Movement & Stabilization

In the second of three columns, chiropractor and educator Dr. Joe Muscolino and his wife, Pilates instructor Simona Cipriani, give *Pilates Style* readers a close-up look at the anatomy involved in movement and stabilization.

by Dr. Joe Muscolino and Simona Cipriani

A new client, diagnosed with rotator cuff impingement syndrome, recently signed up for sessions at Simona's studio, The Art of Control. During our discussion about a rehabilitation program for the client, we determined that we should focus on strengthening and stabilizing her shoulder girdle.

When most people observe a movement pattern, they see the motion. But equally important is the stabilization that is necessary to help create efficient, graceful motions. Here, we explain the anatomy involved in stabilization and movement, and why it's important to understand, especially when working with clients who are injured.

Q. What is the difference between muscles that create movement and muscles that stabilize?

A. Muscles that create movement are (appropriately) called movers and are also known as agonists. When an agonist contracts, it shortens and pulls on both of its bony attachments. Usually, we only want one of its attachments to be mobile; we want the other attachment to be fixed.

This is where stabilization becomes important. Stabilizer muscles contract isometrically to stop movement of one attachment. By stabilizing this attachment, the agonist can more efficiently concentrate its pulling force on the mobile attachment, creating a stronger and healthier movement than otherwise would have occurred. Indeed, coordination largely results from efficient co-ordering of agonist and stabilizer muscles.

> Here, we explain the anatomy involved in stabilization and movement, and why it's important to understand, especially when working with clients who are injured.

Q. Why do Pilates teachers need to know the difference between mover and stabilizer muscles?

A. When clients have injuries, the problem is often due to weak stabilizer muscles, not just weak agonists. Rotator cuff injuries, for instance, are often caused by weak shoulder stabilization. This is especially true with lateral movements (abduction) of the arm. When a muscle that is attached from the scapula (of the shoulder girdle) to the humerus contracts, it creates a pulling force that pulls the upper arm toward the scapula while also creating a pulling force that pulls the scapula toward the upper arm.

An example is when the deltoid contracts to laterally move (abduct) the arm. The deltoid also rotates the scapula in a downward direction (Figure 1). This both weakens the ability of the client to raise the arm and causes pinching of the supraspinatus tendon of the rotator cuff group and the subacromial bursa between the scapula and humerus (Figure 2). Therefore, a muscle that rotates the scapula in an upward direction must contract to stabilize the scapula and stop the deltoid from downwardly rotating it. Most commonly, the upper trapezius contracts as the stabilizer in this scenario.

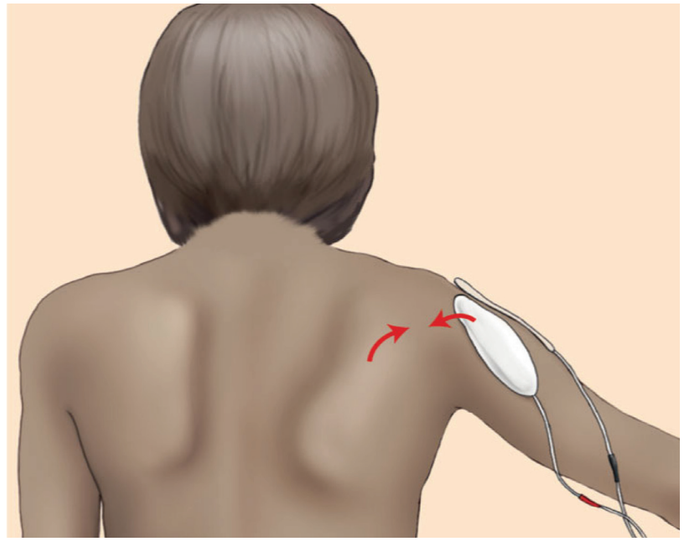

FIGURE 1. FROM MUSCOLINO JE: *KINESIOLOGY, THE SKELETAL SYSTEM AND MUSCLE FUNCTION*, ED. 2. ST. LOUIS, 2011, MOSBY. MODELED FROM PHOTOGRAPHS TAKEN BY DONALD A. NEUMANN, PT, PHD, PROFESSOR, MARQUETTE UNIVERSITY.

FIGURE 1. When the deltoid contracts to abduct the arm, it also downwardly rotates the scapula. (Note, in this illustration, E-stim pads are seen causing this contraction.)

