **superior facets,** which form **synovial joints.**

There are five vertebrae in the lumbar spine, and each vertebra forms three joints with the vertebra above and three joints with the vertebra below (or the sacrum). This three-joint complex includes an intervertebral disc and two facet joints. The intervertebral foramen is an opening between two vertebrae through

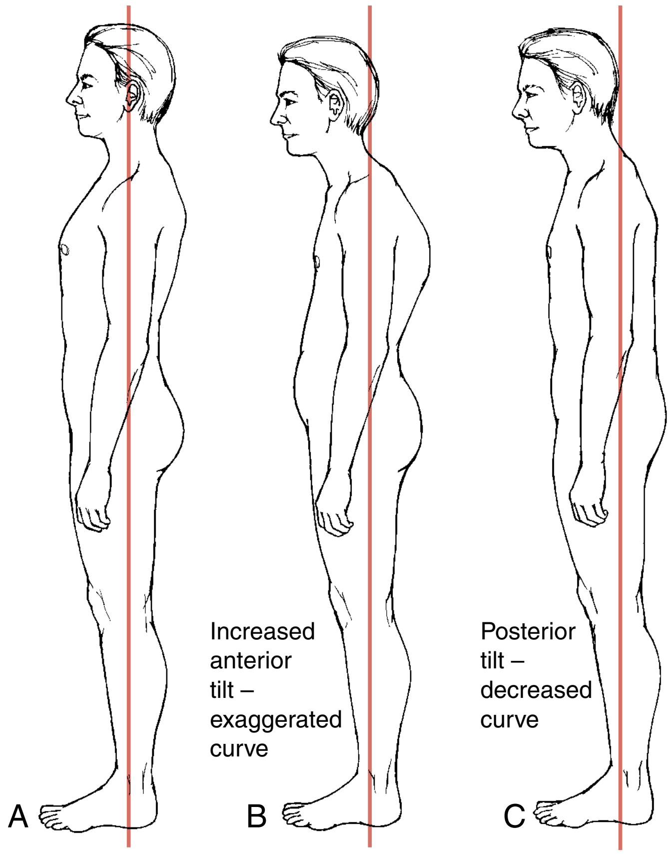

Figure 3-2. A. Normal spinal curves. B. Increased anterior pelvic tilt and exaggerated curve. C. Decreased curve due to a posterior pelvic tilt.

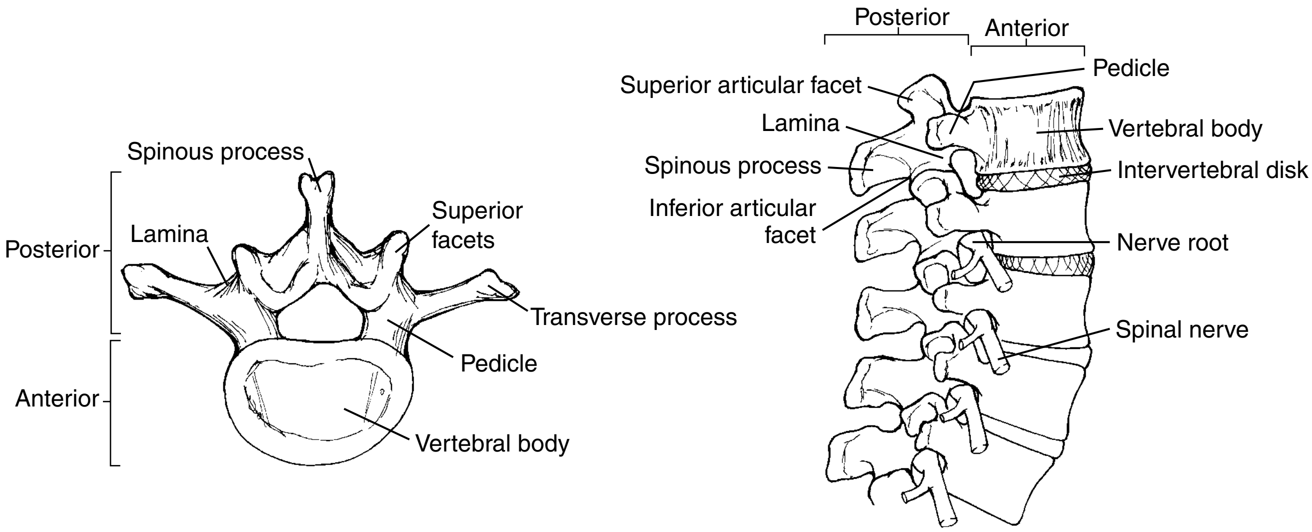

Figure 3-3. Vertebral anatomy. The anterior portion of the vertebrae consists of the vertebral body and the intervertebral disc. The posterior portion consists of a pedicle and lamina, two transverse processes, a central spinous process, and the inferior and superior facets.

which the ventral and dorsal nerve roots travel along the spine.

Intervertebral Disc

- *Definition:* The **intervertebral disc (IVD)** is a fibrocartilage structure that binds two vertebral bodies together.
- *Structure:* The IVD is composed of a nucleus and an annulus.
  - **Nucleus:** The nucleus is a colloidal gel contained within a fibrous wall that is 80 to 90% water, which changes its shape, and releases and absorbs water. The nucleus obtains its nutrition by movement, and this water-binding capacity decreases with age.
  - **Annulus:** Concentric layers of interwoven fibrocartilaginous fibers form the annulus. In the young, the fibroelastic tissue is primarily elastic but becomes more fibrous with age, and therefore loses some shock-absorbing ability. The outer third of the annulus is innervated by mechanoreceptors and free nerve endings (pain receptors) that have automatic, unconscious (i.e., reflexive) communication with the surrounding muscles.[1]
- *Function:* Provides a shock-absorbing hydraulic system that permits a rocker-like movement of one vertebra upon the other because of a fluid shift in the nucleus and an elasticity of the annulus. The disc also provides proprioceptive and nociceptive functions. Disc nutrition into the annulus occurs by movement of the spine, which pumps fluids into the disc through compression and decompression.
- *Dysfunction and injury*: The IVD is prone to acute and chronic injuries and is a major source of LBP. It is susceptible to age-related degeneration that involves loss of fluid in the nucleus and loss of elasticity of the annulus.
  - Repetitive torsion forces (that is, repetitive bending and twisting) can cause: an internal derangement or tear of the annulus, also called a protrusion or bulge of the disc; or a prolapse, which is a leaking of disc material into the spinal canal.
  - When injured, the disc leaks inflammatory material that can be a source of LBP and referral of pain caused by irritation of the nerve root.
- *Treatment implications*: Orthopedic massage (OM) introduces a new method of treatment called *wave mobilization* that theoretically helps promote fluid exchange to the disc. Through rhythmic cycles of posterior to anterior (P–A) mobilization, the author postulates that this compression and decompression pumps the disc to help rehydrate a degenerated disc, and also helps disperse excess inflammatory fluids in an acute disc.

Facet Joint

- *Definition*: The **facet joint** is a diarthrodial or synovial joint, containing a synovial space surrounded by a connective tissue joint capsule, adipose tissue fat pads, and a fibromeniscus (See Fig. 3-3).

- *Structure*
  - **Articular surface:** The articular surface is covered by hyaline cartilage and, in the healthy state, is lubricated with synovial fluid.
  - **Joint capsule:** The joint capsule is composed of an inner synovial layer and an outer fibrous layer. It is reinforced anteriorly with the ligamentum flavum and posteriorly with the multifidus muscle. The joint capsule is one of the most richly innervated structures of the spine. It contains proprioceptive and nociceptive nerve fibers.
- *Function*: The facets determine the range and direction of movement and have some weight-bearing capacity. In the healthy state, they are designed to slide on each other. Extension closes the facets, and flexion opens them. Compression squeezes fluid out of the hyaline cartilage, and the cartilage is rehydrated as the fluid is reabsorbed with the release of the compression. Activities of daily life, such as walking, move the spine through these cycles of compression and decompression, thus promoting normal lubrication in the facets. Sitting, on the other hand, is only compressive, and dehydrates the facets.
- *Dysfunction and injury*
  - **Hypomobility:** Restricted motion at the lumbosacral facets implies a loss of the normal gliding motion on the cartilage surfaces. This is called a joint fixation. Restricted motion of the facet results in a reflex that typically creates hypertonicity of the muscles at the same vertebral level.
  - **Degeneration:** A sustained contraction of the paraspinal muscles (muscles on either side of the spine) increases the compression to the facets and accelerates their degeneration.
  - **Acute Facet Syndrome:** The cause of "locked back" is not well understood. One chiropractic theory proposes a fixation or microadhesion of the facet surfaces, and that manipulation introduces normal movement by releasing the fixation. There are other current theories that suggest that the cause is an entrapment of the fibromenisci between the facets.
  - **Joint Capsule Injury:** Because the capsule is highly innervated, sprains are painful, potentially giving local and referred pain into the leg. Injury also affects the mechanoreceptors, resulting in altered movement patterns, dysfunctions of coordination and balance, and altered reflexes to the muscles, creating either weakness or hypertonicity.
- *Treatment implications:* One of the intentions of OM is to induce P–A mobilization into the facets in rhythmic oscillations of compression and decompression. This stimulates the synovial lining of the capsule to increase lubrication and to rehydrate the facets. If the facets are swollen, the author theorizes that this same mobilization helps disperse excess fluids. Patients who have chronic LBP must have balance and coordination exercises as part of their rehabilitation to reeducate the proprioceptors. OM is especially effective with hypomobility and degeneration, whereas an acute facet syndrome often requires manipulation to correct the fixation. With a joint capsule injury, OM helps promote a healthy repair through mobilization and massage, thus reducing adhesions in the joint capsule.

Intervertebral Foramen

- *Definition:* The **intervertebral foramen (IVF)** is an opening (foramen) formed by:
  1. Two pedicles from the superior and the inferior vertebrae that form the roof and floor;
  2. The disc, posterior longitudinal ligament and vertebral body anteriorly;
  3. The facets, anterior capsule and ligamentum flavum posteriorly.
- *Function:* Provides an opening for the motor and sensory nerve roots that originate at the spinal cord.
- *Dysfunction:* Narrowing of the IVF can cause compression of the nerve roots creating pain, numbing, tingling, and weakness in the legs. The diameter of the IVF is narrowed by many factors: disc degeneration, disc protrusion, thickening and fibrosis of the ligamentum flavum and joint capsule, facet position, facet degeneration and calcification, and increased lordosis of the lumbar spine. If the narrowing is significant, it is called foraminal encroachment.

Nerves of the Lumbosacral Spine

Ventral (motor) and **dorsal (sensory)** nerve roots originate from the spinal cord and merge at the IVF. The union of these two roots is called a **spinal nerve.**

Dorsal Root Ganglion

The **dorsal root ganglion** (DRG) is a cluster of cell bodies of the sensory root and typically lies in the IVF near the disc. The DRG has been postulated to be a major site of pain, called radicular (which means root) pain.[5]

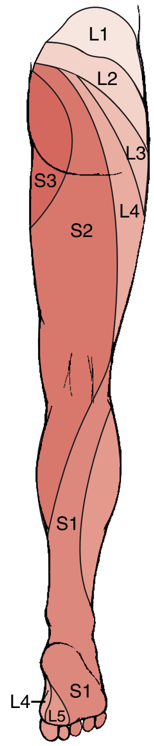

Figure 3-4. Dermatomes of the posterior lower limb.

It is also mechanically sensitive, so altered movement patterns may initiate reflex activity that results in sustained muscle contraction.

A **dermatome** is an area of skin supplied by the sensory (dorsal) root of a spinal nerve. Irritation of the DRG elicits a sharp pain in the dermatome corresponding to the root (Figs. 3-4 and 3-5).

Ventral Roots

- A **myotome** consists of the muscles that are supplied by the motor root(s) of the spinal nerve(s). Irritation of the motor (ventral) root elicits muscle weakness and potential atrophy.
- The corresponding myotomes of the lumbar nerve roots are L2-hip flexion (iliopsoas); L3-knee extension (quadriceps); L4-ankle dorsiflexion (anterior tibialis); L5-great toe extension (extensor hallucis longus); S1-foot eversion (peroneals); and S2-knee flexion (hamstrings). If weakness is detected in these muscles, one source of the weakness might be nerve root irritation. However, it takes a great deal of clinical experience to determine that the nerve root is the source of the weakness.
- Assessment of a nerve root involvement involves the straight–leg-raising (SLR) test to determine abnormal root tension (see p. 103, Assessment). The most common cause of increased root tension is a swollen or bulging disc.

Lumbar Plexus

Branches of nerves that communicate with other branches of nerves form a nerve plexus.

The **lumbar plexus** consists of nerves from L1–L4 and travels through the psoas muscle (Fig. 3-6). It innervates the anterior, medial, and lateral thigh, leg, and foot. It includes the femoral, lateral femoral cutaneous, obturator, and genitofemoral nerves.

Sacral Plexus

The **sacral plexus** consists of nerves from L4–L5 and S1–S3. It forms the sciatic nerve, which is actually two nerves within the same sheath, the common peroneal and tibial nerves. These nerves supply the posterior thigh, leg, and foot, as well as the anterior and lateral leg and the dorsum of the foot (See Figs. 3-6 and 3-8).

Sacroiliac Joint

- ***Definition:*** The **sacroiliac joint (SIJ)** is a synovial joint consisting of the articulation of the sacrum with the right and left iliac or innominate bones.

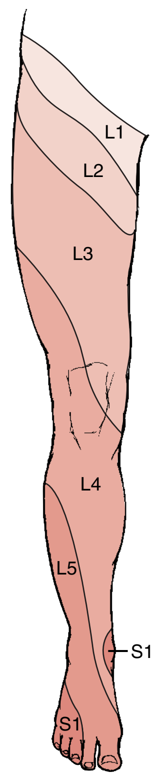

Figure 3-5. Dermatomes of the anterior lower limb.

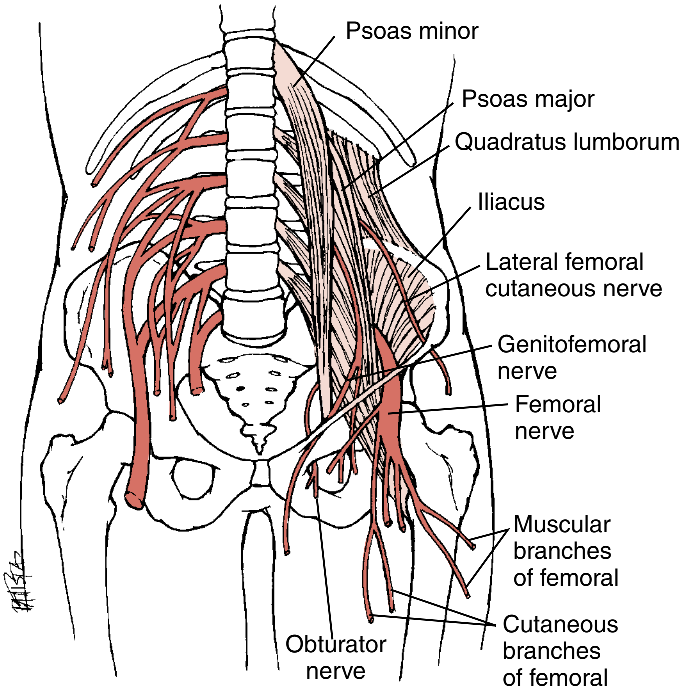

Figure 3-6. Muscles and nerves of the anterior pelvis. The lumbosacral plexus consists of nerves from L1–L4 and travels through the psoas muscles. It divides into many branches, including the femoral, lateral femoral cutaneous, obturator, and genitofemoral nerves.

- ***Structure:*** As in all synovial joints, its joint capsule is a pain-sensitive structure. The articular surfaces are different from any other joint in the body in that the hyaline articular cartilage of the sacrum faces the fibrocartilage surface of the ilium. The joint has a corrugated design, with ridges and depressions; that is, it is a self-locking mechanism, like a keystone of an arch.
- ***Function:*** The main movements of the SIJ are a forward tilting of the sacrum called nutation and a backward tilting called counternutation. The main movement of the innominates is rotation anteriorly and posteriorly. The symphysis pubis has a superior and an inferior translatory movement. Stability comes from the close-fitting joint surfaces, the muscles, the ligaments, and the fascia that cross the joint.
- ***Dysfunction:***
  - Subluxation or fixation of the SIJ, in which the undulating ridges and depressions are no longer complimentary, and/or the normal movement of the SIJ is decreased (fixation) is a common dysfunction. There may be a loss of normal motion characteristics because of ligamentous shortening, irritation of the articular surfaces of the SIJ caused by ligamentous laxity, muscular hypertonicity causing a loss of normal movement characteristics at the SIJ, and articular dysfunction.
  - Pain from SIJ dysfunction or injury can be sharp, dull, or aching, and typically is in the buttock area, groin, posterior thigh, and, occasionally, below the knee.
- ***Treatment implications:*** Because the SIJ is stabilized with the muscles that attach to the pelvis and sacrum, assessment should consider the length, strength, and movement patterns of the major muscles of the SIJ. Since the SIJ is a synovial joint with lubricated surfaces with some movement, part of our intention is to mobilize the SIJ in posterior-anterior (P–A) glide to help restore motion and rehydrate the cartilage surfaces.

Lumbosacral Spine Ligaments

In addition to the dynamic stability provided by the musculature, a "continuous ligamentous stocking" wraps around the bones and interweaves with the muscles, providing essential passive stability to the lumbopelvic region.[6]

- **Anterior longitudinal ligament**: The anterior longitudinal ligament (ALL) is a dense band that runs along the anterior and lateral surfaces of the vertebral bodies and discs from the second cervical vertebra to the sacrum. The ALL serves as an attachment for the crura of the diaphragm and resists extension.
- **Posterior longitudinal ligament**: The posterior longitudinal ligament (PLL) runs within the vertebral canal along the posterior surfaces of the vertebral bodies from the second cervical vertebra to the sacrum. The PLL resists flexion.
- **Neural arch ligaments:** The ligamentum flavum, interspinous ligament, supraspinous ligament, and intertransverse ligament compose the neural arch ligaments. The interspinous ligament is continuous with the ligamentum flavum, which is a continuation of the joint capsule, which is continuous with the supraspinous ligament, which is attached to the thoracolumbar fascia (TLF).
- **Sacrotuberous ligament**: The sacrotuberous ligament is a triangular structure that extends from the posterior iliac spine, the SIJ capsule, the coccygeal vertebrae, and the ischial tuberosity. The biceps femoris, multifidus, and TLF all interweave with this ligament.

- **Sacrospinous ligament**: The sacrospinous ligament arises from the lateral margin of the sacral and coccygeal vertebrae and the inferior aspect of the SIJ capsule and attaches to the ischial spine.
- **Short and long dorsal (posterior) sacroiliac ligaments:** These sacroiliac ligaments are a complex array of multilevel, multidirectional ligaments. The long dorsal SIJ ligament travels under the sacrotuberous ligament, from the posterior superior iliac spine (PSIS) to the lateral sacral crest. This ligament resists counternutation.
- **Iliolumbar ligament**: The iliolumbar ligament arises from the transverse processes of L4–L5 and attaches to the iliac crest and adjacent region of the iliac tuberosity.
- **Inguinal ligament**: The inguinal ligament is formed by the inferior margin of the aponeurosis of the external abdominal oblique. It arises at the anterior superior iliac spine (ASIS) and inserts into the pubic tubercle.

- ***Function:***
  - The ligaments of the lumbopelvic region provide passive stability to spine and pelvis. These ligaments and fascia serve as attachment sites to the major prime movers and to stabilizing muscles of the spine.
  - The ligaments and joint capsules have a neurosensory role. They have nociceptors and proprioceptors and play an important role in initiating reflex activity in the musculature.[2]
- ***Dysfunction:***
  - Ligament injury decreases mechanoreceptor and proprioceptive functions, leading to reflexive muscle hypertonicity or weakness, altered movement patterns, altered coordination and balance, and instability.[7]
  - Ligament injury can also lead either to laxity and consequent joint instability or to shortening and thickening of the ligaments that lead to stiffness in the joint. Both outcomes alter joint mechanics and neurologic function.
- ***Treatment implications:*** Treatment of injured ligaments consists of four primary intentions:
  1. Rehydrate the tissue. This occurs through cycles of compression and decompression while performing the massage strokes.
  2. Reestablish normal neurologic communication between the muscle and the ligament with muscle energy technique (MET).
  3. Release adhesions with transverse massage and MET. As the fascia of the myotendon unit is attached to the ligaments, muscle contraction mobilizes the ligaments, helping to reduce adhesions.
  4. Exercise the ligament. If the ligaments have become weakened, exercise rehabilitation is the most effective therapy. In addition to strength training, balance and coordination exercises are essential.

Thoracolumbar Fascia

- ***Definition***: The **TLF** is a sheet of dense connective tissue that covers the muscles of the back of the trunk.
- ***Structure***: The TLF is divided into posterior, middle, and anterior layers.
  - The posterior layer is located under the skin and subcutaneous fat and begins as a continuation of the aponeurosis of the latissimus dorsi. It is thick and fibrous and is attached to the lumbar spinous processes and the supraspinous ligament and surrounds the erector spinae and multifidus.
  - The middle layer attaches to the transverse processes and intertransverse ligaments of the lumbar vertebrae.
  - The anterior layer surrounds the quadratus lumborum and attaches laterally to the transverse abdominus and the internal oblique. The TLF continues to the sacrum and ilium and blends with the fascia of the gluteus maximus (G. max.).
- ***Function***: The TLF plays an important role in lumbopelvic function because it can be dynamically engaged through the muscles that attach to it. The latissimus dorsi, G. max., transverse abdominus, and internal oblique tighten the TLF and stabilize the lumbopelvic spine when they contract.
- ***Dysfunction***: The fascia typically palpates as thickened and lacks resilience in the client who has chronic LBP. Theoretically, this thickening and lack of resilience is caused by the laying down of excessive collagen resulting from sustained hypertonicity in the latissimus dorsi and the pushing force on the fascia resulting from broadening of the erector spinae muscles when they contract. The TLF forms a container or septa for the muscles contained within it, and these muscles are designed to slide relative to their container. Fibrosis constricts these normal gliding characteristics.
- ***Treatment implications***: Because the fascia often is thickened from sustained muscle contraction, MET and OM are used to reduce the hypertonicity in the muscles contained within the fascia, to lengthen the fascia, and to dissolve the adhesions between the muscles and the fascia.

