Integrating Science With Technique

INFORM YOUR APPROACH TO DELIVER MORE EFFECTIVE BODYWORK

IT ALL STEMS FROM ANATOMY

Anatomy, or structure, is the fundamental key for all manual and movement therapy. From anatomy, everything else follows: physiology (function), pathophysiology (altered function), assessment, and treatment.

Let's illustrate this using the coracobrachialis muscle as our example. The anatomy of the coracobrachialis is that it attaches from the coracoid process of the scapula to the medial surface of the humerus. From this, we can deduce that it crosses the glenohumeral (GH) joint anteriorly and medially, telling us that this muscle flexes and adducts the arm at the GH joint. Therefore, we now know the muscle's actions (physiology). Knowing this tells us what its pathophysiology would be. If the coracobrachialis were tight, in addition to perhaps causing local and/or referred pain when palpated, it would likely limit the ability of the arm to move into extension and/or abduction. Assessment would also follow: we simply challenge the muscle to stretch by moving the arm into extension and abduction, and look for decreased range of motion. Further, we could use our knowledge of the attachments and actions of the muscle to palpate it and determine the integrity of its tissue. Treatment would follow by performing manual therapy and stretching to loosen and lengthen the coracobrachialis.

Even though anatomy course work can feel like a memory game while in school, the effort spent to learn anatomy pays dividends many times over. I view anatomy education as the dues that must be paid to be able to reason through the physiology, pathophysiology, assessment, and treatment necessary for effective clinical orthopedic manual therapy. From a teaching point of view, anatomy can become vibrant and enchanting if the instructor and the learning resources apply the anatomy to the actual assessment and treatment techniques that form the profession—in effect integrating the science content with the hands-on content.

By Joseph E. Muscolino, DC

1

All muscles that cross the hip joint anteriorly with a vertical component to their fiber direction are hip joint flexors. *Muscolino, Joseph E.* The Muscular System Manual, *3rd ed. Elsevier, 2010.*

Do you bring science to your massage table and to your hands-on work? Or do you treat them exclusively from one another?

In some schools, science and technique are taught independently from each other, sometimes leaving practitioners without the important interfacing of disciplines that could positively inform their work.

With a true integration of science and manual therapy, new therapists are empowered to think critically, creatively applying their assessment and treatment techniques to address a client's needs.

CLINICAL ORTHOPEDIC MANUAL THERAPY

A disconnect between the sciences and hands-on work may not be of the utmost importance when manual therapy is done for the purpose of relaxation, but it matters greatly if clinical orthopedic manual therapy (COMT)—sometimes referred to as *medical massage*—is being performed. COMT's goal is to remedy a specific musculoskeletal condition with which the client presents. This requires an understanding of the mechanism of the client's condition, as well as an understanding of the mechanisms of the appropriate assessment and treatment techniques. It also requires a clear understanding of the science—in other words, the structure and function of myofascial tissue. In these circumstances, a disconnect between science knowledge and hands-on knowledge can result in therapists being less able to render effective and successful manual therapy for their clients.

