Strengthening the Core From the Inside Out

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It is not uncommon to include spinal-stabilization exercises in both injury-prevention and rehabilitation programs. Textbooks and professional journals abound with instructional techniques for maintaining proper postural stability and strengthening the abdominal and lower back muscles to provide this stability. With multiple potential anatomical structures contributing to lumbar pain syndromes, clinicians often focus rehabilitation on improving function rather than solely on pathomechanics. Improved function often requires improved spinal stabilization. This does not mean that the spine must be maintained in a perfectly static position but rather refers to maintaining the spine within a range of motion that allows for pain-free function. Most core-strengthening programs emphasize strengthening the gluteus maximus, erector spinae, rectus abdominis, and the external oblique muscles to achieve this while ignoring the importance of strengthening the “internal core.”

Research suggests that the internal core, consisting of the transverse abdominis with assistance from the muscles of the pelvic floor, lumbar multifidus, and, to some extent, the internal obliques, provides the primary stabilization to the lumbar spine. Of these, the transverse abdominis is considered the primary stabilizer. It is hypothesized that without adequate strength of both the internal- and external-core musculature, inefficient movement patterns develop, which can lead to improper technique and injuries to both the back and the extremities.

Internal-Core Function

A review of functional anatomy identifies the importance of the transverse abdominis in providing lumbar-spine stabilization. On inhalation, the downward pull of the diaphragm forces the contents of the abdominal cavity down against the floor of the pelvis. This signals a cocontraction of the pelvic-floor muscles and a passive contraction of the transverse abdominis. In addition, the multifidi and deep erector muscles are stimulated, creating an internal corset that provides spinal-segment stabilization. On exhalation, the challenge then becomes to maintain spinal stabilization as pressures decrease. Contraction of the transverse abdominis serves to minimize the pressure loss during exhalation. The transverse abdominis presses the viscera posterior, superior, and inferior, and, along with cocontraction of the other muscles of this internal core, allows for the reciprocal relaxation of the diaphragm. In healthy individuals, activation of this inner core occurs before movement of any other body segment. In individuals with low back pain, however, the activation of the transverse abdominis is commonly delayed. During maximal strengthening efforts, voluntary activation of the transverse abdominis, combined with proper breathing techniques, provides ideal stabilization for the lumbar spine.

Transverse Abdominis Strengthening

Commonly, lumbar-spine rehabilitation programs begin by teaching injured athletes to find a neutral pelvic position while lying supine. The neutral position creates the least amount of stress and force on injured tissue, causes the least amount of pain, and allows for optimal healing. Exercise then progresses to a prone position, to kneeling (quadruped to biped), and eventually to an upright position and functional activities. Because the action of the transverse abdominis is independent of the other abdominal muscles, it is critical to teach athletes to initiate the transverse abdominis muscle before performing all other rehabilitation exercises. This is best taught with the athlete in a quadruped position. Proper quadruped positioning consists of the athlete being positioned on hands and knees while the shoulders, knees, and hips are flexed to 90°, with the arms aligned under the shoulders and the knees aligned under the hips (Figure 1). The lower legs should be aligned with the knees, which are then aligned with the hips. After finding the
neutral position, instruct the athlete to take a normal inhalation, allowing the chest, diaphragm, and belly to expand (Figure 2). As the athlete begins to exhale, have him or her contract the transverse abdominis by attempting to compress the navel (belly button) to the spine. This continues through the entire exhalation, and the athlete should attempt to hold this position for a short period of time beyond the completion of exhaling all air (Figure 3). Performing this exercise in the quadruped position challenges the transverse abdominis to exert maximal effort to overcome gravitational pull and create sufficient internal pressure. Furthermore, it is an easy and efficient strengthening exercise for learning proper core activation before activating other muscle groups while maintaining the spine in a neutral position (Figure 4). This exercise can be advanced by performing the same breathing and tightening activities while starting in a biped position, moving into a biped position (Figures 5a and 5b), and standing (on both feet and on one foot; Figure 6). It can be made further challenging, as other core-strengthening activities often are, by then performing the same exercises on an unstable surface such as a balance disc or physioball, by integrating a rotational component, and eventually into light followed by heavier functional tasks with external loads.

**Integrating Breathing Exercises Into the Strengthening Program**

The function of the transverse abdominis can be further enhanced through breathing exercises. It is a natural reaction when the body is challenged from an external force to momentarily hold one’s breath to create additional support and stability for the spine. Martial artists have long known that maximizing