Muscles of the Lumbopelvic Region

- ***Function:*** Muscles are not only the engines of voluntary and involuntary movement in the body, but they provide a dynamic stabilizing force to the joints. Muscles also unconsciously (reflexively) communicate with all of the other structures of the body, including the skin, nervous system, and connective tissue, including the ligaments and joint capsules. They express our emotions and reflect our comfort or distress. It is important to remember that muscles of the hip region, including the iliopsoas, gluteals, quadratus lumborum (QL), tensor fascia lata, rectus femoris, and hamstrings, as well as the abdominals, all have a profound influence on lumbopelvic function.
- ***Dysfunction:*** Muscle contraction is often a primary source of lumbopelvic dysfunction and pain.[8] In LBP or dysfunction, it is typical for the erector spinae to be held in a sustained contraction. The hypertonicity limits the movement in the joints, creating a fixation of the facets. This stimulates the joint mechanoreceptors, which have neurologic reflexes to the surrounding muscles. Some muscles increase their tension, and others become inhibited, such as the multifidus.

Jull and Janda[9] have discovered predictable patterns of muscle imbalance. These imbalances alter movement patterns and therefore add a continuing stress to the joint system. Hypertonicity is also a major source of pain itself. It is critical to understand these muscle imbalances because they may be a dominant factor in the cause of musculoskeletal pain and a major factor in the continuance of the pain. In the lumbopelvic region Jull and Janda[9] call this muscle imbalance **lower (pelvic) crossed syndrome,** because the tight iliopsoas and erector spinae and the weak abdominals and G. max. form a cross (Fig. 3-7).

Muscle Imbalances of the Lumbosacral Region or Lower (Pelvic) Crossed Syndrome

- **Muscles that tend to be tight and short:** The iliopsoas, the lumbar portion of erector spinae, the piriformis, the rectus femoris, the tensor fascia lata, the QL, the adductors, and the hamstrings are examples of tight, short muscles. (Although the lumbar erectors are usually tight and short, they often test weak. A muscle is weak in its shortened position, and sustained contraction weakens a muscle.)
- **Muscles that tend to be inhibited and weak:** The G. max., medius, and minimus and the abdominals are examples of inhibited, weak muscles.

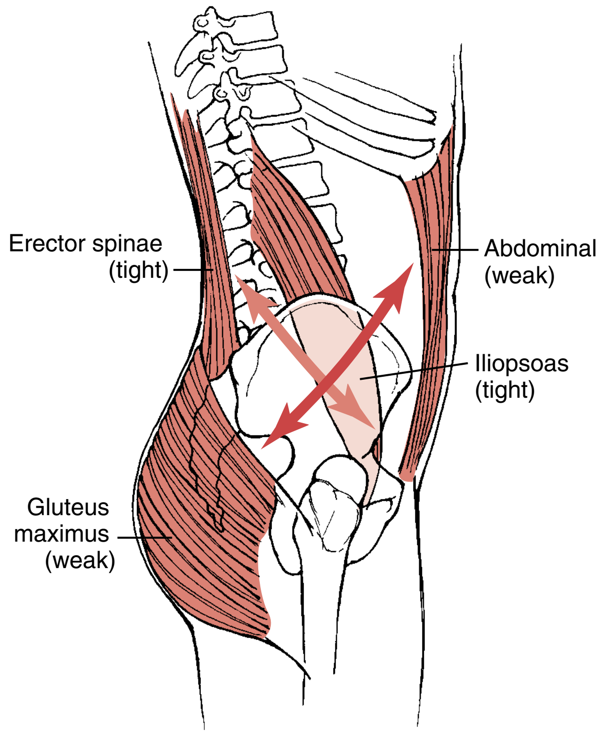

Figure 3-7. Pelvic crossed syndrome.

Postural Signs of the Lower Crossed Syndrome

- Lumbar hyperlordosis caused by short erector spinae.
- Anterior pelvic tilt and protruding abdomen caused by weak G. max., weak abdominals, and tight iliopsoas.
- Hypertonic muscles at thoracolumbar junction resulting from compensation for a hypermobile lumbosacral junction.
- Foot turned outward because of a tight piriformis.

Positional Dysfunction of the Lubopelvic Muscles

- The erector spinae roll into a medial torsion (i.e., toward the midline).
- The iliopsoas rolls into a medial torsion. One cause of this is the effect of a pronated foot, which shortens the leg and pulls the femur into an internal rotation and the pelvis forward, creating an internal or medial torsion to the iliopsoas.
- Gluteals and external rotators of the hip tend to roll into an inferior torsion.

- ***Treatment implications***
  - Clinically, it is more effective to release the hypertonicity in a muscle and to lengthen a short muscle and its connective tissue before trying to strengthen a weak or inhibited muscle. As described by Sherrington's law of reciprocal inhibition (RI), a tight agonist inhibits its antagonist. For

example, a tight iliopsoas inhibits the G. max. Sometimes the muscle is weak because of this neurologic inhibition, and strength can be reestablished within a few contract-relax (CR) METs. If the muscle does not respond after a few sessions, then refer to a chiropractic or an osteopathic doctor for assessment of joint fixation, which is the next most likely cause of muscle weakness. A muscle may also be atrophied, in which case the client would be referred to a physical therapist.
- Use MET to help your client reestablish normal movement patterns through precise, controlled muscle contractions. If a muscle is weak, then other muscles will substitute for that muscle's action. For example, in hip abduction, if the G. medius is weak, the tensor fascia lata (TFL) will substitute. This creates an internal rotation of the hip with abduction, a dysfunctional pattern.
- Reestablish the normal position of the muscles by releasing their abnormal torsion.

Relation of Muscles to Lumbopelvic Balance
See Table 3-1.

Anatomy of the Muscles of the Lumbopelvic Region: The Seven Layers of the Back

The back muscles can be divided into seven layers (Fig. 3-8). See Table 3-2.

Muscular Actions of the Trunk

The trunk is capable of seven different movements: flexion, extension, lateral flexion to the right and left, rotation to the right and left, and circumduction. Flexion opens the lumbar facets, and extension is the close-packed position of the spine as it closes the facets.

The extent of motion in the nonacute spine is determined by many factors, including the tightness of the muscles, the extensibility of the ligaments, the elasticity of the articular capsule, the fluidity, and the elasticity of the disc. If a client is experiencing pain, the muscular guarding and swelling also limit movement.

- Flexion
  - Rectus abdominus: compresses the abdomen.
  - External abdominal oblique: causes lateral flexion to same side and rotation to the opposite side.
  - Internal abdominal oblique: causes lateral flexion and rotation to the same side.
  - Psoas major: flexes and rotates the hip laterally.
- Extension

Extension occurs mostly in the lumbar region of the spine.
  - Erector spinae (sacrospinalis), including the iliocostalis, longissimus, and spinalis: extend, rotate, and laterally flex the trunk on the side of the trunk to which they are attached.
  - Semispinalis thoracis: acts bilaterally to extend the trunk or acts unilaterally, laterally flexing the trunk and rotating it to the opposite side.
  - Multifidus: acts bilaterally to extend the trunk and neck or acts unilaterally, laterally flexing and rotating the trunk and the neck to the opposite side.
  - QL: causes lateral flexion.

Text continued on page 85.

TABLE 3-1 RELATION OF MUSCLES TO LUMBOPELVIC BALANCE

- Muscles that increase the lumbar curve and create an anterior pelvic tilt
  - Tight/short iliopsoas
  - Tight/short sartorius, rectus femoris, and TFL
  - Tight/short adductors—pectineus, adductor brevis, longus, magnus (anterior part), gracilis
  - Tight/short thoracic fibers of longissimus (bowstring effect)
  - Weak abdominals, weak or inhibited gluteals, especially gluteus maximus
- Muscles that decrease the lumbar curve
  - Tight/short gluteus maximus and posterior portion of the adductor magnus
  - Tight/short hamstrings
  - Tight/short abdominals
  - Weak paraspinal muscles
- Muscles that cause a lateral pelvic tilt (pelvic obliquity)
  - A lateral pelvic tilt typically is caused by tight adductors and weak/inhibited hip abductors, a tight quadratus lumborum (QL), tight tensor fascia lata (TFL) and tight iliotibial band (ITB)
  - Adductor hypertonicity can cause a high ilium on the side of contracture, an apparent short leg, and an abduction of the opposite hip
  - Abductor hypertonicity can cause a low ilium on the side of contracture, an apparent long leg, and adduction of the opposite hip
  - A tight TFL and ITB tilt the pelvis down on that side
  - Gluteus medius weakness causes the pelvis to be high on the corresponding side
  - Quadratus lumborum and lateral abdominal contracture elevates the ilium on the high side

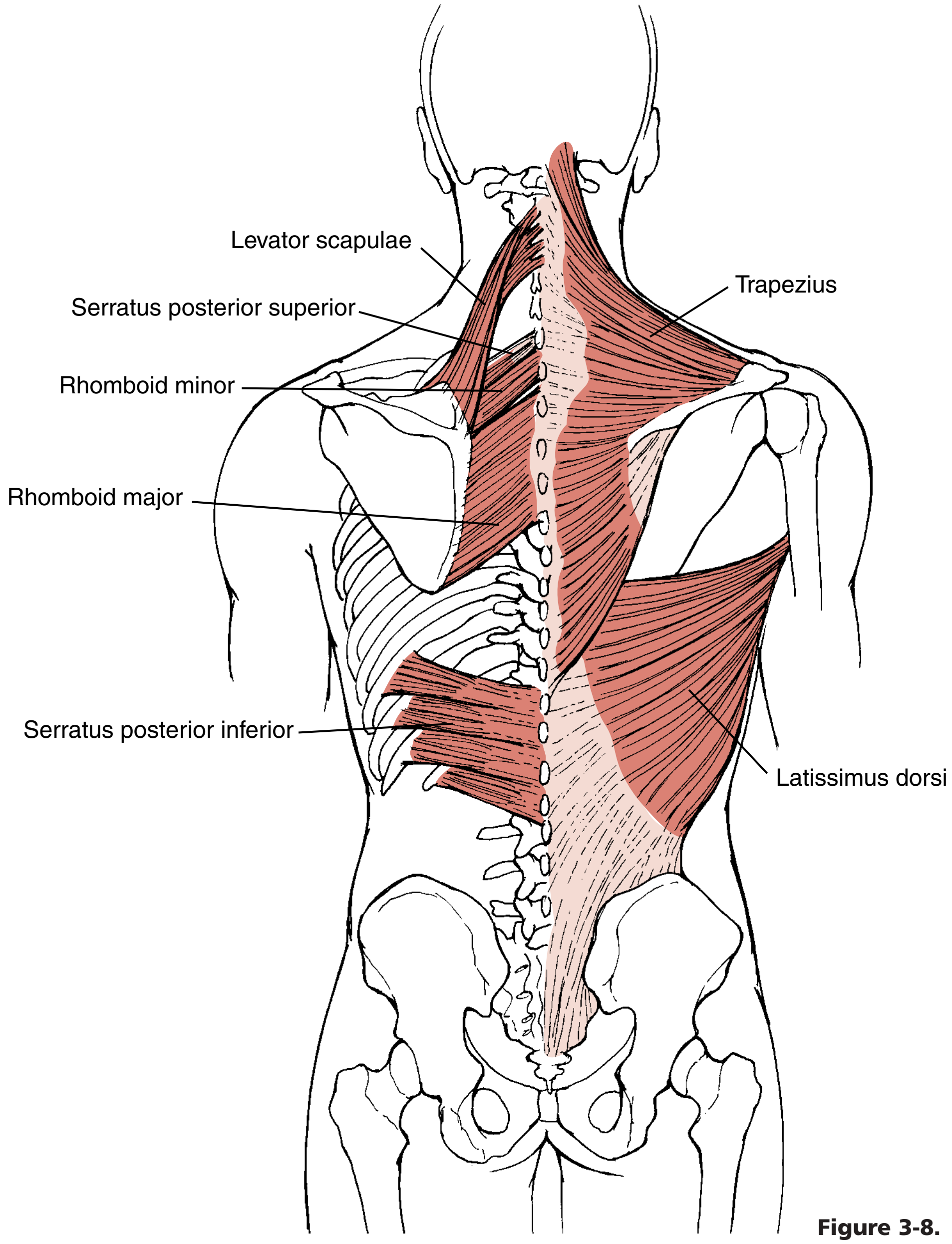

Figure 3-8. Superficial layer of back muscles.

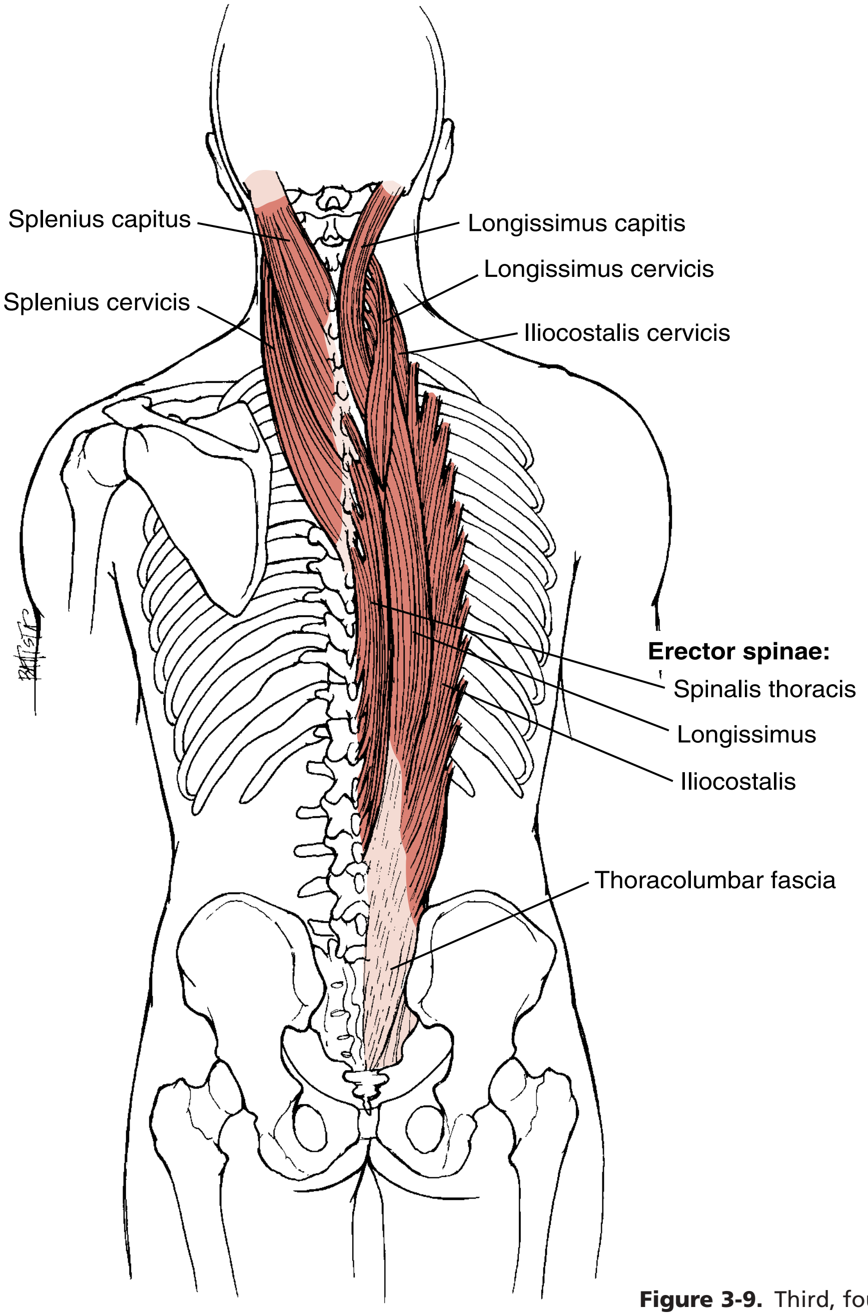

Figure 3-9. Third, fourth, and fifth layers of back muscles.

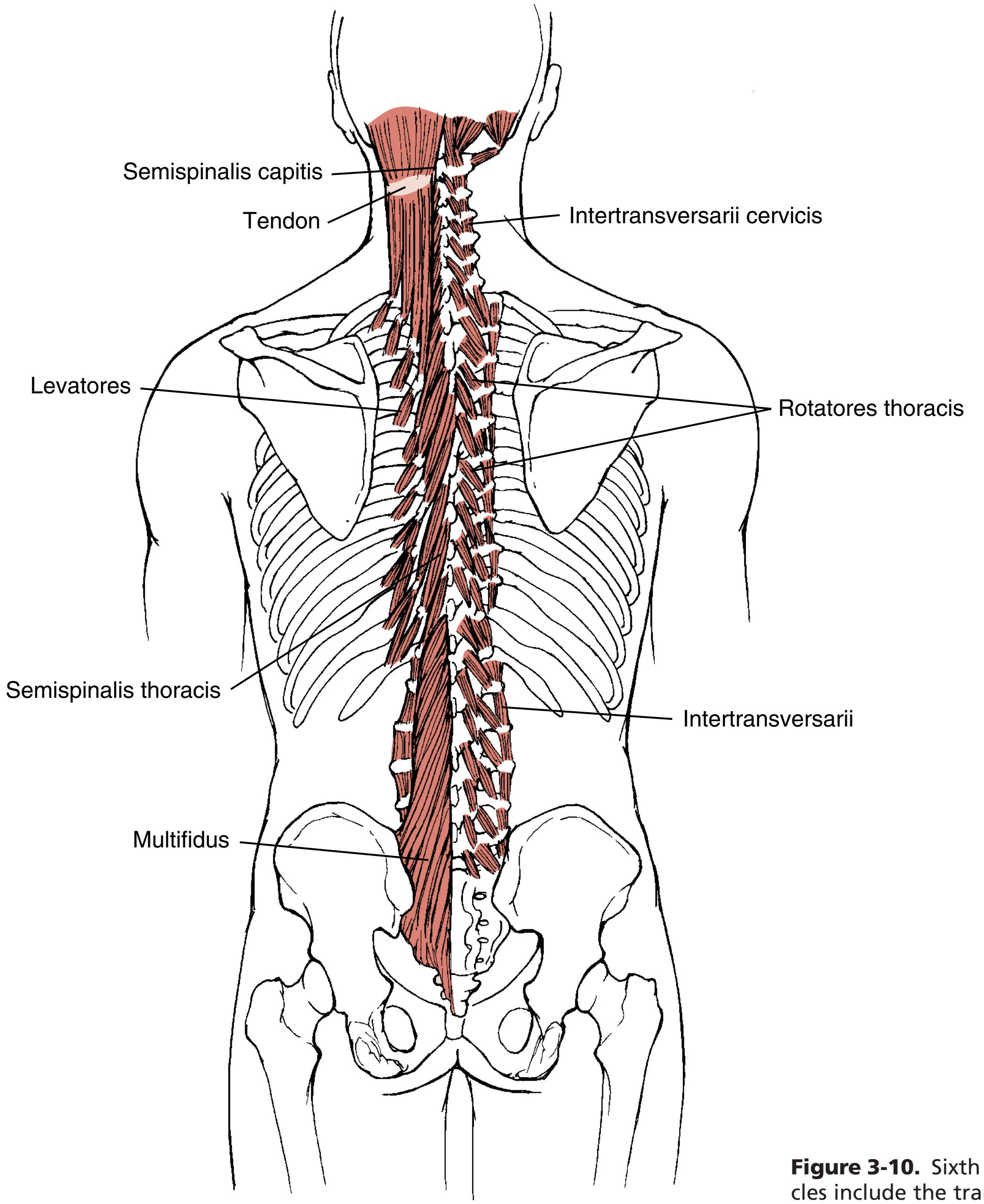

Figure 3-10. Sixth and seventh layers of back muscles include the transversospinalis group.

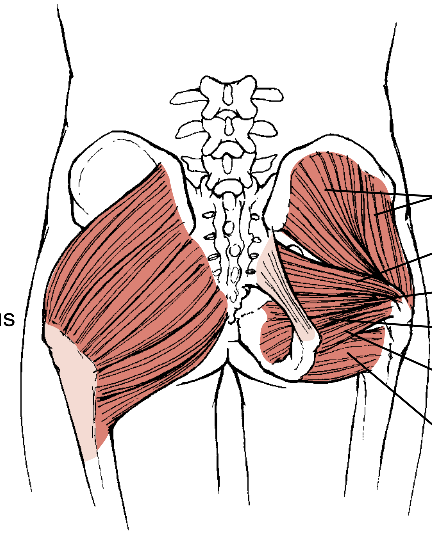

Figure 3-11. Gluteal muscles and deep rotators of the hip.

- Lateral Flexion

  Practically all trunk flexor and extensor muscles contribute to lateral flexion.

  - External and internal abdominal oblique
  - QL
- Rotation
  - External and internal abdominal oblique
  - Erector spinae
  - Semispinalis thoracis
  - Multifidus
  - Rotatores
- Circumduction

  Circumduction results from a sequential combination of flexion, lateral flexion, hyperextension, and lateral flexion to the opposite side.

Dysfunction and Injury of the Lower Back

PATHOGENESIS OF LOW BACK PAIN

The cause of LBP is controversial. A rational hypothesis, described by Kirkaldy-Willis and Bernard,[8] is outlined below.

- Three major factors predispose a client to an episode of LBP:
  1. Emotional upset, such as tension, stress, anxiety, fear, resentment, uncertainty, and depression. Emotional upset causes local areas of vasoconstriction and sustained muscle contraction that leads to muscle fatigue. These changes result in altered patterns of muscle contraction and movement.
  2. Abnormal function of the muscles of the lumbopelvic girdle creates abnormal movement patterns and excessive stresses on the facets and disc. The result of these changes is that movement becomes restricted and painful. These painful restrictions of movement lead to fibrosis around the joint.
  3. Facet joint hypomobility (fixation). As mentioned, this loss of the normal gliding characteristics has reflexive changes in the surrounding muscles, setting up a continuing cycle of muscle dysfunction and further joint dysfunction.
- Muscle dysfunction occurs in a predictable pattern in LBP. In the lower back, the paraspinal muscles tend to be tight. Sustained muscle contraction decreases the blood supply to the muscles, which leads to an accumulation of waste products, and eventual muscle fatigue.
- The multifidus is especially important in LBP. Its fibers interweave with the joint capsule. Sustained contraction adds a compressive load to the joint, and weakness decreases the stability of the lower back; both of these conditions accelerate the degeneration process.
- The client then reports a minor incident, such as gardening, or reaching for a light object, and experiences an episode of acute LBP either at the time, or within a day or two. There are two

Text continued on page 96.