INTEGRATING SCIENCE AND HANDS-ON WORK

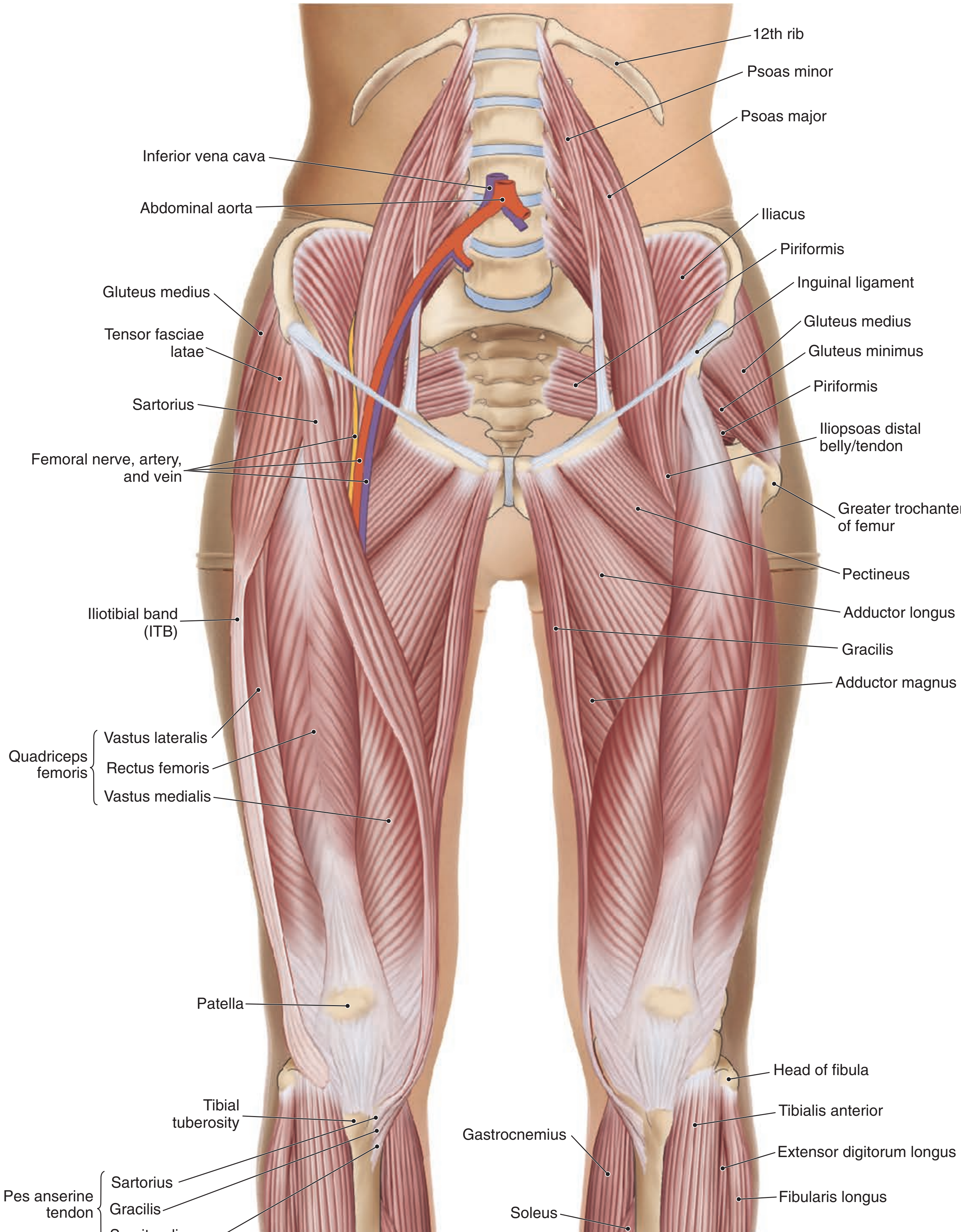
Following are examples of how the knowledge and understanding of the science of myofascial tissue can lead to an enrichment and empowerment of our skills as manual therapists.

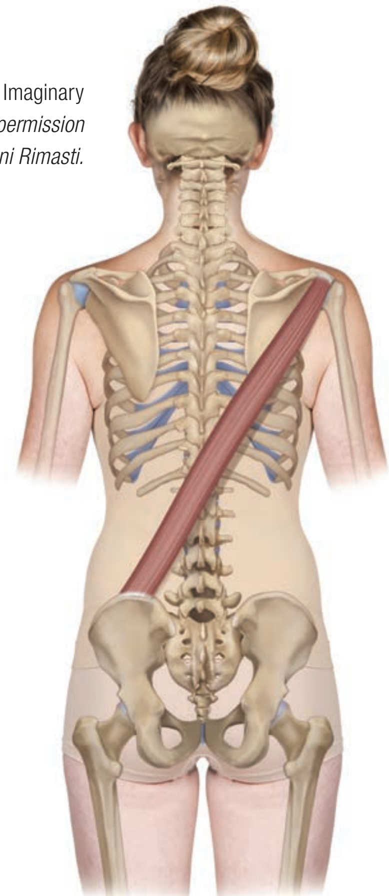
Understanding Versus Memorizing

Having a command of the actions of muscles is critically important to both assessment and treatment techniques. When learning anatomy as students, we are first confronted with two tasks: learning the attachments of the muscle and learning its actions. I believe this work can be cut in half if an understanding of muscle function is applied at the same time, which is why most schools teach kinesiology in addition to anatomy.

At its essence, a muscle is a pulling machine. When it contracts, it creates a pulling force toward its center. It is as simple as that. Therefore, if we look at the line of the pull of the muscle compared to the joint it crosses, we can figure out the action(s) of the muscle.

For example, every muscle that crosses the hip joint anteriorly with a vertical component to its fiber direction can flex the thigh at the hip joint. Instead of memorizing this joint action individually for each and every muscle that crosses the hip anteriorly (i.e., the tensor fasciae latae, rectus femoris, sartorius, iliacus, psoas major, etc.), this one concept can be applied to all the muscles in the front of the hip. So, if we know that a muscle crosses the hip joint anteriorly with a vertical component to its fiber direction, we know it is a hip flexor (Image 1). Similarly, all muscles that cross the hip joint posteriorly, with a vertical component to their fiber direction, can extend the thigh at the hip joint.