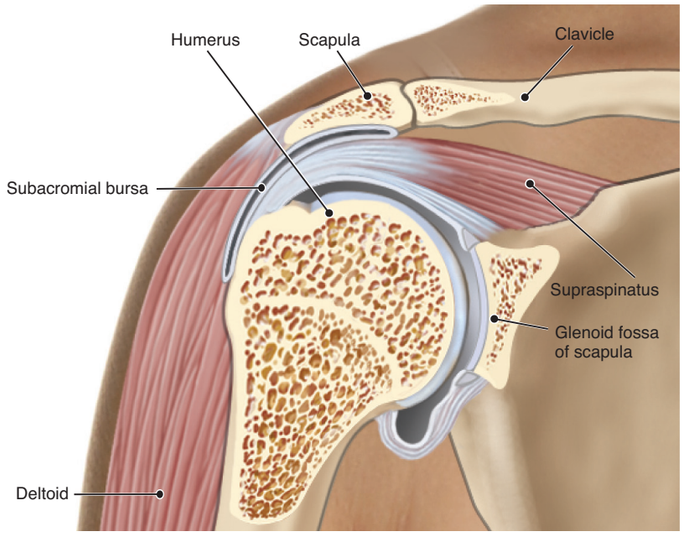

FIGURE 2. FROM MUSCOLINO JE: *THE MUSCULAR SYSTEM MANUAL: THE SKELETAL MUSCLES OF THE HUMAN BODY*, ED. 3. ST. LOUIS, 2010, MOSBY.

FIGURE 2. The rotator cuff tendon and subacromial bursa of the shoulder joint are located between the scapula and humerus. If the shoulder girdle is not well stabilized during motions of the arm, these tissues can be injured.

The Bigger Picture of Stabilization

The concept of stabilization can be broadened to include almost every movement pattern of the body. Indeed, most movements involve stabilization of one part while another part moves. A dancer cannot gracefully extend one leg into the air unless she stabilizes her other leg to balance on it. This is true even of fine motor skills: Almost any time a person performs intricate work with one hand (usually the dominant hand), the other one functions to stabilize whatever is being worked with.

Need a refresher?

Brush up on your muscle contractions knowledge with Dr. Muscolino's and Simona Cipriani's first column in the Resource Guide of of our recent January/February issue.

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FIGURE 3. The second part of Arm Circles involves abducting the arms at the shoulder joints.

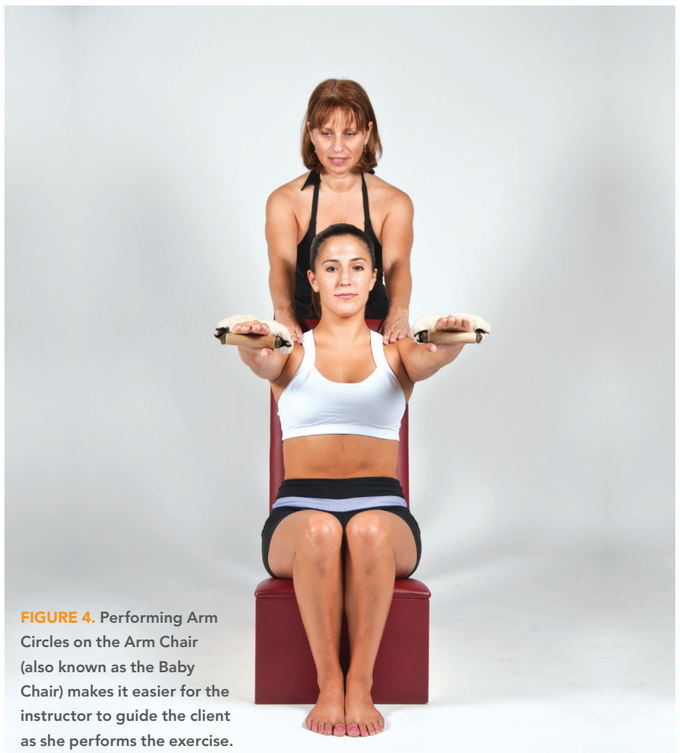

FIGURE 4. Performing Arm Circles on the Arm Chair (also known as the Baby Chair) makes it easier for the instructor to guide the client as she performs the exercise.

Muscles that create movement are (appropriately) called movers and are also known as agonists.

Q. What was your recommended regimen for this client?

A. Simona suggested a number of exercises that focused on shoulder girdle stabilization, including Arm Circles using hand weights. The second phase of the Arm Circles exercise is especially important because the client must abduct the arm from a neutral, anatomic position up to ninety degrees (Figure 3). While this exercise might appear to be oriented toward strengthening the deltoid, Simona was actually more interested in the client's shoulder girdle stabilization.

To accomplish this, Simona asked the client to focus on holding her scapula still as she moved her arms. (The scapula should be stabilized for only the first 30 degrees of arm abduction. After that, it is important for the scapula to move when the arm moves, but it needs to move into upward rotation, not downward rotation.) Simona then paid careful attention to the client's shoulder girdles as the client performed the exercise. Interestingly, the reason for performing this exercise with a weight is not to strengthen the deltoid. Rather, the resistance of the weight increases the client's proprioception so that she can better feel the posture and movement of the scapula.