TABLE 3-2 ANATOMY OF THE MUSCLES OF THE LUMBOPELVIC REGION

First Layer

Muscle	*Origin*	*Insertion*
Trapezius	External occipital protuberance, spinous processes of C7 and all thoracic vertebrae	Spine and acromion processes of scapula and lateral third of clavicle
Latissimus dorsi	Spinous processes of lower six thoracic vertebrae, spinous processes of all lumbar and sacral vertebrae, crest of ilium, and lower three ribs	Crest of the lesser tubercle of humerus

Second Layer

Muscle	*Origin*	*Insertion*
Rhomboid minor	Spine of C7 and T1	Vertebral border of scapula, superior to spine of scapula
Rhomboid major	Spines of T2–T5	Vertebral border of scapula below the spine of the scapula
Levator scapula	Posterior tubercles of the transverse processes of C1–C4. Significant attachment site as four major muscles blend into each other at this point: splenius cervicis, posterior scalene, longissimus capitis, and levator scapula	Superior angle of scapula and to the base of the spine of the scapula

Third Layer *(Fig. 3-9)*

Muscle	*Origin*	*Insertion*
Serratus posterior superior	Spinous processes of C7, T1 and T2	Second–fifth ribs
Serratus posterior inferior	Spinous processes of T11 and T12 and L1 and L2	Lower four ribs: T9–T12

Fourth Layer *(See Fig. 3-9.)*

Muscle	*Origin*	*Insertion*
Splenius capitis	A large, flat muscle from the spinous processes of C3–C7 and T1–T3	Lateral third of superior nuchal line and the mastoid process of the mastoid bone
Splenius cervicis	A large, flat muscle from the spinous processes of T4–T6	Posterior tubercles of transverse processes of upper three cervical vertebrae (C1–C3)

Action	Dysfunction
The upper fibers elevate the scapula, the lower fibers depress it, and the middle fibers retract the scapula. The trapezius is primarily a muscle of the shoulder girdle. For the scapula to be elevated, the anterior head and neck must be stabilized by way of the anchor of the longus capitis and longus colli on the front of the neck.	The upper fibers are tight and short, whereas the lower fibers are weak and long, allowing the scapula to migrate headward, decreasing its stability for movement of the arm.
Extends and adducts the humerus and rotates it medially, draws the arm and shoulder downward and backward, interweaves with the thoracolumbar fascia, and has a stabilizing effect on the lumbosacral spine by tensing the fascia.	Is tight and long (i.e., eccentrically loaded), especially with a rounded-shoulders posture.

Action	Dysfunction
Both major and minor: draws the scapula upward and medially, holds the scapula to the trunk along with the serratus anterior muscle, and retracts the scapula along with the fibers of the middle trapezius.	Rhomboids are weak, which contributes to a rounded-shoulder posture.
Pulls the scapula upward and medially (along with the trapezius); if the scapula is fixed, pulls the neck laterally; acts similar to the deep fibers of the erector spinae (see below) to prevent forward shear caused by cervical lordosis. Levator eccentrically contracts in the head-forward posture.	

Action	Dysfunction
Elevates second to fifth ribs.	
Draws lower four ribs downward and backward.	

Action	Dysfunction
Muscles of both sides acting together extend the head and neck; one side acting alone rotates the head to the same side.	
Muscles of both sides acting together extend the head and neck; muscle of one side rotates the neck and the head to the same side.	

TABLE 3-2 **ANATOMY OF THE MUSCLES OF THE LUMBOPELVIC REGION—cont'd**

Fifth Layer: Erector Spinae *(Fig. 3-9)*

Bogduk and Twomey[10] describes a deep and superficial layer to the iliocostalis and longissimus muscles.

Iliocostalis (Lateral Column): Ilium to Ribs

Muscle	***Origin***	***Insertion***
Lumbar fibers of iliocostalis (deep layer of iliocostalis)	Lumbar component consists of four to five overlying fascicles; attaches on iliac crest just lateral to the PSIS	Lateral aspect of the lumbar transverse process (t.p.) L1–L4
Thoracic fibers of iliocostalis (superficial layer of iliocostalis)	By a tendinous sheet of fascia referred to as the erector spinae aponeurosis to the PSIS, the dorsal surface of sacrum, the posterior sacroiliac ligament, and the sacrospinous ligament	Angle of the rib T12–T4
Iliocostalis cervicis	Angles of the ribs 3–6	Posterior tubercles of the transverse processes of C4–C6

Longissimus (Intermediate Column): Sacrum to Transverse Process

Muscle	***Origin***	***Insertion***
Lumbar fibers of longissimus (deep layer)	Composed of five fascicles, each attaching to the anterior-medial aspect of the PSIS, L5 fascicle is most medial	Transverse processes of all lumbar vertebrae
Thoracic component of longissimus (superficial layer)	Attaches to a broad tendinous sheet called the erector spinae aponeurosis, which attaches to the entire length of the medial sacral crest and the lateral sacral crest where it blends with the sacrotuberus and dorsal sacroiliac ligaments	Divided into two parts: the medial insertions reach the tips of the t.p.s of all thoracic vertebrae T1–T12, and the lateral insertions reach the ribs at the inferior margin, between the tubercle and the inferior angle
Longissimus cervicis	Lies under the splenius capitis, lateral to the semispinalis group and attaches to the t.p.s of upper four to six thoracic vertebrae (T1–T6)	Posterior tubercle of the transverse processes of C2–C6
Longissimus capitis	Transverse and articular processes of lower four cervical vertebrae	Posterior margin of mastoid process deep to the sternocleidomastoid (SCM) and splenius capitis

Spinalis (Central Column): Spinous Process to Spinous Process

Muscle	***Origin***	***Insertion***
Spinalis thoracis	Spines of T11 and T12 and L1 and L2	Spines of T1–T10
Spinalis cervicis (Not always present)	Spinous process of C7	Spinous process of C2
Spinalis capitis (Usually fused with semispinalis capitis)	C7 through T3 t.p.s	Attaches with the semispinalis capitis between the superior and the inferior nuchal lines of the occipital bone

Action	*Dysfunction*
Contracting unilaterally, acts as lateral flexors of the lumbar vertebrae. Acting bilaterally, extends the spine. The deep fibers help stabilize the lumbar vertebrae to the pelvis, and along with the psoas act as guy wires in the A–P plane. These fibers also decrease the lumbar curve, which is the opposite action as the psoas.	
As it does not attach to lumbar vertebrae, acting bilaterally can have bowstring effect, causing increased lumbar lordosis. Unilaterally, can laterally flex thoracic cage. They contract eccentrically when the trunk flexes forward. Through concentric contraction they extend the spine; isometrically, they control the position of the rib cage relative to the pelvis.[2]	
Acting bilaterally, extends the spine; unilaterally, causes lateral flexion.	

Action	*Dysfunction*
Same as lumbar fibers of iliocostalis described above.	
Same as thoracic fibers of iliocostalis described above.	
Acts as a significant stabilizer of the cervical spine along with the SCM and the posterior scalene. These muscles act as guy wires in three planes.[2] The longissimus capitis and cervicis also laterally flex and rotate the spine and head to the same side.	

Action	*Dysfunction*
Erector spinae muscles of both sides acting together extend the vertebral column and assist in maintaining erect posture; muscles on one side acting alone bend the vertebral column to the same side.	

TABLE 3-2 **ANATOMY OF THE MUSCLES OF THE LUMBOPELVIC REGION—cont'd**

Sixth Layer: Transversospinalis Muscles *(Fig. 3-10)*

The transversospinalis muscles consist of three groups that run from the t.p. to the spinous process.

Muscle	*Origin*	*Insertion*
Rotatores	Vertebra t.p.s	Base of spinous process of the first or second vertebra above
Multifidus	Largest and most medial of the lumbar back muscles; consists of a repeating series of fascicles, from the posterior sacrum, the aponeurosis of the erector spinae, the medial surface of the PSIS, and the posterior sacroiliac ligaments; fills the groove between the spinous process and the t.p. in the lumbar spine and forms the muscle mass over the sacrum, medial to the PSIS	Muscle runs superiorly and medially to attach to the spinous and mamillary process of L1 to L5; fibers also attach to capsule of lumbar facets and protect the capsule

Semispinalis group: Muscles run from transverse process to spinous process of the fourth to sixth vertebrae above.

Semispinalis capitis (largest muscle in the back of the neck)	C7 through T6 t.p.s and C4 through C7 articular processes	Covered by the trapezius and splenius capitis in the cervical region, it inserts between the superior and the inferior nuchal lines of the occipital bone
Semispinalis cervicis	T1 through T6 t.p.s	Spinous processes of C2 through C5
Semispinalis thoracis	Transverse of T6–T12	Spines of T1–T6

Seventh Layer

Muscle	*Origin*	*Insertion*
Interspinales	Spinous processes of vertebrae	Adjacent spinous processes
Intertransversarii	Vertebrae t.p.s	Adjacent transverse processes

Gluteal Region *(Fig. 3-11)*

Muscle	*Origin*	*Insertion*
Gluteus maximus	Arises from posterior line of ilium, posterior aspect of the sacrum, coccyx, and sacrotuberous ligament	Ends in a thick tendinous lamina, passes lateral to the greater trochanter, and attaches to the iliotibial tract of the fascia lata; deeper fibers of the lower part attach to the gluteal tuberosity of the femur between vastus lateralis and the adductor magnus

Action	Dysfunction
Stabilizes the lumbar spine; helps control flexion and the shear force in the lower lumbar spine in forward flexion. Counters the action of the psoas.[2] Rotatores and multifidus, when acting bilaterally, extend the vertebral column; when acting unilaterally, bend the vertebral column to the same side and rotate the vertebrae to the opposite side.	
Extension of the cervical spine and head; increases cervical lordosis.	
Has a significant attachment to the spinous process of C-2 and an important stabilizing effect of C-2. Palpation: The semispinalis cervicis and capitis palpate as a rounded muscle bundle lateral to the cervical spinous processes. The trapezius and splenius muscles are flat by comparison. Semispinalis group, when acting bilaterally, extends the vertebral column, especially the cervical vertebrae and head, and rotates the head backwards; when acting unilaterally, draws the head to the opposite side.	

Action	Dysfunction
It has been suggested that these muscles may contribute to proprioceptive input.[2]	

Action	Dysfunction
Extensor and powerful lateral rotator of thigh. Inferior fibers assist in adduction; upper fibers are abductors. Balances trunk on femur; balances knee joint by means of the ITB; and is associated with bringing the trunk upright.	Is weak; inhibited by sustained contraction on the hip flexors, especially the iliopsoas, causing overuse of the hamstrings. Since it is often weak, hip extension may be initiated by the hamstrings, causing a dysfunctional gait pattern.
Principal muscle of abduction. Anterior fibers medially rotate and may assist in flexion; posterior fibers laterally rotate and may assist in extension of hip.	

TABLE 3-2 ANATOMY OF THE MUSCLES OF THE LUMBOPELVIC REGION—cont'd

Gluteal Region—*cont'd*

Gluteus medius	Broad, thick muscle arises from the outer surface of the ilium, between the anterior and the posterior gluteal lines, and the external aspect of ilium	Converges to a strong, flat tendon that is attached to the superior aspect of the lateral surface of greater trochanter
Gluteus minimus	Deep to the gluteus medius, smallest of three gluteals. Fan-shaped origin arises from outer surface of ilium between ASIS and greater sciatic notch	Attached to a ridge in the lateral surface of the anterior-superior portion of the greater trochanter and the hip joint capsule

Deep Lateral Rotators of the Hip

Muscle	*Origin*	*Insertion*
Piriformis	Anterior surface of sacrum among and lateral to sacral foramina one to four; margin of greater sciatic foramen and pelvic surface of sacrotuberous ligament	Passes out of the pelvis through the greater sciatic foramen and attaches by a rounded tendon to the superior-posterior border of greater trochanter; often blended with common tendon of obturator internus and gemelli
Quadratus femoris	Proximal part of lateral border of tuberosity of ischium	Attaches to posterior femur, extending down the intertrochanteric crest
Obturator internus	Internal or pelvic surface of obturator membrane and margin of obturator foramen, the inferior ramus of pubis and ischium	Travels from its origin toward the lesser sciatic foramen, making a right-angled bend over the surface of the ischium between the spine and the tuberosity; blends with the two gemelli, forming the "triceps coxae," inserting on the medial superior surface of the posterior greater trochanter
Gemellus superior	External surface of spine of ischium	Attaches with obturator internus on the medial surface of greater trochanter
Gemellus inferior	Upper part of tuberosity of ischium, below groove for obturator internus	Attaches with obturator internus (as above)
Obturator externus	Flat, triangular muscle covering the external surface of the anterior pelvic wall, arising from bone around the obturator foramen	Trochanteric fossa of femur

Lateral Pelvic Region *(See Fig. 3-6.)*

Muscle	*Origin*	*Insertion*
Quadratus lumborum (QL)	Internal lip of iliac crest and the iliolumbar ligament	Anterior surfaces of L1–L4 t.p.s and twelfth rib

Acting with gluteus medius, abducts the hip; the anterior fibers of the minimus rotate the hip medially. Both may also act as flexors of hip.	If weak, leads to lateral pelvic tilt; pelvis is high on the side of weakness; if contracted, pelvis is low on side of contracture.
	Tightness causes abduction and medial rotation of the thigh. In standing, there will be a lateral pelvic tilt, low on the side of shortness, accompanied by medial rotation of the femur.

Action	***Dysfunction***
Laterally rotates the extended thigh; abducts the hip when hip is flexed.	Sustained contraction in the piriformis may compress the sciatic nerve as it emerges through the sciatic notch, eliciting an ache, numbing, or tingling down the posterior thigh.
Laterally rotates and adducts the hip.	
The strongest lateral rotator of the hip with the gluteus maximus and the quadratus femoris. It acts as an abductor in the flexed position.	Lauren Berry, RPT, theorized that the obturator internus rolls into an inferior torsion with low back dysfunction, and this torsion could create a pulling force on the loose irregular connective tissue suspending the sciatic nerve, creating sciatica.
The two gemelli assist the obturator internus.	
Lateral rotation of the hip and assists in adduction.	

Action	***Dysfunction***
Concentric contraction causes lateral flexion of the trunk to the same side; eccentric contraction controls the rate of lateral bending to the opposite side; isometrically, helps to stabilize the trunk on the pelvis.[2] Palpation: Just lateral to the erector spinae at the top of the iliac crest.	Sustained contraction in the piriformis may compress the sciatic nerve as it emerges through the sciatic notch, eliciting an ache, numbing, or tingling down the posterior thigh.

TABLE 3-2 ANATOMY OF THE MUSCLES OF THE LUMBOPELVIC REGION—cont'd

Anterior Pelvic Region

Muscle	*Origin*	*Insertion*
Psoas major and minor	Divided into a superficial and a deep part—the deep part arises from the t.p.s, L1–L5 and the superficial part from the intervertebral discs of T12–L5 and the vertebral bodies T12–L5; lumbar plexus of nerves travels between the two parts and is susceptible to entrapment; psoas minor is an inconstant muscle from T12–L1 and inserts on the iliopubic eminence	Travels with the iliacus over the lateral pubic ramus to insert onto the lesser trochanter of the femur
Iliacus	Upper margin of iliac fossa and the inner lip of the iliac crest	Lesser trochanter

Abdominal Muscles

Muscle	*Origin*	*Insertion*
Rectus abdominus	Pubic crest and symphysis of pubic bone	Fifth to seventh cartilage of rib cage and xiphoid process
External oblique	Largest and most superficial of the abdominals, it attaches by fleshy digitations from the lower eight ribs, interdigitating with the serratus anterior	Attaches on the external lip of the iliac crest; on the inguinal ligament and the outer layer of the rectus sheath
Internal oblique	Intermediate lip of iliac crest; thoracolumbar fascia; lateral 2/3 of the inguinal ligament	Attaches on fleshy digitations to lower three ribs (9–12); the linea alba and aponeurosis help in formation of rectus sheath; also attaches with the transverse abdominus to the thoracolumbar fascia
Transverse abdominus	Costal—deep surfaces of costal cartilages of lower six ribs Vertebral—the thoracolumbar fascia from the t.p.s of the lumbar vertebrae Pelvic—internal lip of iliac crest, lateral third of inguinal ligament	Aponeurosis helps form the rectus sheath; attaches to xiphoid process and linea alba

Dysfunction of the abdominal muscles: The abdominal muscles are weak in a client with LBP, which causes an anterior pelvic tilt, increased lumbar lordosis, and a rounded-shoulder posture. Weak abdominals decrease the stability of the lumbopelvic region. They are often inhibited by tight extensors. Strengthening the abdominals decreases tension in the erector spinae, decreases the lumbar curve, and increases the stability of the lumbopelvic region. Shortness in the abdominals depresses the chest and contributes to thoracic kyphosis.

Action	Dysfunction
Because the psoas and the iliacus have the same insertion point and the same action, they are often described as one muscle, the iliopsoas; however, they are two distinct muscles. They are the main flexors of the hip; they also laterally rotate the hip; with the extremity fixed, the psoas flexes the trunk; unilateral contraction causes rotation of trunk to the opposite side. Acts to stabilize the lumbar spine on the pelvis, and as an anterior guy wire to balance the effect of the deep erectors.	Shortens, often owing to extensive sitting. This causes an increased lordosis, an anteriorly rotated pelvis, and an increased compressive load to the lumbar facets.
Has the same action as the psoas; they are the main flexors of the hip; also laterally rotates the hip; with the extremity fixed, the iliacus flexes the trunk; unilateral contraction causes rotation of the trunk to the opposite side. A sustained contraction causes an anterior torsion of the ilium, bringing the ASIS forward and down, and an extension of the lumbar facets, causing increased compression.[2]	

Action	Dysfunction
Flexes the vertebral column; pulls the sternum toward the pubis (antagonist of erector spinae); tenses the abdominal wall; all the abdominal muscles act to stabilize the trunk. They also eccentrically and isometrically contract to prevent excessive rotation and lateral flexion in the trunk.[2]	
Both sides acting together flex the vertebral column, rotate the trunk to the opposite side, and resist anterior torsion of the ilium.	
Same as for external oblique, except rotates toward same side, and bends the body laterally; also stabilizes the spine through the thoracolumbar fascia.	
Flattens abdominal wall.	

different mechanisms of injury: (1) a rotational strain that typically injures the facet joints, and (2) a compression force in flexion, which typically injures the disc. It is important to realize that in any given injury, the muscles, facets, and disc are all involved to some degree.

- This minor trauma leads to inflammation of the synovial lining of the capsule, called synovitis, and to sustained hypertonic contraction in the paraspinal muscles, usually on one side of the lower back. The inflammation releases enzymes that cause minimal degeneration of the articular cartilage.
- This phase of dysfunction is often followed by a phase of instability, which is demonstrated by abnormal, increased movement of the facets. There is laxity in the joint capsule and the annulus of the disc, and subluxation (partial dislocation) of the facets.
- The last phase of pathogenesis is the stable phase, in which the body responds to the continuing degeneration by laying down connective tissue and bone.
- Continuing degeneration leads to bony spurs under the periosteum, enlargements of the inferior and superior facets, periarticular fibrosis, and loss of motion.
- Changes in the disc begin in the dysfunctioning phase with small circumferential tears in the annulus that become larger and form a radial tear that passes from the annulus to the nucleus. These tears increase until there is internal disc disruption, which can lead to a disc herniation in which the nucleus shifts position.
- With further degeneration the normal disc height is reduced owing to the loss of proteoglycans and water.

FACTORS PREDISPOSING TO LOW BACK DYSFUNCTION AND PAIN

- ***Functional factors:*** Posture, joint dysfunction, muscle imbalances, deconditioning, fatigue, altered movement patterns, or emotional tension.
- ***Structural factors:*** rheumatologic, endocrine or metabolic, neoplastic (tumors), and vascular diseases; infection; congenital anomalies; referred pain from pelvic and abdominal disorders.

DIFFERENTIATION OF LOW BACK PAIN

LBP can be caused by many conditions in addition to functional problems, injury, or degeneration in the musculoskeletal system. These other causes are diverse but may be categorized as follows:

- Visceral diseases such as kidney stones or endometriosis
- Vascular diseases such as aneurysms
- Tumors, especially cancer that has metastasized from another site
- Stress-related disorders, such as adrenal exhaustion

The vast majority of LBP is caused by a mechanical disorder, a problem of function, and not pathology. The precise cause of the mechanical LBP can be difficult to determine. Sometimes it is a case of a frank injury, but more often there is an underlying chronic muscle imbalance, poor posture, or emotional stress. Assuming that the client's pain is caused by a mechanical disorder, there are two fundamental types of pain that refer into the leg(s): sclerotomal and radicular. The two types are differentiated by the quality of pain. These two types of referral are important to distinguish, because it helps you differentiate a simple mechanical disorder from a serious condition, such as a herniated disc.

Sclerotomal pain, the first type of referred pain, is caused by an injury to the paraspinal muscle, ligament, facet joint capsule, disc, or dura mater and can manifest locally and be referred to an extremity. For example, pain from a muscle strain in the lumbar region may be felt as a pain in the thigh in addition to the lower back. Usually, the sclerotomal referred pain is described as *deep, aching, and diffuse*.

Radicular pain, the second type of referred pain, is caused by an irritation of the spinal nerve root. If the sensory (dorsal) root is irritated, *sharp pain, numbing, or tingling that is well-localized* in dermatomes occurs. If there is compression of the motor (ventral) nerve root, in addition to the pain, numbing, and tingling, there may be a weakness in the muscles supplied by that nerve root (myotome) and a decrease in the response in the corresponding reflex. The most common cause of nerve root irritation is disc herniation. Nerve root pain is much more serious and requires an assessment by a doctor.

With these two categories in mind, we can enumerate nine common types of LBP. Note that these are artificial categories and that an injury or dysfunction usually has several of these causes of pain at the same time. For example, with a simple overuse injury of the lower back during gardening, muscles, ligaments (including joint capsule), and joint dysfunction would all typically be involved. These categories should be used as a guide to help differentiate simple from more complex problems.