12th rib
Psoas minor
Psoas major
Inferior vena cava
Abdominal aorta
Iliacus
Piriformis
Inguinal ligament
Gluteus medius
Gluteus medius
Tensor fasciae latae
Gluteus minimus
Piriformis
Sartorius
Iliopsoas distal belly/tendon
Femoral nerve, artery, and vein
Greater trochanter of femur
Pectineus
Adductor longus
Iliotibial band (ITB)
Gracilis
Adductor magnus
Quadriceps femoris
Vastus lateralis
Rectus femoris
Vastus medialis
Patella
Head of fibula
Tibial tuberosity
Tibialis anterior
Gastrocnemius
Extensor digitorum longus
Fibularis longus
Pes anserine tendon
Sartorius
Gracilis
Semitendinosus
Soleus



Can you figure out its actions? See the Imaginary Muscle Exercise at right. *Reproduced with permission from Joseph E. Muscolino. Artwork by Giovanni Rimasti.*

The idea is that instead of trying to learn and memorize the actions for each of the many, many muscles of the body, we can learn muscle actions by placing muscles into their functional groups based on their location. For example, hip flexors are in front, extensors are in back, abductors are on the outside, and adductors are on the inside (rotators do not fall as neatly into functional groups based on location, but can still be understood by looking at the direction in which they wrap around the hip joint). And these functional groups can be combined. For example, if a muscle is in front and toward the outside, it both flexes and abducts the hip joint. Seeing lines of pull to place muscles into functional groups is not difficult; it just takes a little practice. And when applied, it saves literally half the work of learning the muscles of the body.

Reverse Actions

Applying the simple fundamental idea that a muscle's contraction results in a pulling force upon its attachments, and that this force is directed toward the center of the muscle, can be applied to better understand what are referred to as (closed-chain) *reverse actions*. A reverse action occurs when a muscle contracts and its proximal attachment moves toward its distal attachment (instead of its distal attachment moving toward the proximal one); or, on the axial body, its inferior attachment moves toward its superior attachment (instead of the superior attachment moving toward the inferior one). These reverse actions tend to occur when the end of the extremity (foot or hand) is against a stable surface (hence the term *closed-chain*), increasing its resistance to movement so the proximal attachment has less resistance to moving than the distal one.

When a muscle contracts, its pulling force is exactly the same on both of its attachments, so reverse actions are actually quite common in the body. This is especially true in the lower extremity because the foot is so often on the ground. For example, all flexors of the thigh at the hip joint are anterior tilters of the pelvis at the hip joint (Image 2A–B). And, ironically, this reverse pelvic action is likely more important to the client's health than the standard thigh action. Tight hip flexors do not cause the thigh to be posturally locked into flexion up in the air; rather they cause the pelvis to increase its anterior tilt, which then impacts the posture of the spine (Image 3A–C). Applying the simple concept of how a muscle contracts allows us to better understand reverse actions and their impact on our clients' postural patterns.

Imaginary Muscle Exercise

A creative and instructive exercise to demonstrate how to use the attachments of a muscle to figure out its actions is to ask someone to create an imaginary muscle. The person needs to only state what the muscle's attachments are and trace its path from one attachment to the other. From this, it should be possible to figure out what the actions of this imaginary muscle are. This exercise can even be more creative by allowing the muscle to cross from one side of the body to the other. The more creative, the more fun it is.

The accompanying figure shows an imaginary muscle that attaches from the person's right acromion process of the scapula to the person's left posterior iliac crest. Can you figure out its actions? Postulate your theory before moving on.