Q. Did the client perform this on an apparatus?

A. Yes. To more effectively guide and instruct the client's shoulder girdle stabilization, Simona decided to have her perform Arm Circles on the Arm Chair (also known as the Baby Chair). The advantage to working on the Arm Chair is that the client's back rests against the chair. With her back against the chair, the client was able to feel her scapula and better sense its posture during the exercise. Using the Arm Chair also made it easier for Simona to physically guide the client as she performed the exercise (Figure 4).

Q. In the case of the Hundred, which muscles are agonists and which are stabilizers?

A. When doing the Hundred, the thighs are flexed at the hip joints by contraction of the hip flexors (Figure 5). An observer might

FIGURE 3, 4 AND 5. COURTESY SIMONA CIPRIANI. THE ART OF CONTROL. PHOTOGRAPHY BY YANIK CHAUVIN *WWW.YANIKCHAUVIN.COM*

FIGURE 5. When doing the Hundred, muscles of the anterior abdominal wall contract with a force of posterior tilt to stabilize the pelvis against the anterior tilt force of the hip flexors.

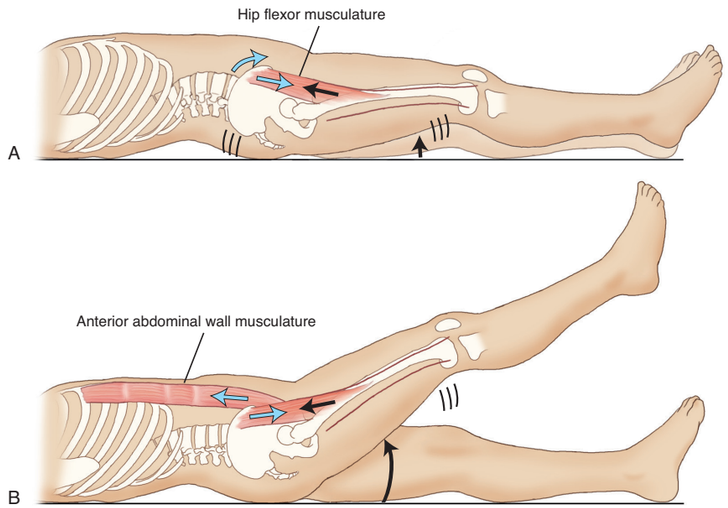

FIGURE 6. **A.** Flexor muscles of the thigh at the hip joint also pull the pelvis into anterior tilt. **B.** Muscles of the anterior abdominal wall stabilize the pelvis, preventing it from anteriorly tilting.

FIGURE 6. FROM MUSCOLINO JE: *KINESIOLOGY, THE SKELETAL SYSTEM AND MUSCLE FUNCTION*, ED. 2. ST. LOUIS, 2011, MOSBY.

How Stabilization Works

Stabilization muscles work by isometrically contracting to hold an attachment of the agonist from moving. Most commonly, it is the proximal attachment (the attachment that is closer to the core) that is stabilized. Stabilizer muscles accomplish this by contracting with a force that is opposite—in other words antagonistic—to the force of the agonist on that attachment. For example, as described above, because a hip flexor muscle tilts the pelvis anteriorly, a stabilizer muscle contracts and creates a force of posterior tilt of the pelvis; because the deltoid is a downward rotator of the scapula, the stabilizer muscle contracts and creates a force of scapular upward rotation.

It should be noted that stabilizer muscles are not the same as antagonist muscles. Antagonist muscles create a force that is opposite to the force of the agonist at the attachment of the agonist that is moving, whereas stabilizers work at the fixed attachment of the agonist. In Figure 6, an antagonist muscle would be an extensor of the thigh at the hip joint; in the scenario in Figure 1, an antagonist muscle would be an adductor of the arm at the shoulder joint.

believe that the emphasis of this exercise is to strengthen the hip flexors, but the Pilates instructor is paying more attention to the positioning of the pelvis and lumbar spine. When the supine client contracts her hip flexors, these muscles pull the distal thigh attachment into flexion, but they also pull the proximal pelvic attachment into anterior tilt. If the anterior abdominal wall muscles do not efficiently contract (with a force of posterior tilt) to stabilize the pelvis, the pelvis would anteriorly tilt (Figure 6), weakening the ability of the thigh to lift into flexion. More importantly, it would also increase the curve of the lumbar spine, placing pressure on the posterior discs and facet joints of the spine. In time, this would likely lead to lower-back injury. **PS**

Dr. Joe Muscolino has been an author and educator in the world of manual and movement therapies for more than 25 years. For more information, visit his website, www.learnmuscles.com, or follow him on Facebook at The Art and Science of Kinesiology.

Simona Cipriani is a former dancer and has been a Pilates instructor for 18 years. She owns and runs The Art of Control at Purchase College, SUNY in Purchase, NY. For more information, visit www.artofcontrol.com.