COMMON TYPES OF DYSFUNCTION AND INJURY TO THE LOWER BACK

Muscle Strain

- ***Cause:*** Strains may be categorized as an acute episode, such as a sport injury; a cumulative stress, such as standing at work all day; or an acute episode overlaying a chronic problem. The causes are described in "Pathogenesis of Low Back Pain" on p. 85, and "Factors Predisposing to Low Back Dysfunction and Pain" on p. 96.
- ***Symptoms:*** Pain is usually described as diffuse and achy, either across the low back or on one side. Client reports being stiff and tight, especially with certain movements. Rest is relieving. An acute injury may present as a gripping spasm in the lower back that can be worse with active motion.
- ***Signs:*** Active motion localizes the area or line of pain. On palpation, muscles are tight and tender. Passive motion is not painful, except with full muscle stretch.
- ***Treatment:*** OM, CR-MET for weak muscles, and post-isometric relaxation (PIR) should be performed on short or tight muscles. Depending on the severity of the injury, the strain resolves in 1 to 4 weeks.

Ligament Sprain (Including Joint Capsule)

- ***Cause:*** The same causes described for "Muscle Strain" apply to ligaments.
- ***Symptoms:*** Pain is well localized and can be sharp in certain movements.
- ***Signs:*** Active and passive motion can be painful. Resisted motion usually is not painful. We assess the ligaments by movement characteristics in response to wave mobilization strokes. Ligamentous thickening in the lumbosacral region is either localized or diffuse. Localized thickening feels like a dense, leathery resistance to movement as P–A mobilization is introduced in that specific area. Diffuse thickening, such as that present in degenerative arthritis, reveals this same dense, leathery resistance to motion, but in a more diffuse area. We can palpate ligaments over the SIJ, and they feel thick and fibrous if they have shortened.
- ***Treatment:*** OM, passive motion in pain-free ranges and strengthening exercises should be performed. It often takes 6 weeks to 1 year to heal.

Fixation or Subluxation of the Vertebral Facets (Facet Syndrome)

- ***Cause:*** Poor posture, muscle imbalances, emotional or psychological tension leading to muscle hypertonicity, fatigue, and deconditioning all predispose to altered joint movement and potential fixation of the facets.
- ***Symptoms:*** Fixation or subluxation may be completely painless. They may present as either a sudden or an insidious onset of well-localized unilateral or bilateral paravertebral pain. It may radiate to the groin, buttock, or thigh.
- ***Signs:*** Active extension may cause a "catch" or abrupt restriction in area of the fixation. A decrease in lateral bending may occur, and flexion is cautious and limited. Hypertonicity and tenderness may be present in the paravertebral muscles. Motion palpation of the joint reveals loss of normal passive motion at the end range. SLR is normal.
- ***Treatment:*** OM and gentle mobilization of the joint are indicated. Refer to a chiropractic or osteopathic doctor for correction of fixation through manipulation.

Sacroiliac Joint Dysfunction

- ***Cause:*** Refer to cause of joint fixation described above.
- ***Symptoms:*** Pain in the buttock, groin, and posterior thigh pain can be sharp, dull, or aching; occasionally, pain below the knee occurs.
- ***Signs:*** Indicators of SIJ dysfunction are: an unlevelling of the pelvis measured at the PSISs or the ASISs, tenderness to palpation at the PSIS on one or both sides, a positive Kemp's test eliciting pain to the SIJ, and a diminished passive mobilization in P–A glide at the SIJ.
- Treatment: OM, especially gluteal work, including the sacrotuberous, sacrospinous, and interosseous ligaments of the SIJ, and balancing of the muscles attaching to the pelvis by means of MET, and mobilization of the SIJ are indicated treatments. To assess the need for an adjustment (manipulation), refer the client to a chiropractic or osteopathic doctor if he or she does not respond to treatment.

Piriformis Syndrome

- ***Cause:*** Piriformis syndrome is caused by a hypertonic piriformis muscle, often caused by SIJ dysfunction, or by overuse resulting from pelvic obliquity that leads to weakness of the G. medius of the ipsilateral side. The piriformis then overworks trying to substitute as an abductor.[1] In approximately 10% of the population, the sciatic nerve travels through the piriformis muscle, which causes a predisposition to sciatica when the muscle is in a sustained contraction. In the other 90%, the sciatic nerve travels under the muscle and is vulnerable to a sciatic irritation if the muscle is short and tight.

- ***Symptoms:*** Pain occurs in the middle of the buttock and can radiate down the posterior thigh, but rarely past the knee.
- ***Signs:*** Palpation reveals a tight and tender piriformis muscle; stretching the piriformis muscle by adducting the flexed hip over the supine client's extended leg increases buttock pain; straight leg raise (SLR) with internal rotation can increase the pain, which is relieved when the hip is externally rotated.
- ***Treatment:*** Perform MET and OM to relax, stretch, and reposition the piriformis; correct pelvic obliquities through MET; and facilitate weak G. medius.

Coccydynia

- ***Cause:*** Many patients report falling on the buttocks, or giving birth as the initial event. Often, articular and soft-tissue changes such as coccygeal ligamentous fibrosis, spasm in the muscles of the pelvic floor, and subluxation of the sacrococcygeal joint occur. Pain may be referred from the lumbar spine, SIJ, or pelvic viscera.
- ***Symptoms:*** Clients may experience coccyx pain, especially when sitting. It rarely refers to another location.
- ***Signs:*** Indicators of coccydynia are pain at the coccyx when sitting and the presence of thick, fibrotic ligaments about the coccyx.
- ***Treatment:*** Coccydynia treatment necessitates the release of the ligaments of the sacrococcygeal joint and the balancing of the musculature of the pelvic region. If patients do not respond to the soft-tissue therapy, refer them to a chiropractic or an osteopathic doctor to assess the need for manipulation of the subluxed or fixated joint.

Arthrosis (Arthritis): Degeneration of Vertebral Facets

- ***Cause:*** Arthrosis is caused by previous injury to the facets, chronic fixation of the facets, sustained muscle tension, muscle imbalances that create altered movement patterns through the joint, poor posture, deconditioning, and obesity.
- ***Symptoms:*** Clients experience a dull, achy pain that is worse in the morning, better with certain movements, and aggravated by others. Client feels diffuse stiffness in entire lower back.
- ***Signs:*** Arthrosis indicators are a chronic loss of lumbar extension with localized damage or a more complete loss of lumbar motion with diffuse changes in the affected joints. Another sign is a loss of passive motion ("joint play") at the involved facets.
- ***Treatment:*** Arthrosis clients need to move. Some pain accompanies increased movement, but it is a necessary pain to recover function in the joint. The general rule is that the client should be able to completely relax into the pain of moving the involved area. OM is helpful.

Spondylosis (Disc Degeneration)

- ***Cause:*** Spondylosis has the same factors described above under "Arthrosis."
- ***Symptoms:*** Clients report stiffness and a diffuse, dull ache across the lower back and gluteal region, relieved by short periods of rest. Long periods of rest increase stiffness. Stiffness and pain are worse in the morning.
- ***Signs:*** Decreased range of motion (ROM), especially extension, is an indicator of spondylosis. Disk degeneration is clear on x-rays.
- ***Treatment:*** OM and yoga are helpful. In addition, clients should walk briskly for 20 minutes or more per day. Traction on a slant board should be performed to promote fluid uptake in the disc.

Disc Herniation (Disc Bulge, Protrusion)

- ***Cause:*** Disc herniation is most common in young adults, between 30 and 40 years old. It is probably a result of repetitive stresses and eventual tearing of the annulus fibrosis, especially in rotation and forward flexion; however, some authors such as Kirkaldy-Willis and Bernard[8] suggest that the condition may start as a dysfunction caused by muscle imbalance. Sedentary lifestyle and obesity are risk factors.
- ***Symptoms:*** Clients report a sharp, nagging, or gripping pain in the gluteal region and the middle of the lower back. With disc herniation, pain, numbing, or tingling refers into the legs with irritation of the nerve root. Even at rest, pain is still present. Sitting usually worsens the symptoms.
- ***Signs:*** Often, the client presents to your office in slight forward flexion or in sustained lateral flexion (called antalgia). All active motion is painfully limited. Coughing, sneezing, and moving bowels may increase pain. The client usually has a positive SLR and well–leg-raising test, sensory changes in specific dermatomes, or weakness in the legs.
- ***Treatment:*** OM is done lightly, as deeper work could de-stabilize the spine. Work under the super-

vision of a doctor (chiropractic, osteopathic, or medical). Treatment should include strengthening, stabilizing, and proprioceptive reeducation.

Assessment

HISTORY QUESTIONS FOR CLIENTS WHO HAVE LOW BACK PAIN

Once you have ruled out the "red flags" (See Chapter 2, "Assessment & Technique") that may indicate a serious pathology and the need for an immediate referral to a doctor, you need to determine the "level of distress" in your client, that is, "how bad is the pain?" Questions such as "Did you sleep comfortably last night?" "Is the pain sharp or diffuse?" and "Do you have pain, numbing, or tingling in your legs?" will help you determine the following: (1) the appropriate depth of your massage strokes; (2) the appropirate amount of mobilization; (3) the necessity of referring your client to a doctor after your session; and (4) the recommendations for follow-up treatments. Refer to the section "Subjective Examination: Taking a History" in Chapter 2 for more information.

Did You Sleep Comfortably Last Night?

Pain that occurs when a client rolls over in bed is usually benign and caused by a mechanical problem. Pain that has decreased after a night's sleep usually indicates a mechanical problem, that is, muscle, ligament, or joint injury or dysfunction. Pain that is constant, even at rest is indicative of inflammation, such as a disc herniation, or a more serious pathology, such as a tumor, and needs referral to a doctor.

Is the Pain Sharp or Diffuse?

A sharp pain in the lower back or SIJ area usually indicates a joint problem. If there is a referral of sharp and gripping pain into the legs, then it indicates a nerve-root problem. A diffuse LBP can be muscle, ligament, or joint dysfunction or injury. Your active ROM assessment helps differentiate these various conditions (see "Summary of Possible Findings of Active ROM," p. 102).

Do You Have Pain, Numbing, Or Tingling in Your Legs?

If the client answers yes, you need to perform the SLR test before you begin your massage (see p. 103). If the SLR test creates intense, sharp pain in the legs, it typically indicates a nerve-root problem, and you need to refer your client to a doctor. If your client can lie on the table comfortably in the fetal position, you may perform gentle massage. The intention is to relax the client and not attempt to perform deep release of the muscles as that could be destabilizing. If the SLR creates a diffuse pain, numbing, or tingling in the legs, it is usually a sclerotomal pain (see "Differentiation of Low Back Pain"), and OM is indicated. As mentioned, a constant, gripping pain in the legs needs an immediate referral, and massage on the lower back is contraindicated.

OBSERVATION: CLIENT STANDING

Note any redness or swelling of the skin that may indicate inflammation and the need for much lighter pressure in your strokes. Also, notice any scars that may indicate a previous serious injury or previous surgery.

Observe any asymmetry in your client's posture from the posterior and the side views. A detailed postural assessment is for clients with chronic pain. If the client is experiencing acute pain, perform a postural assessment to determine if the sustained position, usually lateral bending (antalgia) or forward flexion, is a result of muscle spasms. If these postures are associated with acute pain, it usually indicates a facet syndrome or a disc protrusion. Postural assessment for acute pain is brief.

Posterior View

- **Is the client listing to the side?** It may be a result of chronic muscle and joint imbalance. If the client cannot straighten because of the pain, it usually indicates a disc protrusion or muscle strain in the QL or the iliopsoas.
- **Is the spine vertical?**
  - ***Position:*** Have your client stand in front of you.
  - ***Action:*** Place your index and middle finger on either side of the C7 spinous process, and slowly move your fingers down the spine to L5.
  - ***Observation:*** Does your client have a lateral curvature, called scoliosis, in the thoracic or lumbar spine? Lumbar scoliosis may be caused by sciatic neuritis, joint dysfunction, muscle spasm, irritation of the disc, or degenerative joint disease (DJD) (see Chapter 4 for further assessment of scoliosis).

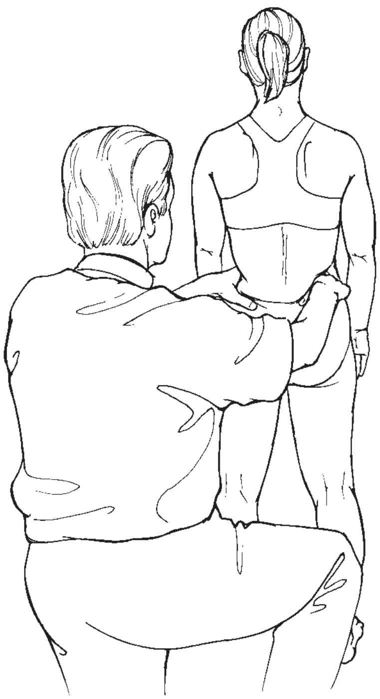

Figure 3-12. Assessment of iliac crests. To assess whether the iliac crests are level, place your fingertips on the top of the iliac crests.

- **Are the iliac crests level?** (Fig. 3-12)
  - □ ***Action:*** Place your fingertips on the iliac crests.
  - □ ***Observation:*** If they are uneven, then make a note of the high side in your chart. Compare this finding with a seated assessment. If the iliac crests are uneven in standing and level sitting, there may be a leg-length difference or pronation in the ankle on the short side. If they remain uneven in standing and sitting, it indicates a muscle and joint dysfunction in the lumbopelvic region.
- **Is the head tilted to one side or balanced in the midline?**
- **Are the shoulder heights equal?** Place your index fingers horizontally under the inferior angles of the scapulae.

Side View

- The earlobe should be in line with the upright acromion process. The most common dysfunction is the forward-head posture.
- **Observe the lumbar curve from the side to see if it is increased or decreased.**
  - □ ***Action:*** Place your index fingers on the ASIS and the PSIS on the side the closest to you.
  - □ ***Observation:*** The ASIS and the PSIS should be approximately level with a normal curve.
- **Correct the client's standing posture.**
  - □ ***Action:*** Adjust the lumbar spine so that the ASIS and the PSIS on the same side are level. Next, bring the head back if necessary so that the opening of the ear is over an upright acromion.

MOTION ASSESSMENT

Start by asking your client if any particular motion brings up the pain. Have your client perform that motion last. While the client performs the movements, note the ROM and whether the movement is painful. If it is painful, ask the client about the quality of the pain and its location.

Forward Flexion

- □ ***Position:*** Have your client stand in front of you, feet placed shoulder-width apart.
- □ ***Action:*** Ask the client to bend forward as far as comfortable, with knees kept straight (Fig. 3-13).

Figure 3-13. Assessment of active flexion. To assess active flexion in the lumbopelvic region, ask the client to bend forward as if she is going to touch her toes. Tell her to stop if it becomes painful. Have her bend her knees when coming back to standing.

Figure 3-14. Assessment of extension. To assess extension, have the client place her hands on her lower back and bend backwards to her comfortable limit.

- ***Observation:*** Flexion is a combination of hip, lumbar, and thoracic motion. The trunk should flex at least to 90°, that is, parallel to the floor. You can measure the distance from the fingertips to the floor. Observe the spine from the side. The lumbar curve should flatten in bending forward. If the lumbar lordosis is maintained, it indicates erector spinae muscle spasms or hypomobility of the joints. Diffuse soreness or pain in the lower back indicates an injury to the muscle, ligament, or joint. A sharp pain in the lower back indicates joint involvement. A dramatic limitation of motion indicates inflammation and swelling and a more serious injury.

Extension

- ***Position:*** The therapist stands at the client's side and asks the client to stand with feet shoulder-width apart and palms on the lower back (Fig. 3-14).
- ***Action:*** Have the client bend backward to a comfortable limit, keeping the knees straight.
- ***Observation:*** The ROM of lumbar extension is approximately 30°. Does lumbar spine curve? Or is the client bending only at the hips? Active extension is the best test for joint dysfunction and injury since extension compresses the facets. A sharp local pain in extension indicates a facet syndrome. With a facet syndrome, diffuse pain, numbing, or tingling may refer into the gluteal region, thigh, and leg. A sharp, dermatomal pain in extension often indicates a nerve-root problem, as extension also closes down the IVF slightly.

For clients who have chronic pain or dysfunction, a more accurate assessment of pure lumbar extension may be done with your client lying prone on the massage table, resting on his or her elbows, with the pelvis remaining on the table. Is there a round curve in the lumbar spine? If there is limitation of this motion, it indicates a chronic degenerative condition or hypomobility of the joints. A loss of motion and stiffness indicates muscle and connective tissue shortening, including ligaments.

Side Flexion

- ***Position:*** The client stands with feet shoulder-width apart and arms at sides. The therapist stands behind the client and places both hands on the client's hips to stabilize the pelvis so that it does not sway or rotate (Fig. 3-15).

Figure 3-15. Assessment of lateral flexion. To assess lateral (side) flexion, stand behind your client and hold her pelvis to prevent any rotation or swaying. Ask her to slide her hand down the side of her leg to her comfortable limit.

- ***Action:*** Ask the client to slide one hand down the side of his or her leg without rotating the trunk.
- ***Observation:*** The client should be able to slide his or her hand down equally on both sides, almost to knee level (approximately 30°). The lumbar spine should form a smooth curve in side bending. If there is a sharp angle, then it indicates hypomobility at the facet joints. Pain on the bending side indicates a joint problem because the facet is being compressed. Pain, stiffness or tightness on the opposite side often indicates QL irritability.

Kemps Test (Quadrant Test)

- ***Intention:*** To help differentiate narrowing of the IVF caused by degeneration or SIJ problems.
- ***Position:*** Assume the same position as the side-bending test.
- ***Action:*** Have the client slide his or her hand down the back of the leg, one leg at a time, to a comfortable limit.
- ***Observation:*** Kemps test compresses the IVF and SIJ slightly and elicits referral of sharp pain into the leg with disc problems, diffuse referred pain with SIJ problems, or LBP with sacroiliac or lumbar joint dysfunctions and injuries (Fig. 3-16).

Figure 3-16. Kemps test. Kemps test is used to help differentiate sacroiliac problems and compression of a nerve caused by narrowing of the IVF. Have your client slide her hand down the back of her leg. This combines rotation and extension of the spine and compresses the IVF on the side of turning.

Summary of Possible Findings of Active Range of Motion

A dramatic limitation of the ROM is indicative of a facet syndrome, a disc injury, or a moderate to severe strain or sprain of the musculoligamentous tissues. If the ROM is normal, and the movement elicits diffuse LBP, then it is usually a muscle problem. If active motion is slightly decreased, and the motion elicits a sharp back pain, then it often indicates a joint or ligament problem. If there is a generalized loss of all motions without pain, just stiffness, there is often a diffuse arthrosis or spondylosis in the lumbosacral spine. Diffuse loss of motion, joint stiffness, and referral of pain into the legs with extension and Kemps test may indicate foraminal encroachment, a degenerative condition in which the IVF is narrowed and the nerve root is being compressed. This requires a referral to a chiropractic or osteopathic doctor.

BALANCE ASSESSMENT

- ***Intention:*** To assess chronic LBP. Chronic LBP often leads to balance problems from instability and dysfunction of the proprioceptors.
- ***Position:*** Have your client stand next to the wall so that he or she can place a hand on the wall for support while performing this test. The therapist stands facing client.
- ***Action:*** Ask your client to lift one foot off the ground a few inches and attempt to balance on the other leg for 10 seconds. Repeat on the other side.
- ***Observation:*** Chronic LBP patients and geriatric patients often have problems with balance. If your client cannot balance comfortably on each leg, then have him or her do this as an exercise at home for 30 seconds to 1 minute on each leg, once a day.

SEATED ASSESSMENT

- **Place your thumbs under the PSISs to see if they are level.** An unlevelling is called a pelvic obliquity. This may be a result of muscle spasms, DJD, sciatic neuritis, disc herniation, or joint fixation in the SIJs or lumbar spine.
- **Assess sitting posture.** Is the client's posture slumped? Correct a slumped posture by introducing a slight lumbar curve and placing the client's head so that the opening of the ear is over the upright acromion (see Fig. 5-12).

PALPATION

Client Seated

- Most of the palpation is done in the context of performing the strokes. A scanning palpation is done in a few areas to rule out a serious lower back problem. Severe pain with medium pressure to the bone is a red flag for serious pathology.
- Press with a medium amount of pressure on the following structures: the sacrum, both PSISs, each spinous process in the lumbar spine, the gluteal muscles, and the paraspinal muscles.

Client in the Side-Lying Position

- □ ***Intention:*** Perform palpation to assess the condition of the soft tissue and joints of the lumbosacral region; palpation is best accomplished with the client in the side-lying position.
- □ ***Position:*** Ask the client to lie in the fetal position, with a pillow between the knees. This is the most relaxed position for the soft tissue of the spine.
- □ ***Action:*** Begin by rocking the client gently. This rocking movement introduces a wave into the body, and like sonar, returns information to the therapist regarding the level of relaxation in the client. A guarded, tense person is rigid to this motion, and a relaxed, open person is pliable and resilient. Next, use the supported-thumb position to perform a series of slow P–A wave mobilization strokes along the SIJ and the lumbar spine (Fig. 3-17).

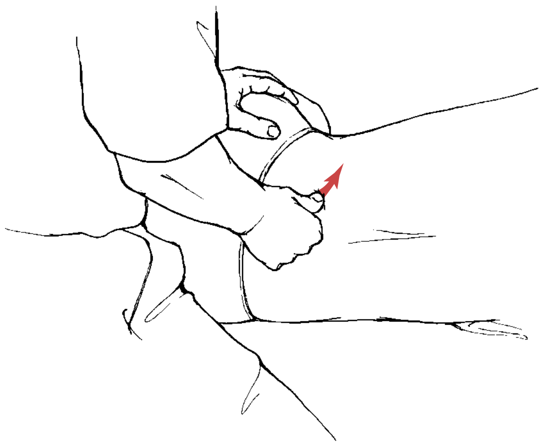

Figure 3-17. Palpation in the side-lying position. Assess the soft tissue and the motion of the spine.

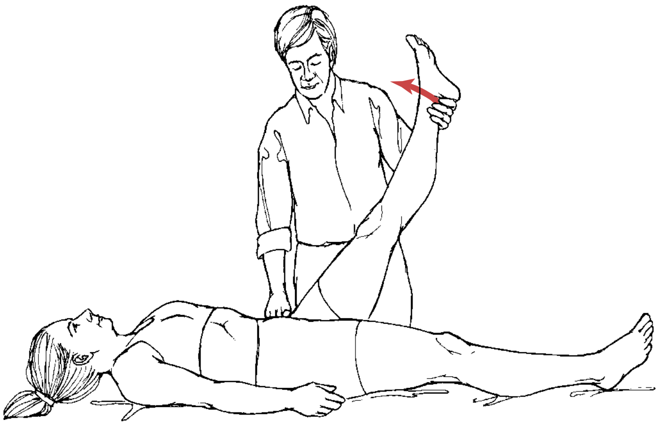

Figure 3-18. SLR test. The SLR test is performed if there is pain, numbing, or tingling into the leg. The therapist slowly lifts the client's leg off the table until there is pain in the leg or until there is tissue tension, usually occurs at approximately 70°.