The Answer

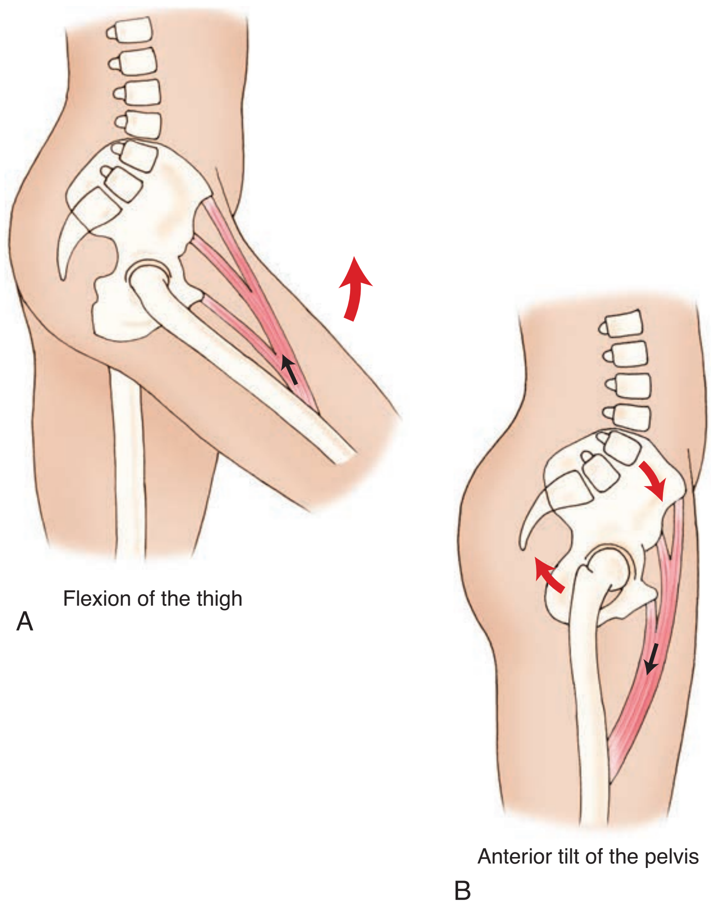
Pulling across the spinal joints, this imaginary muscle crosses the spinal joints posteriorly with a vertical component to the direction of fibers; therefore, it extends the trunk at the spinal joints in the sagittal plane.

Because this muscle crosses the upper trunk laterally on the right side, it right laterally flexes the upper trunk at the spinal joints in the frontal plane. But because it crosses the lower trunk laterally on the left side, it left laterally flexes the lower trunk at the spinal joints in the frontal plane.

Because it wraps from the upper right trunk to the lower left pelvis, it right rotates the trunk at the spinal joints in the transverse plane.

By pulling on the pelvis, it would anteriorly tilt the pelvis in the sagittal plane, elevate the left side of the pelvis in the frontal plane, and left rotate the pelvis in the transverse plane (as well as extend the lower trunk, left laterally flex the lower trunk, and right laterally flex the upper trunk, by moving the "lower" spinal joints relative to the "upper" spinal joints, and left rotate the lower trunk relative to the upper trunk at the spinal joints).

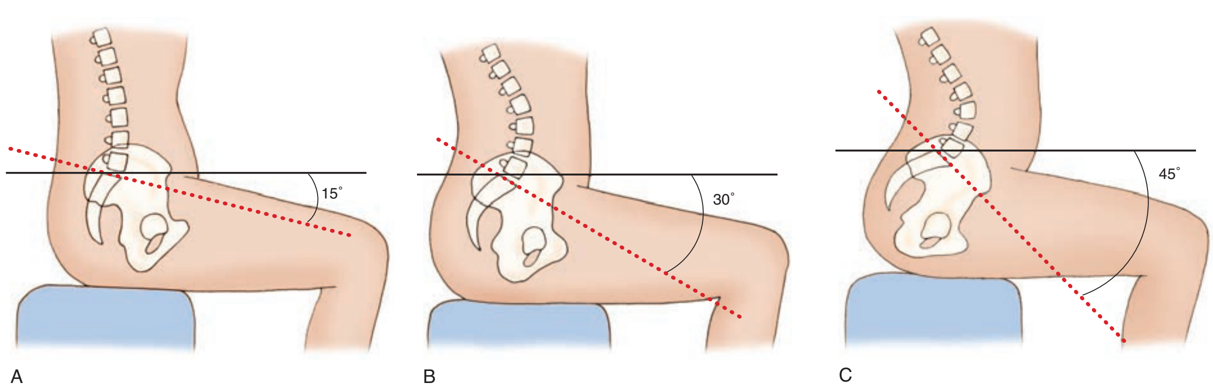
Pulling on the scapula, it could depress, retract, and downwardly rotate the right scapula at the scapulocostal joint.



