Balancing Mobility *and Stability*

Joe Muscolino | DC

Joe Muscolino is a Doctor of Chiropractic. He has been an instructor in the world of massage therapy for over 25 years.

The musculoskeletal system is a marvel of engineering. Myofascial tissues generate and transmit forces that create the proper balance of stability and flexibility to maintain integrity of the body through posture and motion. As manual therapists, our focus is usually on our clients' flexibility. However, it is important to understand and recognize the importance of stability and how the myofascial system blends forces of stability with the forces that create motion.

When we think of muscle function, we usually think of muscles shortening as they concentrically contract as movers to create motion of a body part at a joint. What we often don't realize is that the concentric contraction of mover muscles may be ineffective without the accompanying isometric contraction of stabilizer muscles.

When a muscle contracts, it pulls toward its center, exerting its tension force equally on both attachments; therefore, either one of its attachments or both of it attachments could theoretically move. The muscle cannot choose which of its attachments will move. However, when we contract a muscle, we usually desire that only one specific attachment moves. For this to occur, the other attachment must stay fixed in place, in other words, be stabilized. And for this to occur, a stabilization force is needed.

Sometimes the stabilization force is provided by gravity. In other words, one of the attachments is less likely to move when the muscle contracts because that attachment is heavier than the other. For example, when the brachialis muscle contracts, it can either flex the forearm toward the arm at the elbow joint, or it can flex the arm toward forearm at the elbow joint, or both. Most of the time, the forearm will move instead of the arm because not only is the arm a larger and heavier body part than the forearm, but for the arm to move, the rest of the body must move with it; whereas for the forearm to move, only the forearm and hand need to move. As a rule, proximal body parts are heavier than distal ones, and when proximal body parts move, the core of the body must move with it. For this reason, people often think of muscle contractions as moving the distal attachment. Indeed, this is the reasoning for the terminology of naming muscle attachments as *origin* and *insertion:* the origin is the proximal, heavier attachment; and the insertion is the distal, lighter attachment. Therefore we usually envision the lighter insertion being mobile and moving toward the heavier, stable origin *(Figure 1)*. But this is not always the case.

Often, body weight does not provide sufficient stabilization force, and without additional stabilization force, the proximal attachment of the mover muscle will move. Looking at the same example, if we place a weight in the hand, perhaps the person is attempting to lift up a heavy suitcase, and now ask the brachialis to contract, the arm/body may now be lighter than the forearm/hand along with the weight, resulting in movement of the arm instead of the forearm at the elbow joint *(Figure 2)*. And even without a weight placed in the hand, brachialis contraction would still likely create enough force that there would be slight motion of the arm. The problem is that any motion of the arm would commensurately decrease the force and effectiveness of the forearm's motion. To prevent this, a force in addition to gravity would have to occur to fully stabilize the arm. This force comes from muscle contraction.

It is extremely common for muscular contractions to create stabilization forces that accompany muscular contraction movement forces. The interplay of these muscular stabilization and movement forces

Reverse Actions

When a mover muscle contracts and its distal attachment moves toward its proximal attachment, this can be referred to as its *standard action.* When its proximal attachment moves instead, it can be described as its reverse action. Standard actions usually occur when the extremity is in *open chain position;* reverse actions usually occur when the extremity is in *closed chain position.*

Looking at the upper extremity as an example, the parts of the upper extremity are the shoulder girdle, arm, forearm, and hand. These parts can be viewed as a "chain" of kinematic elements. If the hand is free to move in space, it is an "open chain." If instead the hand is holding onto a stable object/surface, for example a banister when climbing the stairs, it is a "closed chain."

In open chain position, the distal attachment has less resistance to movement so it usually moves, creating a standard action. However, in closed chain position in which the hand is holding onto a stable object or surface, the distal attachment is more resistant to moving; for this reason, the proximal attachment usually moves instead, creating a reverse action.

Figure 1. The brachialis contracts, flexing the forearm toward the arm at the elbow joint. (Figure courtesy of Joseph E. Muscolino)

Figure 2. When attempting to lift a heavy suitcase, brachialis contraction can cause the arm to flex toward the forearm at the elbow joint. (Figure courtesy of Joseph E. Muscolino)

is coordinated by the nervous system. When a mover muscle contracts to move one of its attachments, another muscle called a stabilizer muscle is ordered by the nervous system to contract and stabilize the mover muscle's other attachment. It is the fine interplay and balance of these muscular contractions, in other words *coordination* of muscular contractions, that allows for efficient, healthy, and graceful motion.

Following are examples of the balance of movement and stabilization forces in the body.

Pelvic Girdle Stabilization

The classic example of stabilization occurs at the pelvis and is often known as *core stabilization.* Almost every muscle that crosses the hip joint attaches from the pelvis to the thigh. Because both the thigh and the pelvis are mobile, for these muscles to contract and efficiently move the thigh, their pelvic attachment must be stabilized. Let's use hip flexors as an example. If a person in supine position contracts to elevate the thigh into flexion at the hip joint, hip flexor musculature would also exert a force of anterior tilt on the pelvis at the hip joint. This would have two undesired effects. The first is that any movement of the pelvis would decrease the strength and range of motion of flexion of the thigh. The second is that anterior tilt of the pelvis would result in an increased lordosis of the lumbar spine, causing increased compression on the lumbar facet joints and narrowing of the intervertebral foramina.

To prevent the pelvis from anteriorly tilting, a stabilization force of posterior pelvic tilt is needed. This is usually accomplished by contraction of the anterior abdominal wall musculature. *Figure 3* demonstrates an example of this mover/stabilization coordination pattern in which the tensor fasciae latae (TFL) is the mover of thigh flexion and the rectus abdominis acts to stabilize the pelvis.

Shoulder Girdle Stabilization

Just as movement of the thigh at the hip joint requires stabilization of the

Pilates and Core Stabilization

Although Pilates is a comprehensive method of body conditioning, it is probably best known for its emphasis upon core stabilization patterning and strength. Whereas classic fitness training is usually focused on the ability of the extremities to work against resistance and move large weights, the Pilates instructor focuses more on the core of the body while the extremity is working. For example, in the mat exercise known as *Leg Circles,* the client lies in a supine position and moves the thigh in circles. Although movement of the thigh is important, the Pilates instructor is more concerned with the client's ability to engage stabilization musculature of the core to isometrically contract and hold the pelvis stable. Indeed, during almost every Pilates exercise, the primary concern of the instructor is the quality of the coordination between the mobility and stability muscles. There is an old saying in the world of Pilates that manifests this emphasis on the quality over quantity of motion when performing exercise: *"It is not how many; it is how."* (Above: Photographs courtesy of Simona Cipriani, The Art of Control Pilates.)

The Three Keys to Neuro-myo-fascio-skeletal Health

Although there are many factors that are important to the health of our myofascial and skeletal tissues, stability to co-order (i.e., co-ordinate) all of these muscular contractions for healthy posture and movement patterns. The