- □ ***Observation***
  - □ A healthy lumbosacral spine is resilient and bends with your pressure. The strokes are relaxing and completely pain-free.
  - □ Inflamed tissue is painful. The degree of pain indicates the level of inflammation.
  - □ Hypertonic muscles have a tight, springy resistance to movement.
  - □ Thickened soft tissue in the ligaments and capsule has a thick resistance to your movement.
  - □ A localized degeneration has a hard resistance to movement, whereas more diffuse degeneration has a similar hard resistance in a broader area.

OTHER TESTS

Straight–Leg-Raising Test

- □ ***Intention:*** Perform the SLR test if the client has pain radiating to the leg (Fig. 3-18). The test helps differentiate a nerve root lesion from sclerotomal pain.
- □ ***Position:*** The client is supine. The therapist stands at the side of the table by the leg with the referred pain.
- □ ***Action:*** The therapist grasps the client's leg just proximal to the ankle and slowly lifts it up, keeping the knee straight, until there is pain or until an elevation of 70° is attained.
- □ ***Observation:*** The test is positive if lifting the leg increases or initiates leg pain, numbing, or tingling below the knee before 70° of elevation. Note the

quality and location of the pain. Intense, sharp pain usually indicates nerve-root tension, probably an injury to the disc. Pain that is only in the back indicates a ligament sprain or facet syndrome. If the client has a positive SLR test, then perform the SLR test on the "good leg." If the test elicits pain below the knee on the involved leg, it indicates a much more severe disc problem. If the SLR test is negative, that is, there was no aggravation of leg pain with elevation of the leg, and the client reports that they often have referral of diffuse pain into the leg, they have sclerotomal pain coming from a joint, muscle, tendon, ligament, etc. (see "Differentiation of Low Back Pain").

Techniques

MUSCLE ENERGY TECHNIQUE

Remember that clients should never perform MET if it is painful.

- In this chapter, MET variations for the piriformis and iliopsoas are shown within the context of the strokes.
- Refer to Chapter 7 for evaluation of the hip joint and for information on MET for the hip abductors, adductors, TFL, and iliotibial band (ITB).

Muscle Energy Technique for Acute Low Back Pain

1. Contract-Relax for the Lumbar Erector Spinae

- ☐ ***Intention:*** An acute low back can be irritated if the facet joints are moved too much. A safe and effective way to reduce muscle hypertonicity in the lumbosacral region is isometric contraction of the lumbar extensors. If this motion is painful, then begin with an RI MET, illustrated below.
- ☐ ***Position:*** Client is side lying in the fetal position, with a pillow between the knees and hips flexed to 90°. To prevent trunk rotation, make sure the client lines up the top shoulder over the lower shoulder and the top hip over the lower hip. The therapist places one hand on the sacrum and one hand on the midthoracic region.
- ☐ ***Action:*** Instruct the client to resist as you press P–A on the spine for approximately 5 seconds. Cue the client by saying, "Don't let me move you." Press for 5 seconds, and then have the client relax. Remember, the client's body should not move as he or she resists your pressure. These are isometric contractions. I often alternate the CR and RI techniques several times, which reduces the hypertonicity in the lumbar erectors and decreases the pain in the lower back.

2. Reciprocal Inhibition for the Lumbar Erector Spinae

- ☐ ***Intention:*** An acute low back may be irritated if the extensor muscles are contracted. A safe and effective way to reduce muscle hypertonicity in the lumbosacral region is isometric contraction of the flexors of the trunk, the iliopsoas. When the iliopsoas contracts, the lumbar extensors relax by means of RI (Fig. 3-19).
- ☐ ***Position:*** Client is side lying in the fetal position, with a pillow between the knees and hips flexed to 90°. The therapist places one hand on the anterior thigh just above the knee and the other hand on the lower back.
- ☐ ***Action:*** Have the client resist your attempt to lightly pull the thigh into extension, that is, toward the foot of the table. Cue the client by saying, "Don't let me move you." Hold for 5 seconds. Alternate the CR and RI techniques several times, which reduces the hypertonicity in the lumbar erectors and decreases the pain in the lower back.
- ☐ ***Observation:*** The lumbar spine should not arch during the RI. Place your hand on the client's back and have him keep the spine against your hand as he resists.

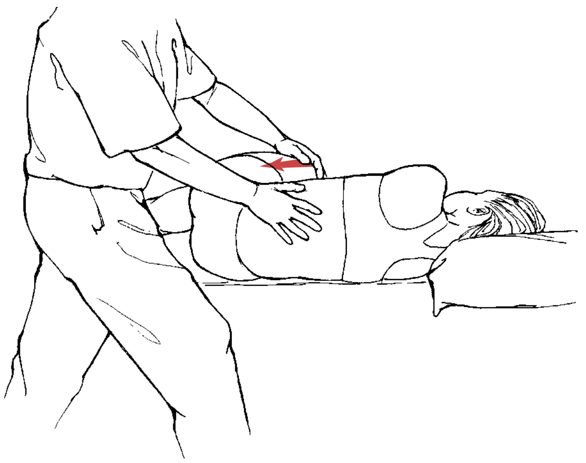

Figure 3-19. RI MET for the lumbar erector spinae. To perform RI on the extensors of the spine, have your client resist as you gently try to pull her thigh into extension.

Muscle Energy Technique to Release Hypertonic Muscles of the Lumbopelvic Region

3. Contract-Relax Muscle Energy Technique for the Lumbar Erector Muscles in the Subacute or Chronic Phase

- ***Intention:*** To reduce muscle hypertonicity by performing CR MET. Hip extension engages the lumbar erectors. If the erectors palpate as hypertonic, then CR MET is a safe and effective way to reduce their hypertonicity (Fig. 3-20).
- ***Position:*** Client is side lying. Have the client straighten the top leg, making sure the knee is fully extended, and lift it off the pillow and into a few degrees of extension.
- ***Action:*** Instruct the client to resist as you attempt to press the client's extended leg forward for approximately 5 seconds. It is often helpful to tap lightly on the lumbar extensors to give a sensory cue to the muscles. You might say, "Feel these muscles working," as they contract. Have the client put the leg back on the pillow and lie in the fetal position. Next, place your hand on the top of the client's thigh just above the knee and have the client resist as you attempt to pull the thigh into extension, as was described in the section "Reciprocal Inhibition for the Lumbar Erector Spinae." Repeat this cycle three to five times.

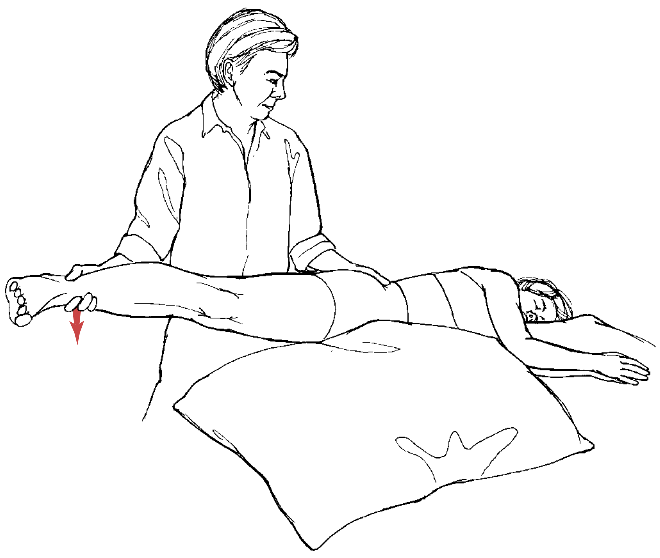

Figure 3-20. CR MET for the lumbar erector muscles in the subacute or chronic phases. To release hypertonicity in the extensors in the client who is not in acute pain, have her straighten her leg and gently lift it off the pillow. Have her resist as you lean your body into her leg, attempting to push it forward.

4. Contract-Relax and Reciprocal Inhibition Muscle Energy Technique for the Piriformis

- ***Intention:*** To perform CR MET to release the hypertonicity of the piriformis.
- ***Position:*** Client is side lying in the fetal position with a pillow between the knees.
- ***Action:*** Have the client lift his or her leg off the pillow and resist as you gently attempt to press it back down to the pillow for approximately 5 seconds (Fig. 3-21). To perform RI on the piriformis, have your client squeeze his or her knees together. This contracts the adductors and reciprocally inhibits the piriformis. You can give a sensory cue by lightly attempting to pull the client's knees apart.

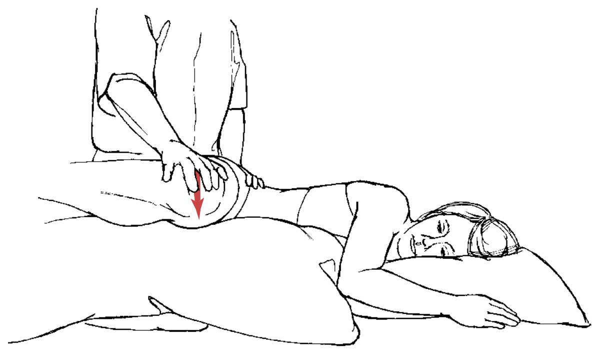

Figure 3-21. CR MET for the piriformis. Have your client lift her leg off the pillow a few inches, parallel to the floor, and resist as you gently attempt to press it back down to the pillow for approximately 5 seconds.

5. Postisometric Relaxation of the Piriformis

- ***Intention:*** The intention is to lengthen the piriformis. The piriformis is typically short and tight, so it compresses not only the SIJ but also the sciatic nerve. PIR of the piriformis should be performed on chronic clients only.
- ***Position:*** The client is supine. To lengthen the right piriformis, have the client cross the right leg over the left, placing the right foot on the table on the outside of the left knee (Fig. 3-22). You may stand on either side, facing the table (although I prefer to stand on the client's left side). Use your superior hand to hold the client's right ASIS to stabilize the pelvis, and place your left hand on the lateral aspect of the client's right distal thigh.
- ***Action:*** Have the client resist as you attempt to pull the leg across the body and push the knee toward the table for approximately 5 seconds. Relax, and as the client relaxes, pull the leg further across the body and press the knee further toward the table, until there is pain or you feel

the resistance barrier. Repeat this CR–lengthen cycle several times.

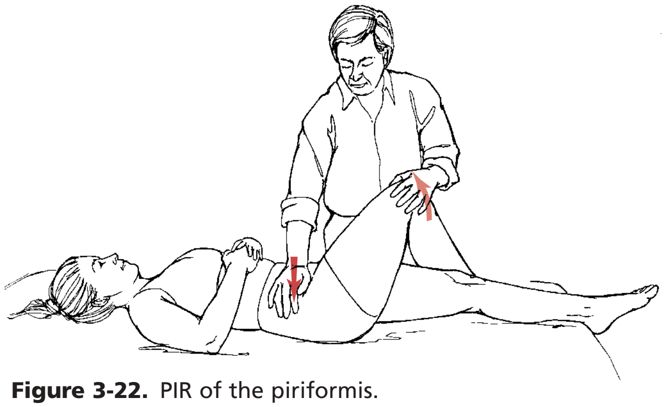

Figure 3-22. PIR of the piriformis.

6. Contract-Relax Muscle Energy Technique for the Iliopsoas

- ☐ ***Intention:*** Use CR MET to reduce the hypertonicity of the iliopsoas.
- ☐ ***Position:*** Stand in the 45° footward position and place both your hands on the client's distal thigh.
- ☐ ***Action:*** Have the client resist as you press gently in an inferior direction on the top of the thigh for approximately 5 seconds (Fig. 3-23).

Figure 3-23. CR MET of the iliopsoas. Therapist stands in the 45° footward position and places both hands on the client's distal thigh. Have the client resist as you press gently in an inferior direction on the top of her thigh for approximately 5 seconds.

7. Reciprocal Inhibition Muscle Energy Technique for the Iliopsoas

- ☐ ***Intention:*** To perform RI to reduce the pain and hypertonicity of the iliopsoas by contracting the hip extensors, antagonists of the iliopsoas.
- ☐ ***Position:*** Stand in a 45° headward direction and place both your hands on the client's shin or posterior thigh.
- ☐ ***Action:*** Have your client resist as you press gently in a headward direction for approximately 5 seconds. This engages the hip extensors, and reciprocally inhibits the iliopsoas, the main hip flexors (Fig. 3-24).

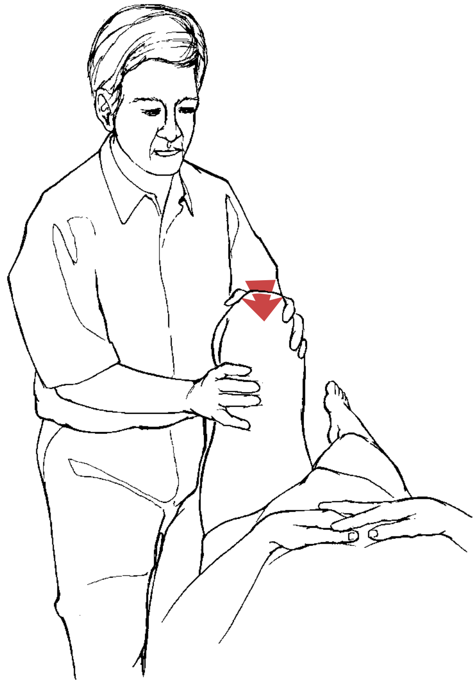

Figure 3-24. RI of the iliopsoas. Have your client resist as you press in a superior direction on her shin or posterior thigh.

8. Length Assessment and Postisometric Relaxation for the Iliopsoas and the Rectus Femoris

- ☐ ***Intention:*** To assess the length and to perform PIR for the iliopsoas and the rectus femoris (Fig. 3-25). The iliopsoas is a significant contributor to acute and chronic LBP. A short iliopsoas increases the lumbar curve, compressing the facets, and inhibits the normal function of the lumbar extensors through RI. The release of the iliopsoas for acute conditions is done with the strokes shown later in this chapter.
- ☐ ***Position:*** Instruct your client to sit on the end of the table, then grasp the right leg and pull it to the chest. Support the client's head with one hand and place the other hand on the flexed leg. Ask your client to tuck his or her chin, and then rock the client back onto the table, resting the head on a pillow. The left leg will hang over the edge of the

table. The knee should be pulled to the chest just enough to keep the lower back flat on the table.

- ☐ ***Observation:*** If the length of the iliopsoas is normal, then the left thigh will be parallel to the floor or lower. If the length of the rectus is normal, the lower leg will be perpendicular to the floor. If the TFL is short, the leg will be abducted slightly.
- ☐ ***Action:***
  - ☐ To lengthen the iliopsoas, perform PIR. Have the client resist as you press down on his or her left thigh. Press for 5 seconds, and after the client has relaxed for a few seconds, press down on the distal thigh to a new resistance barrier, stretching the iliopsoas and anterior hip joint capsule.
  - ☐ To lengthen the rectus femoris, have the client resist as you use your leg to press into the client's leg, attempting to press the leg into further flexion. Press for 5 seconds, have the client relax, then press again into a new resistance barrier.
  - ☐ Repeat the CR–lengthen cycle several times.

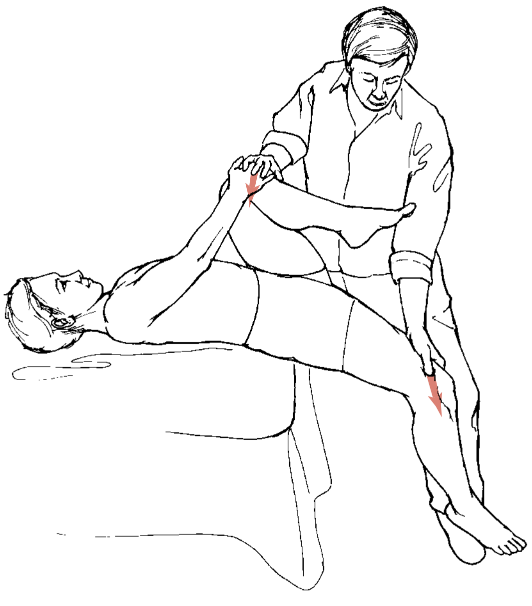

Figure 3-25. Length assessment and postisometric release of the iliopsoas.

9. Postisometric Relaxation of the Quadratus Lumborum

- ☐ ***Intention:*** To lengthen the QL (Fig. 3-26). The QL is typically tight in chronic LBP, and performance of PIR is a safe and effective way to lengthen it.
- ☐ ***Position:*** Client is side lying, with the top leg straightened, the bottom leg flexed. You may need to cue the client by asking him or her to hike the hip to resist you as you pull the leg. Explain that you want him or her to use the muscles on the top of the hip (crest of the ilium) to resist your pull, holding the hip toward the shoulder.
- ☐ ***Action:***
  - ☐ Hold the client's leg above the ankle and abduct the leg approximately 20° from the midline. Instruct the client to resist, saying, "Don't let me move you," as he or she pulls the leg for approximately 5 seconds. Make sure the client's body is neutral and not rotated forward or backward. If the leg is too heavy or creates discomfort in this position, then place pillows under the top leg to support it, or tuck the leg under your armpit. After the client holds for 5 seconds, have him or her relax, and as the client relaxes, pull the leg and stretch the quadratus. Then repeat the CR–lengthen cycle a few times. At the end of the PIR cycle, use PIR to help "set" the QL in its new lengthened position. Place your fist on the heel of the client's straightened leg and have the client resist as you push headward for approximately 5 seconds.
  - ☐ If the QL is acute, flex the client's hips in the fetal position. Face footward, place your hands on the iliac crest, and ask client to resist as you gently push the ilium inferiorly.

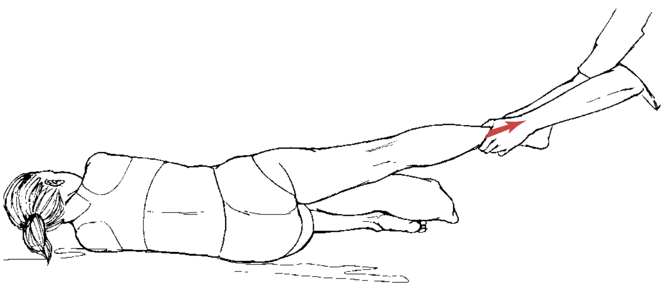

Figure 3-26. PIR of the QL.

Isotonic Muscle Energy Technique for the Gluteus Maximus

- ☐ ***Intention:*** Hip extension is primarily accomplished by the hamstrings and G. max. and secondarily by the erector spinae (Fig. 3-27). Weakness in the G. max. is common and may cause the lumbar erectors to initiate hip extension, which hyperextends the lumbar spine and compresses the facets. MET helps facilitate (strengthen) the G. max.

- ☐ ***Position:*** Have your client lie face down on the table and bend one knee to 90°. Place one hand on the G. max. and the other hand on the back of the thigh.
- ☐ ***Action:*** Instruct the client to lift his or her thigh slowly off the table a few inches and to hold it for 5 seconds. This movement is accomplished primarily by the G. max. Tap the muscle lightly with your fingertips and say, "Feel this muscle working," as the client is contracting. Repeat this five times. Perform this action on both sides.
- ☐ ***Observation:*** Note the trunk position. Make sure your client does not rotate his or her trunk to perform this motion.

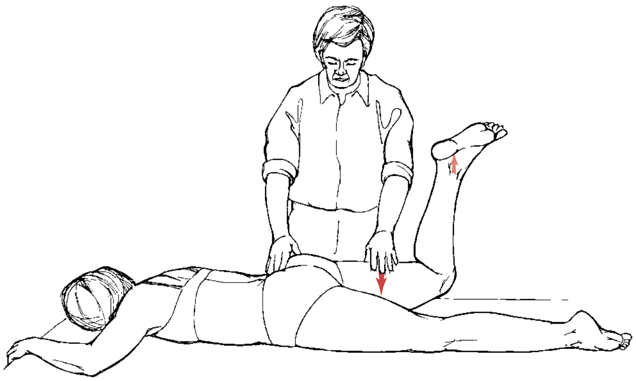

Figure 3-27. Isotonic-MET for the gluteus maximus. With her knee flexed, have the client slowly lift her thigh off the table. It is important to perform the movement slowly to isolate the gluteus maximus.

ORTHOPEDIC MASSAGE

Level I-Lumbosacral

1. Release of Gluteus Medius and Minimus

- ***Anatomy:*** Gluteal fascia; G. max., medius, and minimus; and superior cluneal nerves (Fig. 3-28)
- ***Dysfunction:*** The G. medius is a strong abductor of the hip, and its dysfunction contributes to pelvic unlevelling, and LBP. Although the G. medius and minimus tend to be weak, they may also be hypertonic, known as *tightness weakness,* or weak because of RI of hypertonic adductors. The superior cluneal nerves may become entrapped in the gluteal fascia just below the crest of the ilium.