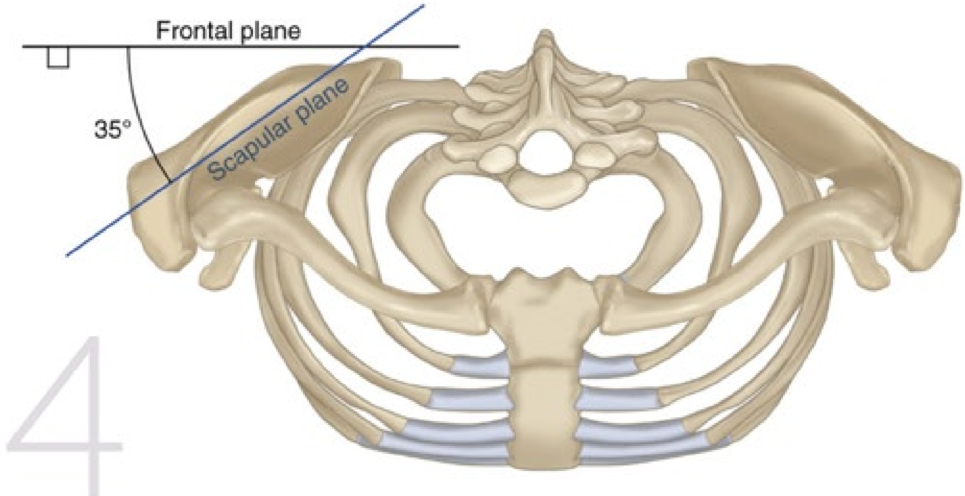
2

All flexors of the thigh at the hip joint are anterior tilters of the pelvis at the hip joint. A: Flexion of the thigh at the hip joint. B: Anterior tilt of the pelvis at the hip joint. *Muscolino, Joseph E.* Kinesiology: The Skeletal System and Muscle Function, *2nd ed. Elsevier, 2006.*

3



The degree of pelvic anterior tilt determines the sagittal plane curvature of the lumbar spine. A: Decreased pelvic anterior tilt results in decreased lumbar lordosis. B: Normal "neutral pelvis" posture results in normal lumbar lordosis. C: Increased pelvic anterior tilt results in increased lumbar lordosis. *Muscolino, Joseph E.* Kinesiology: The Skeletal System and Muscle Function, *2nd ed. Elsevier, 2006.*



The plane of the scapula is approximately 35 degrees off the frontal plane toward the sagittal plane (superior to inferior view). *Muscolino, Joseph E. Artwork by Giovanni Rimasti. Modeled from Donald Neumann's* Kinesiology of the Musculoskeletal System: Foundations for Rehabilitation*, 2nd ed. Elsevier, 2010.*

Asking the client to move the arm in the plane of the scapula better engages the supraspinatus for palpation than asking for pure abduction. *Muscolino, Joseph E.* The Muscle and Bone Palpation Manual*, 2nd ed. Elsevier, 2016.*

Motion Patterns

There is a distinction between the *motion* a muscle creates and the *joint actions* it creates. In kinesiology, a muscle's (joint) action is a cardinal plane (i.e., sagittal, frontal, transverse) component of the motion that it creates. Sometimes the motion of a muscle is the same as its action; this occurs when the muscle's line of pull is oriented perfectly in a cardinal plane. For example, the motion of the brachialis is its cardinal plane action of flexion at the elbow joint.

However, most of the time, a muscle's line of pull is oriented within an oblique plane. In these cases, the muscle's contraction causes an oblique plane motion. But in kinesiology, we do not directly name a muscle's oblique plane motion; rather, we describe the motion by breaking it up into its cardinal plane components, and we then list these cardinal plane actions separately.

A good example is the supraspinatus. The supraspinatus is oriented along the line of the scapula, which, in healthy posture, is approximately 35 degrees away from the frontal plane toward the sagittal

At least, it cannot create pure abduction. When it pulls toward abduction in the frontal plane, it must also pull the arm toward flexion in the sagittal plane. Even more confusing, some textbooks leave out the flexion component of its motion entirely, so the student is even more likely to believe the supraspinatus can do (pure) abduction.

Why does this matter? One application is palpation. When we want to locate a muscle to palpate it, we usually ask the client to engage the muscle to contract so it is the only *hard* soft tissue among the sea of *soft* soft tissues. In the case of the supraspinatus, asking the client to move the arm in the oblique plane that is between abduction and flexion will generate a better contraction to facilitate palpation than by asking for pure abduction alone (Image 5). (Note: ask for only 10–15 degrees of motion so the upper trapezius is less likely to contract to stabilize the scapula and/or move the scapula into upward rotation.)

Another application would be stretching. Knowing that the supraspinatus has a component of flexion tells us that

supraspinatus injury, advising him to avoid GH joint flexion would be important.

Palpation

Palpation is likely the most important orthopedic assessment tool a manual therapist possesses—and massage therapists may be the best palpators of soft tissue in the health field. But there are so many ways that a strong understanding of science can improve one's palpation skills, including understanding the true *motion* pattern of a muscle (as discussed previously under Motion Patterns), scapulohumeral rhythm, and reciprocal inhibition.

Scapulohumeral Rhythm: Scapulohumeral rhythm describes the characteristic synergistic movement of the scapula when