Position

- Therapist Position (TP)—standing, facing the line of the stroke
- Client Position (CP)—side-lying, in the fetal position, with a pillow under the head and between the knees, with the hands resting on each other in a "prayer position"

Strokes

There are three basic lines of strokes to assess the region by palpation and to release the gluteal fascia, cluneal nerves, and G. medius and minimus. Begin superficially with broad, scooping strokes, and proceed with deeper strokes as the area releases. Possible hand positions in-

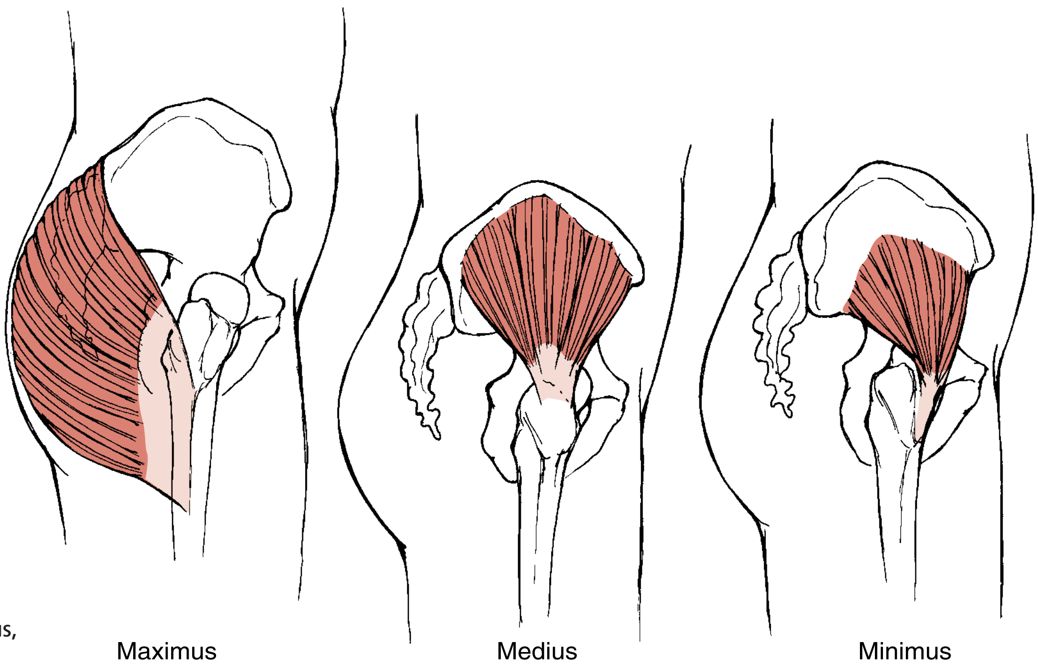

Figure 3-28. Gluteus maximus, medius, and minimus.

clude double thumb, braced thumb using the pisiform of the opposite hand, the fifth metacarpophalangeal (MCP) area of a soft fist, or the forearm and elbow area, which can be angled to be rounded, flat, or fleshy.

1. Begin your spinal sessions by placing both hands on the gluteal region and gently rocking the client's entire body with a rhythm of approximately one cycle per second. This rocking creates a wave in the client's body that is like sonar and that reflects the client's level of relaxation or guarding. It is also a way to make nurturing contact with the client.
2. The first line of strokes begins midway between the greater trochanter and the iliac crest in the belly of the G. medius (Fig. 3-29). Perform a series of 1-inch scooping strokes, perpendicular to the line of the G. medius. Begin another series of strokes approximately 1 inch below your previous stroke, and continue this line of strokes to the area between the PSIS and the greater trochanter.
3. A second line of strokes begins approximately 1 to 3 inches from the greater trochanter at the myotendinous junctions of G. medius and minimus. Start at the superior aspect of this area and work inferiorly in 1-inch scooping strokes around the greater trochanter.
4. The third line is along the superior portion of the iliac fossa to release the gluteal fascia, superior cluneal nerves, and superior portion of the G. medius and minimus. Begin at the most lateral-superior aspect of the ilium, using 1-inch scooping strokes and move your hands more medially and inferiorly as you work down the iliac fossa.

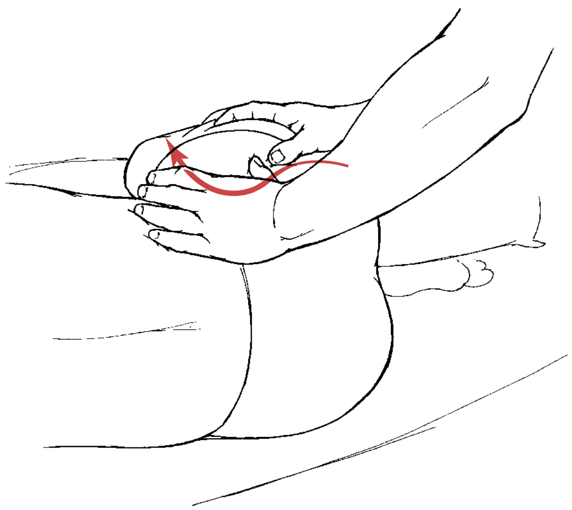

Figure 3-29. Double-thumb technique to release the gluteal fascia, cluneal nerves, and the gluteus medius and minimus.

2. Release of Gluteus Maximus and Sacrospinous and Sacrotuberous Ligaments

- ***Anatomy***: G. max. and the sacrospinous and sacrotuberous ligaments. Work the G. max. superficially; work the sacrotuberous and sacrospinous ligaments deeply (Fig. 3-30).
- ***Dysfunction:*** In dysfunction, the G. max. is weak. It may be hypertonic, especially with hypertonic hamstrings, and a loss of the lumbar curve might occur. The ligaments tend to develop fibrotic change because of excessive tension caused by pelvic obliquity (unlevelling), hyperlordosis, inflammation from trauma, etc. Microscopically, the sacrotuberous ligament tends to develop an inferior torsion and needs to be repositioned superiorly. Fibrosis of the ligaments of the coccyx is a common cause of coccydynia (coccyx pain).

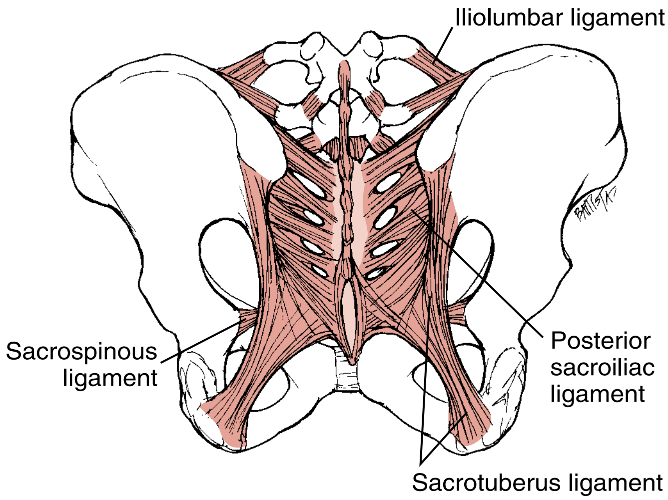

Figure 3-30. Sacrotuberous and sacrospinous ligaments.

Position

- TP—standing
- CP—side-lying, fetal position, with the top part of the client's body angled diagonally forward on the table, and the pelvic area at the edge of the table, the ischial tuberosity facing toward you

Strokes

Work three lines of strokes from the sacrum and coccyx to the ischial tuberosity.

1. Lift the G. max. muscle in short, scooping, inferior to superior (I–S) strokes from below the PSIS to the ischial tuberosity. Begin another series of I–S strokes just below the first line, from the lateral portion of the sacrum and coccyx, and again continue to the ischial tuberosity.

2. Release the sacrotuberous ligament by penetrating underneath the G. max. in the same areas as described in the previous stroke. Perform a series of deep, scooping I–S strokes, lifting this ligament superiorly (Fig. 3-31). Begin at the sacrum and coccyx and work to the ischial tuberosity.
3. Release the sacrospinous ligament from the area of the sacrococcygeal joint to the ischial spine. Perform a series of strokes, lifting the ligament superiorly.

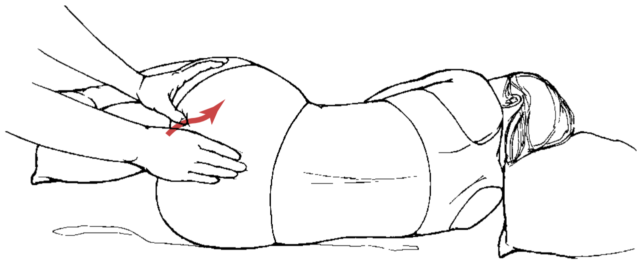

Figure 3-31. Release of the sacrotuberous ligament from the sacrum and coccyx to the ischial tuberosity.

3. Release of Piriformis, Obturator Internus, and Sciatic Nerve

- ***Anatomy***: Piriformis, inferior gemellus, quadratus femoris, superior gemellus, obturator internus, sciatic nerve (Fig. 3-32).
- ***Dysfunction***: These muscles roll into an inferior torsion, especially the obturator internus, which makes a right-angled bend under the sacrotuberous ligament at the ischial tuberosity. Lauren Berry, RPT, believed that this inferior torsion of the obturator internus and its fascia could have a tethering effect on the sciatic nerve, creating sciatica. The sciatic nerve can become entrapped under a hypertonic piriformis, which is a condition called the *piriformis syndrome*. It can also become entrapped in the space between the ischial tuberosity and the greater trochanter.

Position
- TP—standing
- CP—side lying, fetal position

Strokes
1. Palpate the piriformis and perform a CR and RI MET for this muscle. This is the same technique described in the MET section on p. 105.
2. Perform a series of lifting, scooping strokes perpendicular to the line of the fiber of the piriformis (Fig. 3-33). Begin just inferior to the PSIS and continue to the greater trochanter.

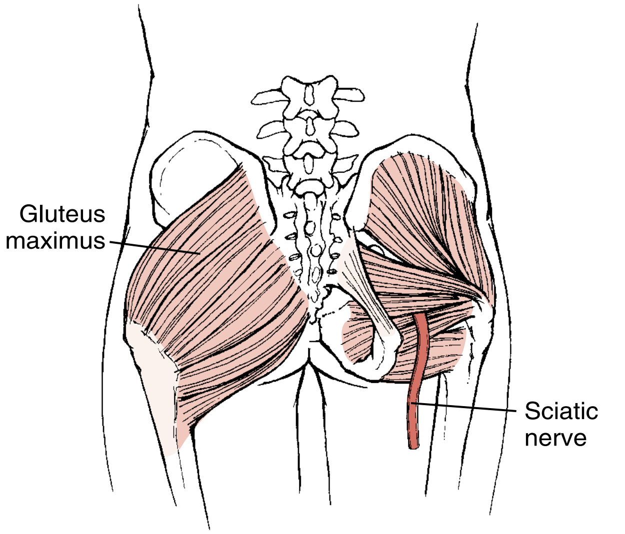

Figure 3-32. Deep rotators of the hip and the sciatic nerve.

3. Perform a series of strokes on the obturator internus along the superior and lateral border of the ischial tuberosity. Lift the soft tissue in a circular motion, scooping laterally to medially, following the contour of the bone (Fig. 3-34).
4. If your client has some mild numbing and tingling down the leg and does not have a positive SLR test, then perform a series of 1-inch scooping strokes with the thumbs, in the M–L plane, going from the lateral surface of the ischial tuberosity to the greater trochanter perpendicular to the sciatic nerve (Fig. 3-35). An entrapped sciatic nerve normally manifests some mild numbing and tingling down the leg as it is being released. *Perform this stroke no more than six times and only if it is needed.*

CAUTION: **Do not repeat this stroke if pain radiates toward the spine, as it usually indicates a nerve-root lesion, in which case crossing the nerve only aggravates the condition.**

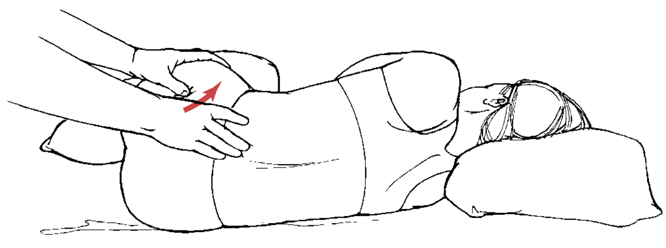

Figure 3-33. Double-thumb release of the piriformis. Begin your strokes just below the PSIS and continue to the greater trochanter.

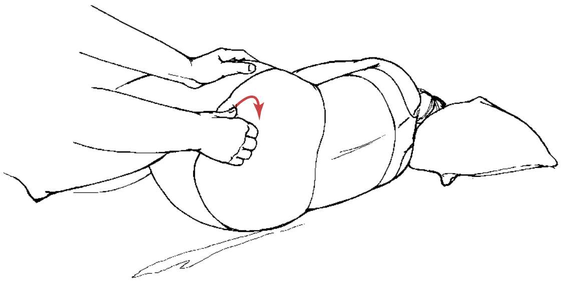

Figure 3-34. Supported thumb technique to release the obturator internus. Lift the soft tissue in a circular motion, scooping laterally to medially along the superior and lateral border of the ischial tuberosity.

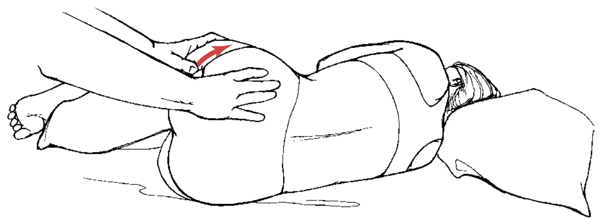

Figure 3-35. Release of a peripheral entrapment of the sciatic nerve from the trough formed between the ischial tuberosity and the greater trochanter.

4. Transverse Release of the Quadratus Lumborum

- *Anatomy*: QL (Fig. 3-36)
- *Dysfunction*: The quadratus tends to shorten with both acute and chronic lower back dysfunction. If it is in a sustained contracture on one side only, due to trauma, postural faults, etc., it will laterally flex the lumbar spine to that side, called antalgia. Antalgia may be caused by many factors, including a protruding disc.

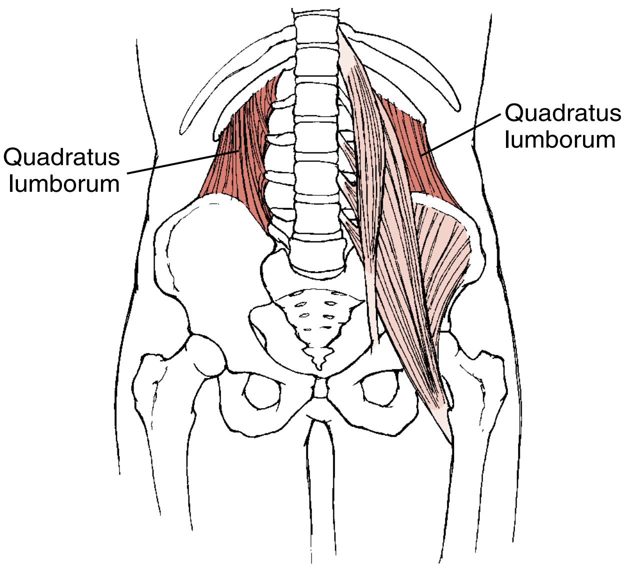

Figure 3-36. Quadratus lumborum.

Position

- TP—standing, 45° headward or 45° caudally
- CP—side lying, fetal position, with back close to edge of table

Strokes

1. Facing 45° headward, use fingertips (Fig. 3-37) or a supported thumb and place your hand just above the iliac crest lateral to the erector spinae. Perform a series of 1-inch scooping strokes on the QL in an M–L direction. The series begins at the most lateral aspect of the QL, and each new stroke begins 1 inch more medially. The supporting hand compresses the ilium headward slightly with each stroke, bringing the origin and insertion of the QL together, helping to relax the QL by turning off the muscle spindles.
2. An alternate position is to face 45° caudally and use a double-thumb technique to perform the same strokes described previously (Fig. 3-38).

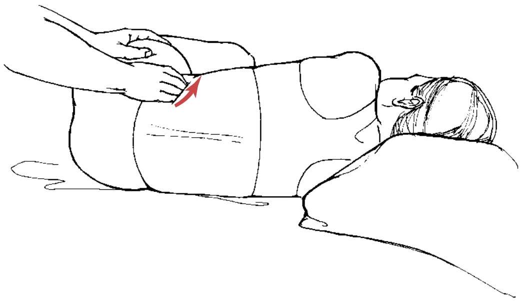

Figure 3-37. Fingertip release of the QL.

3. Begin another series of strokes approximately 1 inch superior to the last series, working into the belly of the QL. Release the entire muscle from the iliac crest to the twelfth rib.

CAUTION: Do not use strong pressure under the last rib, as the kidneys lie in this region and could be irritated by too much pressure.

Figure 3-38. Double-thumb technique to release the QL.

5. Release of the Thoracolumbar Fascia and Erector Spinae Aponeurosis

- ***Anatomy***: TLF (Fig. 3-39), erector spinae aponeurosis (tendinous sheet of attachment)
- ***Dysfunction:*** The most common form of chronic lumbosacral dysfunction is hypomobility or lack of movement. The erectors tend to be tight, compressing the facets and the intervertebral discs. This tightness dehydrates these tissues, leading to degeneration. The fascia and aponeurosis tend to shorten, dehydrate, and leading to fibrosis. The positional dysfunction of the erector spinae is a medial torsion, pulling the erectors to the midline. This pulling is demonstrated by the finding that most patients who have LBP—and most of the adult population for that matter—are in some sustained trunk flexion. Since the erectors attach toward the midline, a forward trunk increases this pulling to the midline.

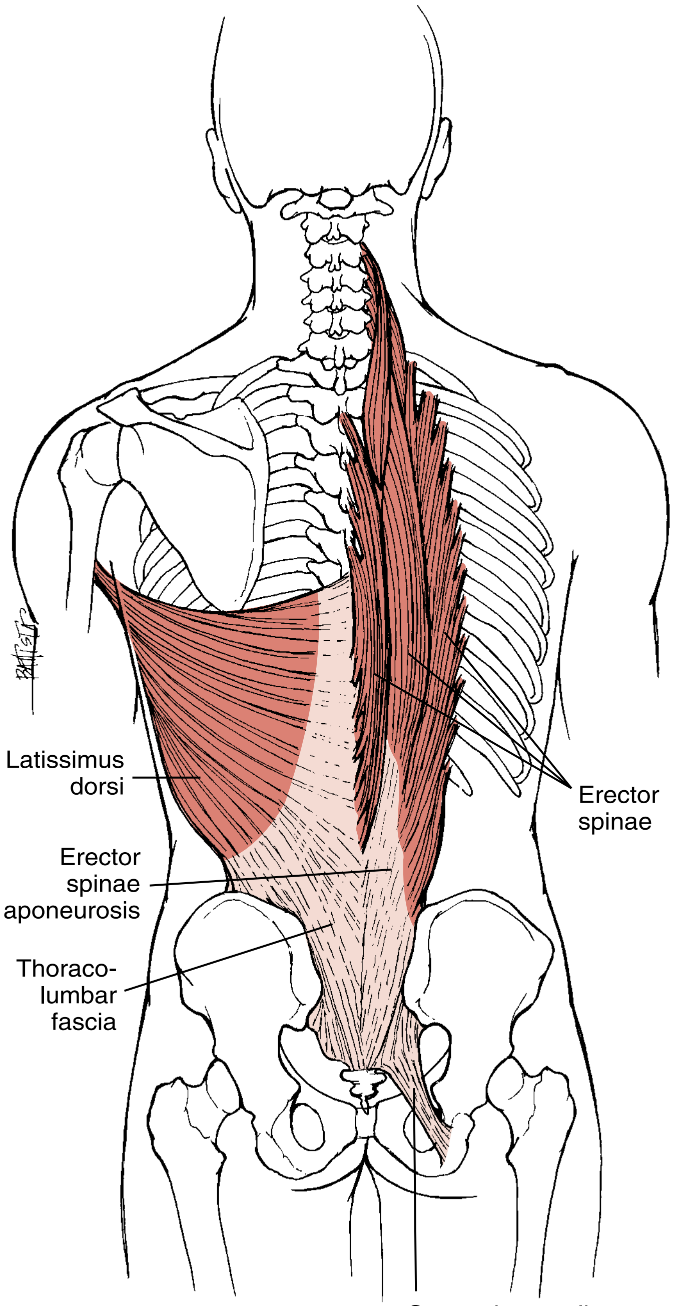

Figure 3-39. Thoracolumbar fascia and erector spinae aponeurosis.

Position

- TP—standing, facing the table at a 45° angle inferiorly for longitudinal strokes and at a 90° angle for transverse strokes; emphasize a lengthening between the thoracic cage and the pelvis
- CP—side-lying, fetal position

Strokes

There are two series of strokes, one directed caudally and the other laterally. These strokes also introduce a P–A glide into the spine. This mobilization technique promotes hydration of the facet joints, the intervertebral discs, the ligaments, and the muscles that have dehydrated due to fibrosis from previous inflammation or hypertonicity. This mobilization "resuscitates" the spine. Use gentle rocking if the client is in acute pain and deeper rocking if the client is chronic.

1. Using a supported-thumb technique, perform a series of strokes approximately 1 inch long that are directed caudally (Fig. 3-40). Begin immediately next to the spinous processes near L4, that is, near the top of the ilium, and work down to the apex of the sacrum. Begin another series approximately

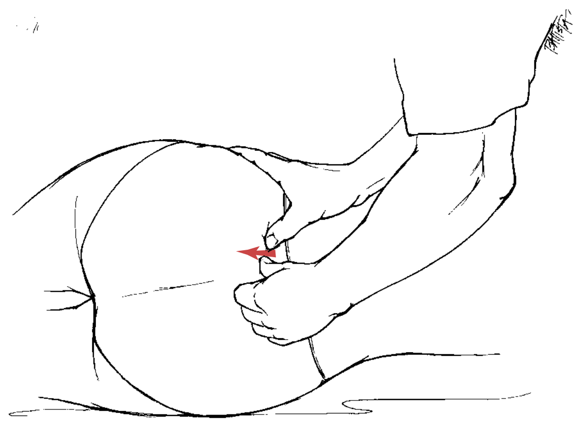

Figure 3-40. Supported-thumb technique to release the thoracolumbar fascia and erector spinae aponeurosis in a superior to inferior direction.

1 inch laterally and include the entire area between the lumbar spinous processes and the ilium. The more superficial strokes release the fascia and the aponeurosis of the erector spinae muscles. The deeper strokes affect the multifidi, ligaments, joints, and discs.

2. Using a supported-thumb technique, perform a series of transverse strokes to release the TLF and erector spinae aponeurosis, working medially to laterally (Fig. 3-41). Begin at the lumbar spinous processes, scooping laterally. Release the entire soft tissue between the lumbosacral spine and the ilium, working from L4 down to the sacral apex.

Figure 3-41. Supported-thumb technique to release the thoracolumbar fascia and erector spinae aponeurosis in an M–L direction.

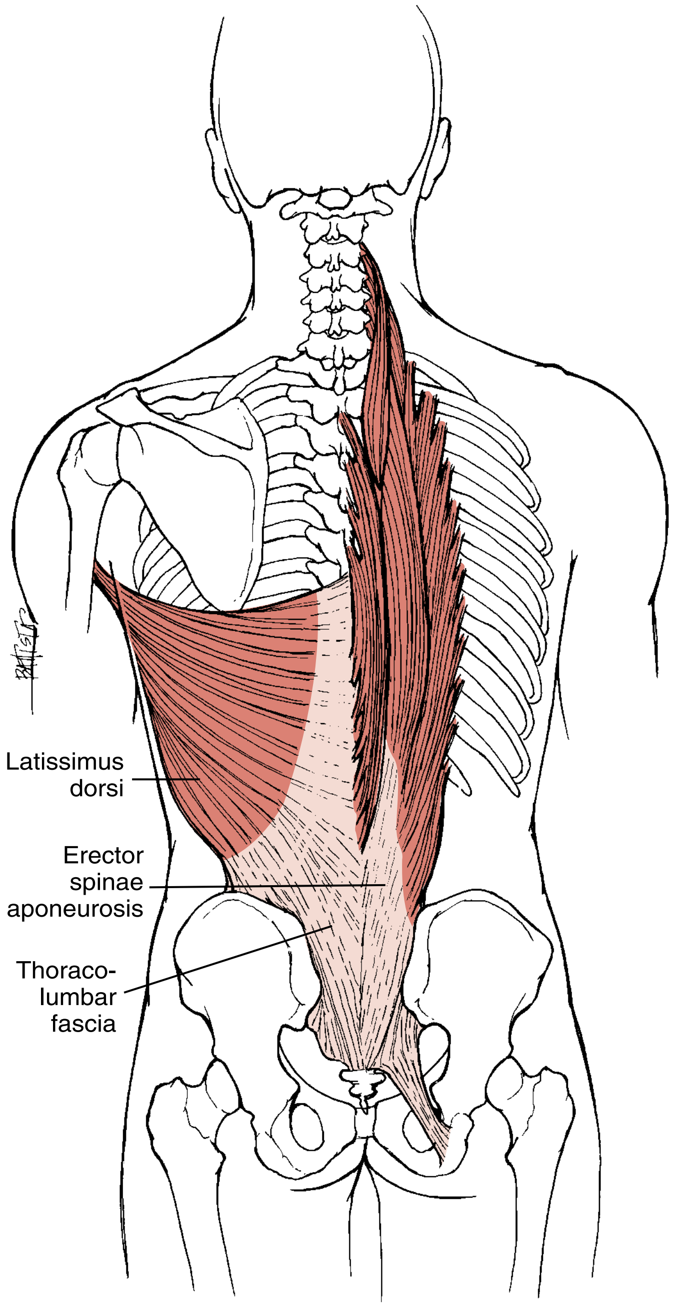

Figure 3-42. Latissimus dorsi, thoracolumbar fascia, and erector spinae.

6. Transverse and Longitudinal Release of Soft Tissue of Lumbar Spine from L4 to T12

- ***Anatomy:*** Latissimus dorsi, TLF, erector spinae (Fig. 3-42)
- ***Dysfunction:*** The latissimus dorsi is eccentrically loaded in chronic LBP; that is, it is long and tight. With the trunk typically in some sustained flexion, the latissimus contracts to assist the extensors and the TLF to which it attaches. The aponeurosis of the latissimus blends with the fascia and palpates as thickened if there is a history of LBP. A sustained contraction in the latissimus internally rotates the humerus, contributing to the position of dysfunction of the glenohumeral joint.

Position

- TP—standing, facing the table at a 45° angle headward for the longitudinal strokes and at a 90° angle for transverse strokes on the erectors
- CP—side-lying, fetal position

Strokes

There are two types of strokes in three lines. Release the TLF, latissimus, and trapezius (at T-12) superficially; release the erector spinae and multifidi deeply. These strokes are all scooping strokes approximately 1 inch long.

1. Using a supported-thumb technique, perform a series of I–S strokes beginning near L4, that is, the level of the crest of the ilium. The first line of strokes is next to the spinous process of the vertebrae (Fig. 3-43). The second line is approximately 1 to 2 inches more laterally, posterior to the transverse processes, at the longissimus attachments. The third line is 1 inch more lateral to the second line.

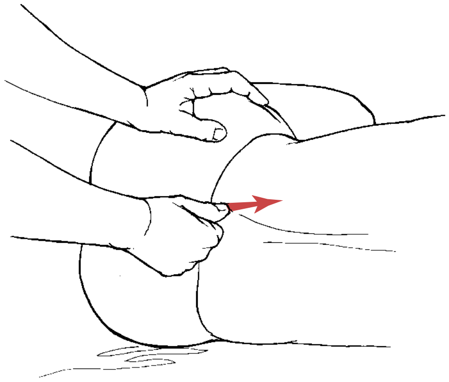

Figure 3-43. Supported-thumb technique to release the first line of the thoracolumbar fascia and erector spinae muscles in an I–S direction.

2. Perform a series of M–L strokes on the three lines described above (Fig. 3-44). The first line begins next to the spinous processes, scooping laterally in 1-inch strokes. The second line is approximately 1 to 2 inches more laterally, and the third line is approximately 2 inches more laterally, on the iliocostalis portion of the erector spinae.

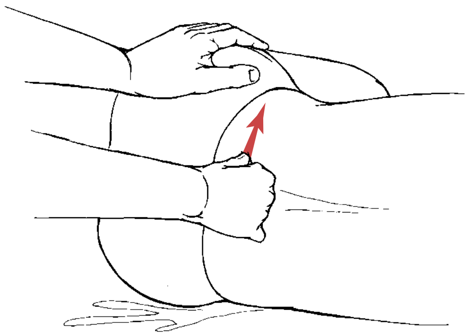

Figure 3-44. Supported-thumb technique to release the thoracolumbar fascia and erector spinae muscles in an M–L direction.

Remember: Pull the skin back 1 inch as you move onto your back leg; scoop into the tissue as you shift your body forward onto your front leg. Stay relaxed. Move your hands with each new stroke, and get into a gentle, calm rhythm as you work. These strokes are deeply relaxing when performed correctly.

7. Transverse Release of the Psoas and Iliacus

- ***Anatomy:*** Psoas major and iliacus (Fig. 3-45)
- ***Dysfunction:*** The iliopsoas tends to roll into a medial torsion, which is often demonstrated as a genu valgum (knock-knees) and pronated ankles, a common weight-distribution dysfunction. The iliopsoas tends to be tight, increasing the lordosis of the lumbar spine, which causes a compression of the lumbar facets. Sitting shortens the iliopsoas.

CAUTION: Do not perform deep iliopsoas work on a pregnant woman.

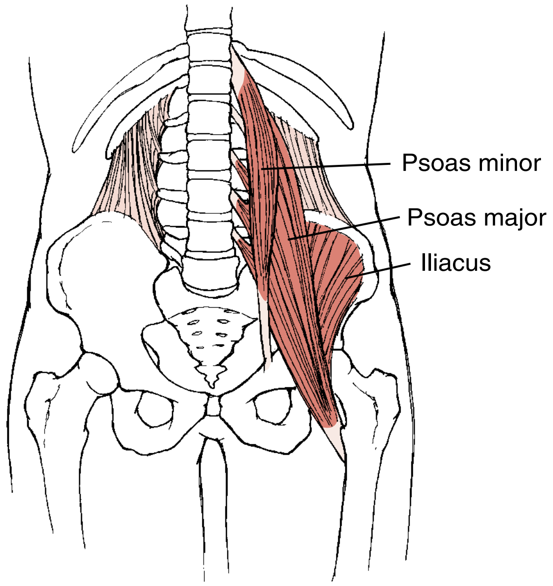

Figure 3-45. Psoas major and iliacus muscles.

Position

- TP—standing, facing the direction of your stroke
- CP—supine

Strokes

1. Palpate the psoas (Fig. 3-46) and perform CR and RI MET on the iliopsoas with the hip at 90° flexion. This MET is described in the "Muscle Energy Technique" section.
2. To release the psoas, assume a 45° headward position, flex the client's hip and knee, and stabilize the

Figure 3-46. Palpation of the psoas. Find the psoas by first placing your fingertips on the ASIS. Move medially approximately 2 to 3 inches, along the inguinal ligament. Gently roll your fingertips slowly into the abdominal tissue just over the superior surface of the ligament. Have your client begin the motion of lifting his thigh toward his chest. You will feel the psoas contract under your fingertips. If the client is ticklish or sensitive to being touched in this area, have him place his hand on top of your hand. This reduces the sensitivity.

client's lower leg against your body (Fig. 3-47). Place the fingertips of both hands on the iliopsoas; rock your body and your client's body rhythmically back and forth as you stroke back and forth on the iliopsoas, parallel to the inguinal ligament. You can also place your flexed knee on the table to stabilize the client's leg.

3. Using the same hand position described in the second stroke, palpate the iliacus by first placing your fingertips on the ASIS. Gently roll your fingertips over the bone and into the iliac fossa. Maintain contact with the iliacus covering the bone by flexing your fingertips, so as not to compress the viscera. Release the iliacus with gentle, lateral to medial, scooping strokes, following the contour of the bone, as if you are cleaning the inside of a bowl. Begin at the ASIS, and then perform another series of strokes 1 inch superiorly and continue in 1-inch segments, covering the entire iliac fossa.
4. Bring the client's hip into approximately 90° flexion. Using fingertips, scoop the iliopsoas laterally in 1-inch strokes as you move the client's hip in circles of abduction and external rotation (Fig. 3-48). This resets the muscle fasciculi. You sink into the tissue as the hip is being flexed, and scoop laterally as the hip is abducted. Then release your fingers as the thigh is being brought to the midline, and repeat the scooping stroke in a slightly new area.

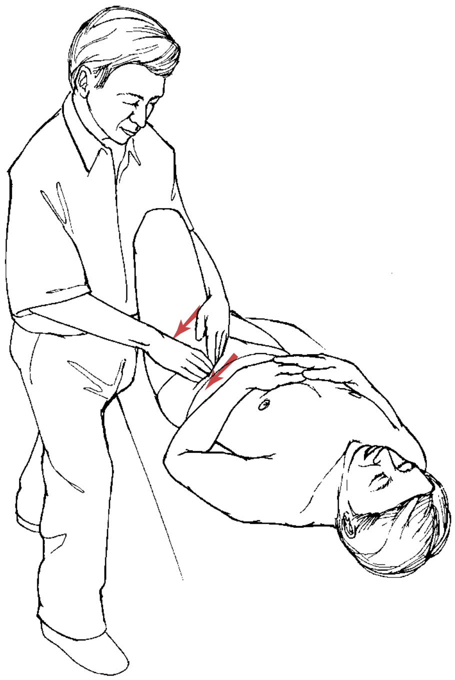

Figure 3-47. Release of the iliopsoas. Place the fingertips of both hands on the iliopsoas and move the client's entire leg with your strokes.

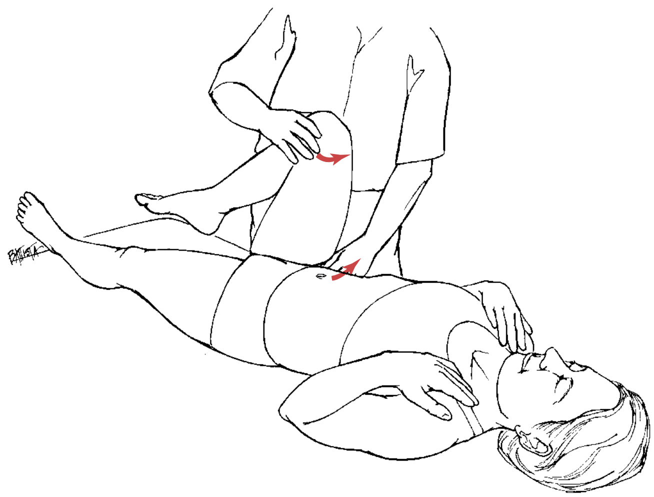

Figure 3-48. Fingertip release of the torsion of the iliopsoas. Move the hip in circles of abduction and external rotation as you roll the fibers of the iliopsoas laterally.

Level II–Lumbosacral

1. Transverse Release of Soft-Tissue Attachments to the Crest of the Ilium

- ***Anatomy***: TLF, internal and external abdominal obliques, erector spinae aponeurosis, transverse abdominus, iliocostalis lumborum, QL (Fig. 3-49).
- ***Dysfunction***: The iliac crest is a significant attachment site for fascia and muscles, and acts as a stabilizer for the pelvis and the lumbar spine. The soft tissue here thickens with chronic irritation associated with injuries and dysfunctions of the lumbosacral spine. The abdominal muscles can be strained at their attachments to the lateral iliac crest, called a "hip-pointer" injury. This area also thickens due to chronic muscle imbalance.

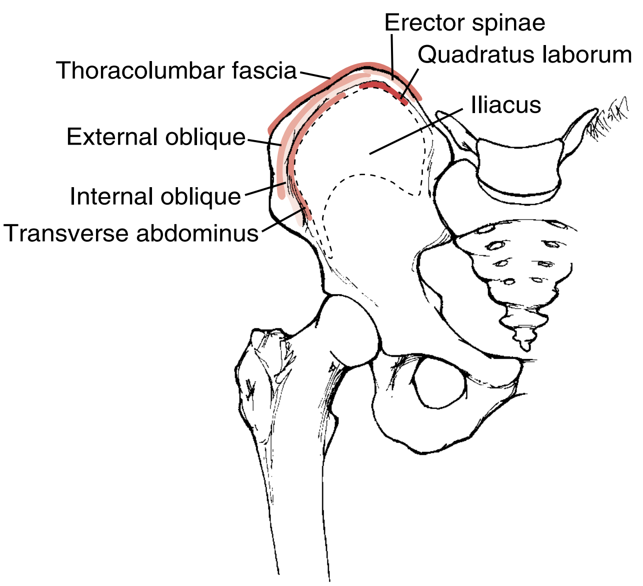

Figure 3-49. Soft-tissue attachments on the iliac crest. From superficial to deep: thoracolumbar fascia, erector spinae aponeurosis, iliocostalis lumborum, external and internal abdominal obliques, the transverse abdominus, and the QL.

Position

- TP—standing, 90° to the crest of the ilium or 45° caudally
- CP—supine; or side-lying, fetal position

Strokes

From superficial to deep, the attachments on the iliac crest are TLF, which blends with the aponeurosis of the latissimus dorsi, iliocostalis lumborum, external abdominal oblique, internal abdominal oblique, transverse abdominus, the QL, and the iliolumbar ligament.

1. Facing 45° inferiorly and using a double (Fig. 3-50) or supported-thumb technique, perform a series of 1-inch scooping strokes in an M–L direction along the crest of the ilium. Begin at the lateral aspect of the external lip of the iliac crest, and move in 1-inch segments more medially with each new stroke. The intention is to "clean the bone." Your strokes should move along the surface of the bone without digging into the bone. A healthy attachment site feels glistening and smooth. Tissue that has been under excessive load or that has been injured feels fibrotic.

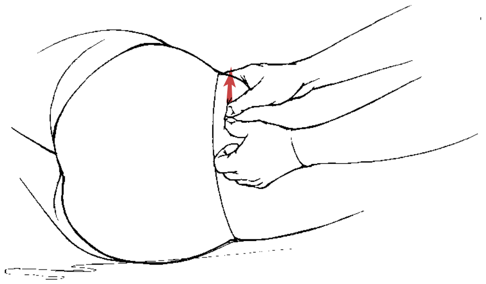

Figure 3-50. Double-thumb technique to release the crest of the ilium.

2. Repeat the same stroke in two more lines on the intermediate and internal lip of the iliac crest. Your body faces more caudally with these strokes. As you perform these strokes, move the entire pelvis into an inferior traction.
3. To release the abdominal attachments from the lateral portion of the iliac crest, ask your client to lie on his or her back, with legs extended. You may place a pillow under the client's knees. Using fingertips over thumb technique, perform scooping strokes from anterior to posterior on the iliac crest (Fig. 3-51). Begin the strokes on the most posterior portion of this area, and move more anteriorly with your strokes.

Figure 3-51. Release of the abdominal attachments to the lateral aspect of the ilium.

2. Transverse Release of the Soft-Tissue Attachments to the Posterior Superior Iliac Spine

- ***Anatomy:*** Thoracic fibers of iliocostalis lumborum, lumbar fibers of the iliocostalis, lumbar fibers of longissimus (Fig. 3-52).
- ***Dysfunction:*** As mentioned in the anatomy section, Bogduk and Twomey[10] has described a superficial and deep portion of the erector spinae. Now the attachments of the deep portion are addressed. These muscles stabilize the lumbar spine and act to prevent anterior shear of the vertebrae relative to the sacrum and ilium.[2] Injury or dysfunction shortens and thickens soft tissue. Attachment points dry out, becoming ischemic and eventually fibrous. The intention is to dissolve the fibrosis, broadening and rehydrating the tissue.

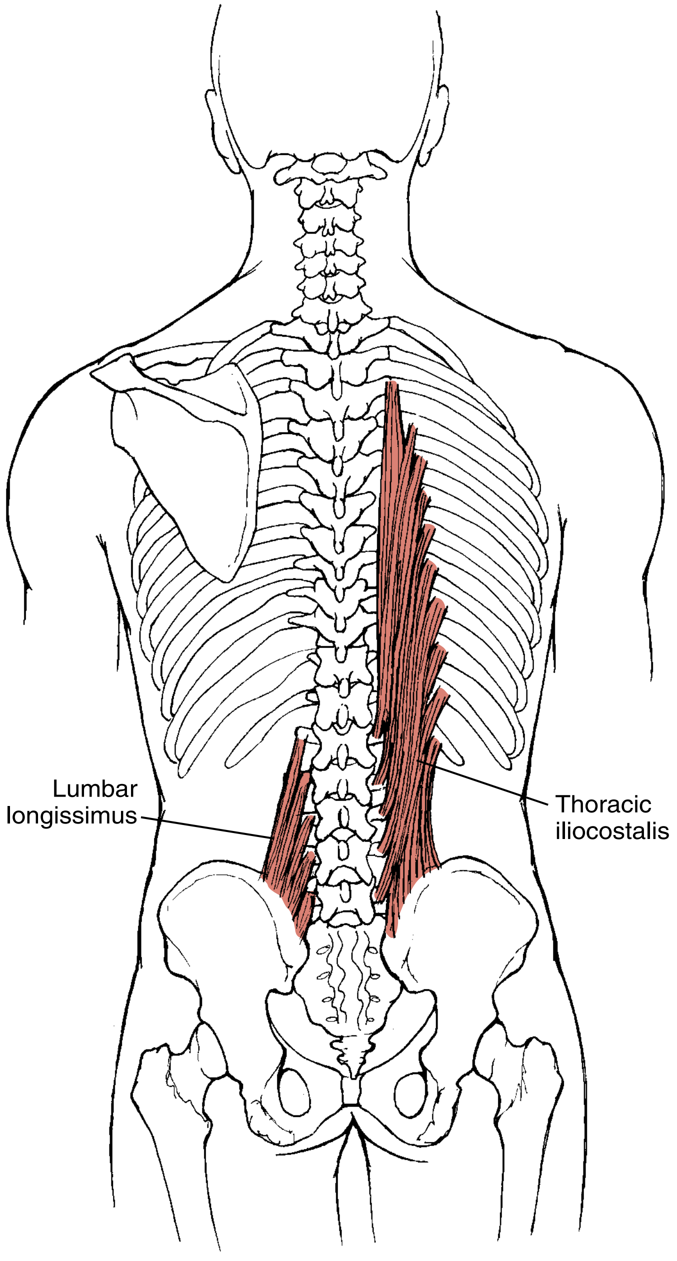

Figure 3-52. Deep portion of the erector spinae muscles. Shown here are the thoracic fibers of the iliocostalis lumborum, the lumbar fibers of the iliocostalis, and the lumbar fibers of the longissimus.

Position

- TP—standing, facing the direction of your stroke
- CP—side-lying, fetal position

Strokes

We use a double- or supported-thumb technique and follow the contour of the bone with our strokes. We are working on the tenoperiosteal attachments of the above muscles to the PSIS. The following strokes are from superficial to deep.

1. Facing slightly headward, perform a series of M–L scooping strokes on the lateral portion of the PSIS and the adjoining portion of the iliac crest (Fig. 3-53). This releases the thoracic fibers of the iliocostalis.
2. To release the lumbar fibers of the iliocostalis, perform a series of 1-inch scooping strokes in an I–S direction on the superior, medial, and inferior aspect of the PSIS. Follow the contour of the bone.
3. Working in the same area as the previous stroke, but more deeply, perform a series of scooping strokes on the deepest portion of the medial aspect of the PSIS. These strokes release the lumbar fibers of the longissimus, which are the deepest muscle fibers attaching to the PSIS.

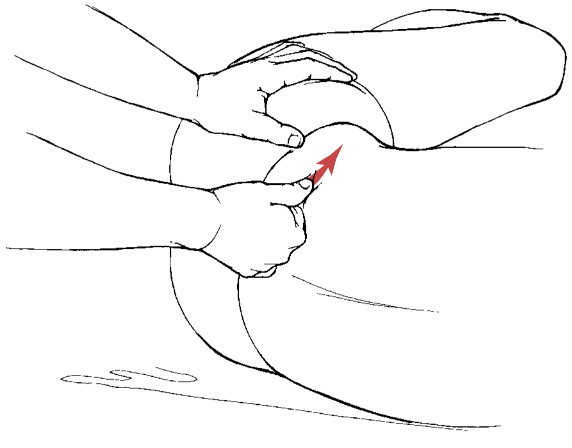

Figure 3-53. Supported-thumb technique to release the lateral portion of the iliac crest and the lateral portion of the PSIS.

3. Release of the Soft-Tissue Attachments to the Sacrum

- ***Anatomy***: From superficial to deep, the attachments on the sacral base are TLF, thoracic fibers of longissimus, multifidus, posterior sacroiliac ligaments which are next to the bone (Fig. 3-54).

As the thoracic fibers of longissimus run headward, they angle approximately 10° to 15° laterally. Deep to the fibers of the longissimus is the multifidus. The muscle mass you palpate medial to the PSIS is the multifidus.

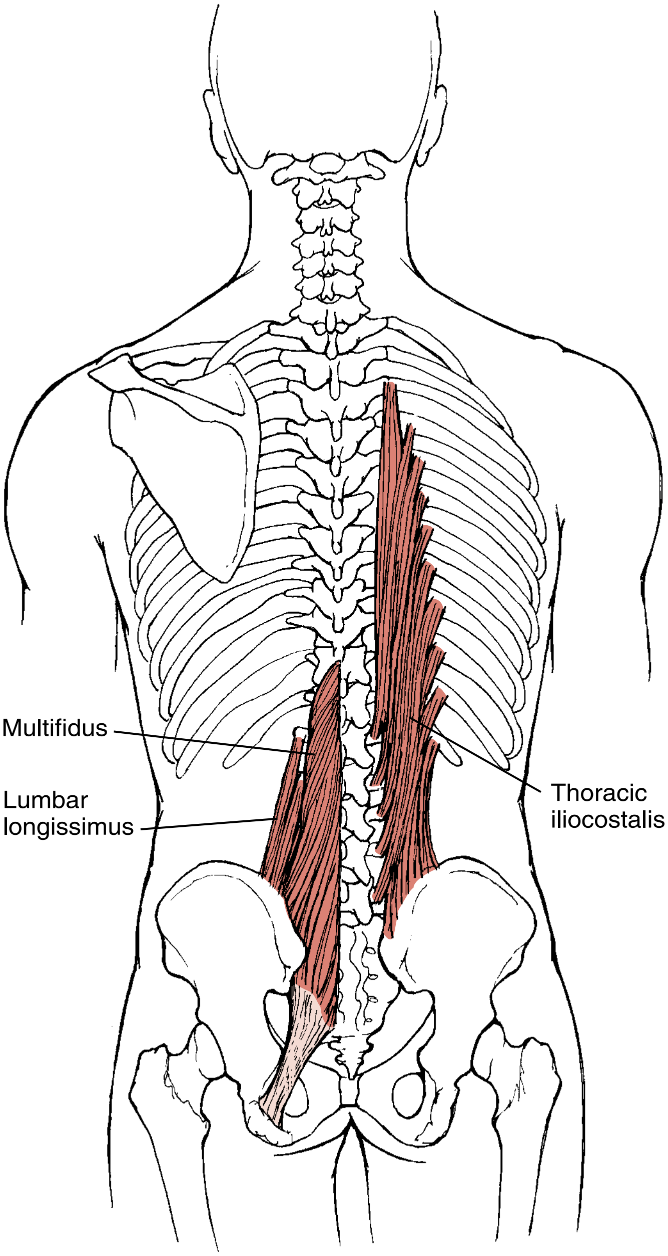

Figure 3-54. From superficial to deep, the attachments to the sacrum are the thoracolumbar fascia, the thoracic fibers of longissimus, the multifidi, and the posterior sacroiliac ligaments.

- ***Dysfunction***: Soft tissue tends to shorten and become fibrotic with overuse or injury. The multifidus attaches to the joint capsules of the vertebral facets, and releasing the multifidus at the sacrum assists in the release of the lumbar facets.

Position

- TP—standing, facing direction of stroke
- CP—side lying, fetal position

Strokes

1. To release the thoracic fibers of longissimus, use the supported-thumb technique. Face caudally and place your working hand just medial to the PSIS at the superior part of the sacrum (Fig. 3-55). Your supporting hand is on the ilium next to the working hand. Perform a series of 1-inch scooping strokes that are angled in a slightly inferior direction. Your first stroke is next to the PSIS, and each new stroke begins a little closer to the midline of the sacrum. The second line of strokes begins slightly below the first line. Work in 1-inch segments to the lowest part (apex) of the sacrum, covering one-half of the entire sacrum.

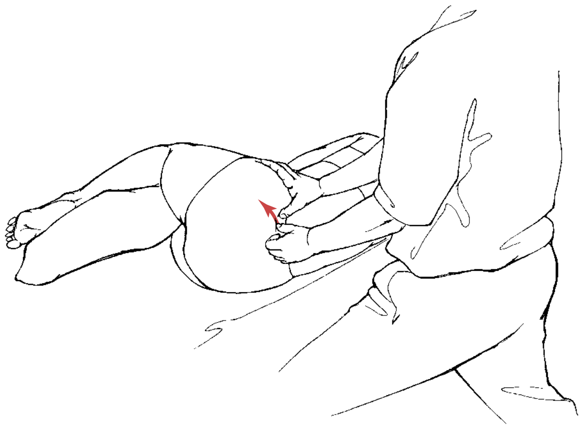

Figure 3-55. Release of the thoracic fibers of the longissimus. Use a supported-thumb technique and perform a series of M–L strokes that are angled slightly inferior.

2. Next, stand in the 45° headward position. Using the supported-thumb technique, perform a series of 1-inch, scooping strokes in an approximately 45° headward direction (Fig. 3-56). To release the multifidi attachments on the sacral base, work at a

deeper level than the previous stroke. Begin just medial to the PSIS, scoop M–L in 1-inch strokes, and work to the midline of the sacrum. Cover one-half of the entire sacrum.

3. Using the same hand technique, perform short, back and forth strokes at various angles for the posterior sacroiliac ligaments. Place your supporting hand on the ilium, and rock the client's body in short oscillations with each stroke. Use your palpation skills to feel for thickened, fibrous tissue. The thicker the tissue, the deeper the transverse strokes to broaden and rehydrate the tissue. These deep strokes on the ligaments are used only as needed to release fibrotic tissue.

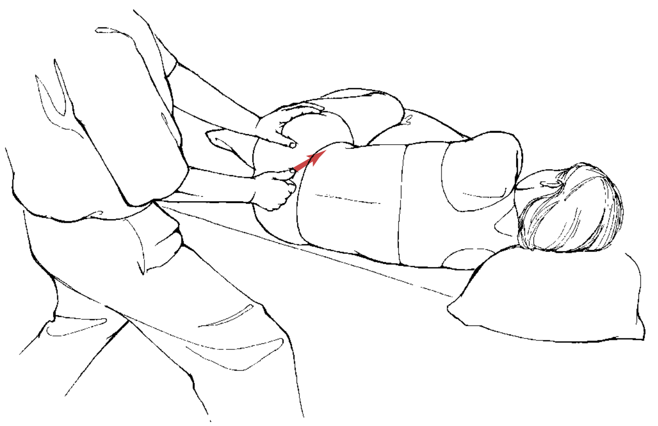

Figure 3-56. Release of the multifidi. Standing in a 45° headward stance, scoop in an M–L direction.

4. Release of Multifidi and Rotatores from L5 to L1

- ***Anatomy:*** multifidus, rotatores (Fig. 3-57)
- ***Dysfunction:*** The multifidi and rotatores attach to the joint capsule and are often strained in back injuries. They either develop a sustained contraction, leading to dehydration and fibrosis, or become inhibited, leading to atrophy and destabilization of the lumbar spine. You must be able to palpate the difference, as it is contraindicated to work deeply on atrophied tissue.

Position

- TP—standing, facing headward
- CP—side-lying, fetal position

Strokes

1. To release the multifidus and rotatores from the area between L5 and L1, use a supported- or double-thumb technique (Fig. 3-58). Stand in the 45° headward stance. Begin near the spinous process of L5, and perform a series of strokes in a 45° headward direction. Scoop under the erector spinae, working transverse to the line of the fiber of the multifidi and rotatores.

CAUTION: These next strokes are for chronic conditions only.

2. To release the soft tissue attachments on the lateral aspect of the lumbar spinous processes, stand facing the table or in a 45° headward stance. In the

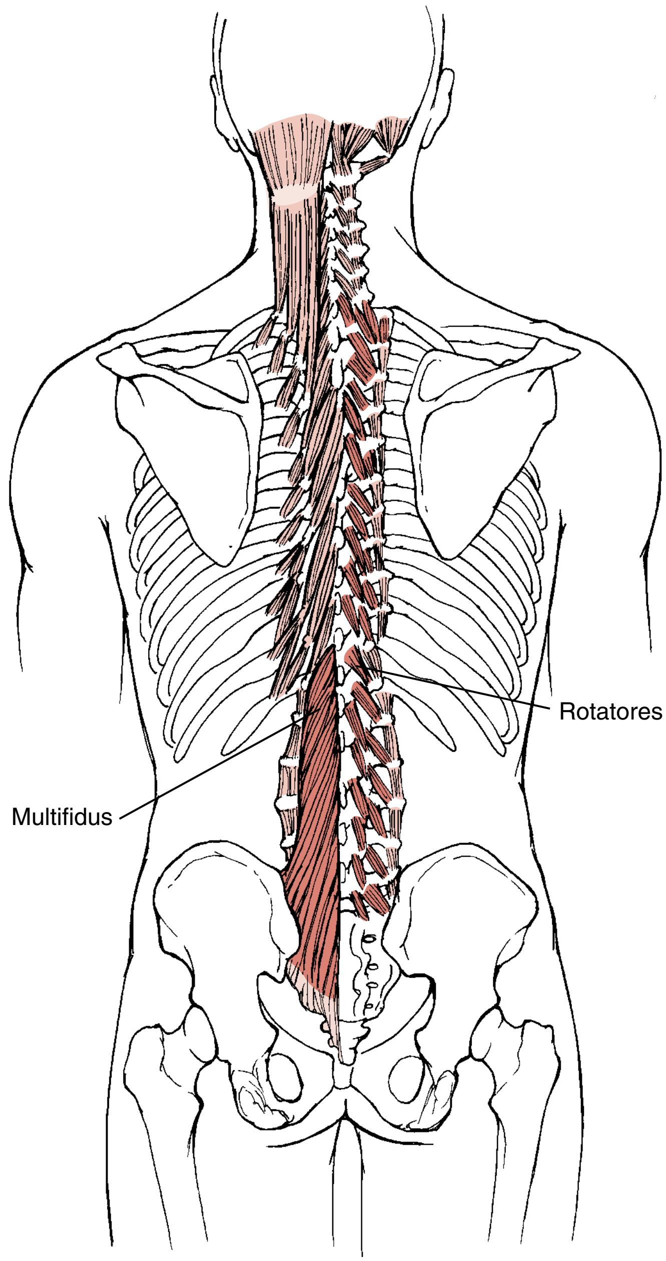

Figure 3-57. Multifidi and rotatores.

lumbar spine the spinous processes are angles almost straight posteriorly. Using a supported-thumb position, perform a series of 1-inch back and forth strokes in the I–S plane on the spinous processes. The bone is cleaned with strokes that scoop across the bone. Do not press into the bone. Work on each spinous process, from L5 to L1.

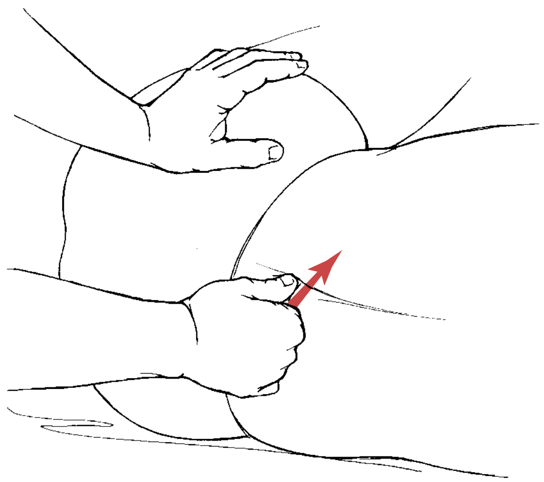

Figure 3-58. Supported-thumb release of the multifidi and rotatores.

5. Transverse Release of Iliolumbar Ligaments and Deep Lamina of the Thoracolumbar Fascia

- ***Anatomy:*** Middle and deep layers of the TLF (alar ligaments) (Fig. 3-59), iliolumbar ligaments (Fig. 3-60).
- ***Dysfunction***: L4 and L5 vertebrae experience the greatest stress in the lumbar spine because the lumbar lordosis tips these vertebrae down, creating a

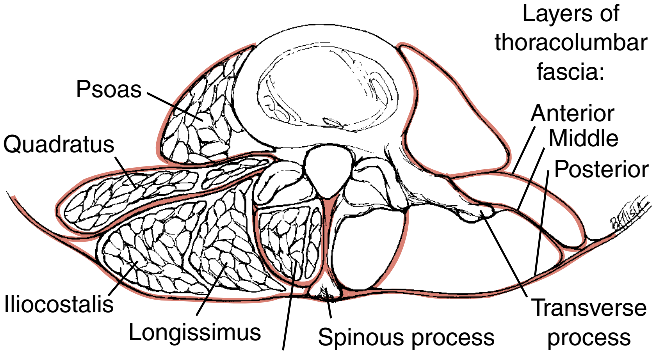

Figure 3-59. Anterior, middle, and deep layers of the thoracolumbar fascia. The three layers travel from the spinous and transverse processes of the lumbar vertebrae to the ilium.

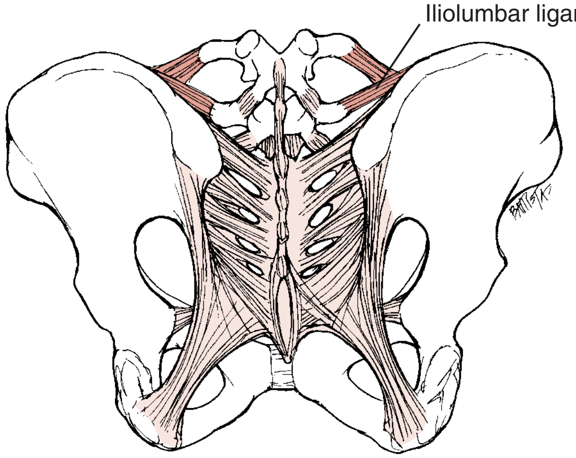

Figure 3-60. Iliolumbar ligaments.

shear. The iliolumbar ligaments provide stability to the SIJ and the L5–S1 vertebrae. These ligaments shorten and thicken in chronic LBP. The deep lamina of the TLF travels from the lumbar transverse processes to the ilium.

Position

- TP—standing, facing headward
- CP—side-lying, fetal position; you may need to increase the lumbar curve slightly by bringing the knees away from the client's chest slightly to put the erector muscles in more slack.

Strokes

Now you are working the deepest layers of soft tissue between the medial aspect of the ilium and the spinous and transverse processes on the lowest lumbar vertebrae. The intention is to scoop transverse to the line of the fiber, broadening these fibers to release any fibrosis. It takes a great deal of preparation to work this deeply. These strokes are for chronic conditions only.

1. Using the supported-thumb position (Fig. 3-61), place your working hand next to the spinous process of L4, which is at the level of the iliac crest. Your supporting hand rests on the ilium. Perform a series of 1-inch scooping strokes in a superior direction between the L4 vertebra and the sacrum, transverse on the deep lamina of the TLF and iliolumbar ligaments. As you move onto your back leg gathering your chi, pull the client's ilium back with you slightly. As you scoop into the tissue, push the client's ilium toward your working hand. This brings the erectors into slack and allows for deeper work.

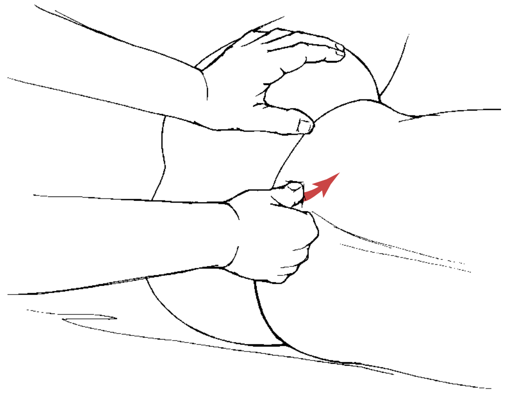

Figure 3-61. Supported-thumb release in three lines for the middle and deep layers of the thoracolumbar fascia and the iliolumbar ligaments.

2. The second line of strokes begins at the L4 area again, but approximately 1 inch lateral to the first line. Perform another series of 1-inch scooping strokes in the superior direction. Continue your series of strokes to the top of the sacrum (sacral base).
3. The third line of strokes is along the medial aspect of the ilium, at the level of L4 and L5. You are now cleaning the bone to release any fibrosis. Scoop next to the bone, not into the bone. Rock your entire body and your client's body as you perform your strokes. If you find fibrotic tissue, your strokes may become more brisk, but always maintain the rocking movement.

CASE STUDY

MB is a 45-year-old, 5'6", 210 lb female accounting supervisor who presented with pain, numbing, and tingling in the left lateral thigh and calf. She reported that the pain began approximately 3 months previously, without any incident. She stated that she had one previous episode approximately 18 months prior to our visit. Again, there was no incident, and it resolved in a few weeks. She said that the pain was worse in the morning, that sitting made it worse, and lying on her back was relieving. She had x-rays taken after the first episode, but the alignment and disc spaces were normal. Prior to our visit, she had received a series of acupuncture and physical therapy treatments, but they were only temporarily relieving.

Examination revealed an elevated ilium on the right side in standing. The spinal curves were normal in the posterior and lateral views. The lumbar ranges of motion were normal, without any pain. The Kemps test was normal. Motor strength testing revealed a moderate weakness in the left hip flexors (iliopsoas), but no pain. The SLR test was normal. Length testing showed that she had a short iliopsoas and piriformis on the left, and the piriformis test elicited symptoms into the left thigh and leg.

A diagnosis was made of piriformis syndrome. Treatment began on the noninvolved iliopsoas with the client supine. Both knees were flexed, her feet on the table. A CR MET was performed for five cycles on the iliopsoas and hip extensors, with the hip in 90° of flexion. Manual work to release the iliopsoas was performed for a few minutes. The same work on the symptomatic iliopsoas was performed. She was asked to move into the fetal position, with the noninvolved side up. CR MET was then performed on the piriformis by having her lift her leg off the pillow for 5 seconds and RI on the adductors by having her squeeze her knees together for 5 seconds. This cycle was repeated for five times. Then, she was asked to roll onto her other side, and the same CR technique was performed on the involved piriformis. Next, she was asked to roll onto her back again, knees up, feet on the table. PIR MET was performed on the involved piriformis to lengthen it. She was shown a simple piriformis-stretching exercise that she could do at home.

MB returned to the office 1 week later for a follow-up and said that she had only slight, occasional symptoms, even after a long drive. She was treated again with the same protocol as described above, and in a follow-up 1 week later, she was asymptomatic. She was encouraged to begin an exercise program, and recommendations for future treatment were on an as-needed basis.

STUDY GUIDE

Lumbosacral Spine, Level I

1. List the names of the muscles in the seven layers of the back, from superficial to deep.
2. Describe the basic origins and insertions of the erector spinae, the psoas, and the QL.
3. Describe the difference between the signs and the symptoms of muscle strain, facet syndrome, disc degeneration, and disc herniation.
4. Describe the MET used for acute LBP.
5. Describe the positional dysfunction of the erector spinae and psoas, and the directions of a therapist's strokes.
6. What is the stroke direction for the sacrotuberous and sacrospinous ligaments?
7. Explain the intention of MET and how to perform MET to release the hypertonic lumbar extensors, piriformis, and QL.
8. What muscles are tight and what muscles are weak in the lower-crossed syndrome?
9. List three major factors that predispose a person to an episode of acute low back pain.
10. List what functional factors predispose to LBP.

Lumbosacral Spine, Level II

1. Describe the basic origins and insertions of the piriformis, gluteals, and multifidus muscle.
2. Describe the main muscles responsible for an increased lumbar curve, and a decreased lumbar curve.
3. Describe the length assessment test and PIR MET for the iliopsoas.
4. List the attachments on the crest of the ilium, from superficial to deep.
5. List three factors that affect the diameter of the IVF.
6. List what attaches to the sacral base, from superficial to deep.
7. Describe the direction of our stroke to release the multifidi and rotatores.
8. Explain how abnormal muscle function can predispose a person to an episode of LBP.
9. Describe the two types of referral of pain and their causes.
10. Describe the SLR test. What are the implications of a positive test?

REFERENCES

1. Kaul M, Herring SA. Rehabilitation of lumbar spine injuries. In: Kibler WB, Herring SA, Press JM, eds. Functional Rehabilitation of Sports and Musculoskeletal Injuries. Gaithersburg, MD: Aspen, 1998:188–215.
2. Porterfield JA, DeRosa C. Mechanical Low Back Pain. Philadelphia: WB Saunders, 1991.
3. Mooney V. Sacroiliac joint dysfunction. In: Vleeming A, Mooney V, Dorman T, Snijders CJ, Stoeckart R, eds. Movement, Stability, and Low Back Pain. New York: Churchill Livingstone, 1997:37–52.
4. Swenson R. A medical approach to the differential diagnosis of low back pain. Journal of the Neuromusculoskeletal System 1998;6:100–113.
5. Cailliet R. Low Back Pain Syndrome. Philadelphia: FA Davis, 1995.
6. Willard FH. The muscular, ligamentous and neural structure of the low back and its relation to low back pain. In: Vleeming A, Mooney V, Dorman T, Snijders CJ, Stoeckart R, eds. Movement, Stability, and Low Back Pain. New York: Churchill Livingstone, 1997:3–35.
7. Freeman MA, Dean MR, Hanham IW. The etiology and prevention of functional instability of the foot. J Bone Joint Surg Br 1965;47:678–685.
8. Kirkaldy-Willis WH, Bernard TN Jr. Managing Low Back Pain, 4th Ed. New York: Churchill Livingstone, 1999.
9. Jull GA, Janda V. Muscles and motor control in low back pain: assessment and management. In: Twomey L, Taylor JR, eds. Physical Therapy of the Low Back. New York: Churchill Livingstone, 1987:253–278.
10. Bogduk N, Twomey L. Clinical Anatomy of the Lumbar Spine, 3rd Ed. London: Churchill Livingstone, 1998.

SUGGESTED READINGS

Calais-Germain B. Anatomy of Movement. Seattle: Eastland Press, 1991.

Chaitow L. Muscle Energy Techniques. New York: Churchill Livingstone, 1996.

Clemente C. Anatomy: A Regional Atlas of the Human Body, 4th Ed. Baltimore: Williams & Wilkins, 1997.

Corrigan B, Maitland GD. Practical Orthopaedic Medicine. London: Butterworths, 1983.

Greenman PE. Principles of Manual Medicine, 2nd Ed. Baltimore: Williams & Wilkins, 1996.

Kendall F, McCreary E, Provance P. Muscles: Testing and Function, 4th Ed. Baltimore: Williams & Wilkins, 1993.

Kessler R, Hertling D. Management of Common Musculoskeletal Disorders, 3rd Ed. Baltimore: Williams & Wilkins, 1993.

Lewit K. Manipulative Therapy in Rehabilitation on the Locomotor System, 3rd Ed. Oxford: Butterworth Heinemann, 1999.

Liebenson C. Rehabilitation of the Spine. Baltimore: Williams & Wilkins, 1996.

Magee D. Orthopedic Physical Assessment, 3rd Ed. Philadelphia: WB Saunders, 1997.

Norkin C, Levangie P. Joint Structure and Function, 2nd Ed. Philadelphia: FA Davis, 1992.

Platzer W. Locomotor System, vol 1, 4th Ed. New York: Thieme Medical, 1992.

Reid DC. Sports Injury and Assessment. New York: Churchill Livingstone, 1992.