

Core Stability Principles

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I want to share what I've learned recently regarding principles of core stabilization. I always am surprised to learn how much I don't know. I have been forever confused by the differences between the approaches of the Australian PTs, who have pioneered our understanding of the inner core muscles, and other teachers in the rehab world, who follow Stuart McGill's approach (a more global abdominal- and back-training approach).

I have been looking for something that would make sense of this divide, and I think I finally have found it. The teacher with whom I recently studied is Mark Comerford, an Australian PT of Kinetic Control (UK). Comerford has attempted to integrate, synthesize and understand the principles of both rehab and performance-oriented exercise training. I will attempt to share the basic principles in this article, using the lower back as the model. Future articles will share more specifics. For this article, I am just going to reference the course I attended and Comerford's Web site.¹ (I will reference more peer-reviewed material for future articles.)

First, you have to understand how different types of muscles function. We are all aware of tonic or postural muscles and that they are different than phasic or power muscles. Postural/tonic muscles are designed for endurance and are able to be active continually for a long time. They are not designed as prime movers but are designed to stabilize and maintain the center as the arms and legs move around them. The phasic muscles are designed to fire with more power to move the limbs, especially in the sagittal plane for throwing, running or explosive action.

Comerford further divides the postural or stability muscles into local (the inner core) and global (the outer core). The inner core muscles are mostly single-joint, shorter muscles. They are designed to control translation and the small glides that joints make. For the trunk and low back, these would include the transverse abdominals, deep multifidi, pelvic floor and posterior fibers of the psoas.

Moving outward from the inner core, we find the outer core – the global stabilizer muscles. For the trunk and low back, these include the abdominal obliques, anterior psoas, gluteal muscles, quadratus lumborum and the superficial multifidi. These are still tonic, one-joint muscles. These are considerably stronger than the inner core and work in tandem with it. They control specific directions of movement such as flexion, extension and rotation.

The final grouping of muscles is our prime movers – the phasic mobilizers. These are about strength and sagittal plane movements. These are trained by traditional resistance training in gym exercises.

Local Stabilizers

We'll start with an exploration of the inner core. These muscles increase stiffness and tension via their pulls on the fascia. This is a good stiffness, a good tension that promotes stability and gives something solid for the other muscles to pull on. See my "Why Fusions Fail" article² for a better understanding of the positive role of muscles and fascia in creating stiffness. The inner core muscles allow movement but maintain alignment of vertebrae. They activate in any and all directions of movement. Research shows they have a protective response and function to anticipate. In a healthy, pain-free back, they pre-activate for predictable stresses. Before you ever move your arm, your transverse abdominals fire about 50 milliseconds before the main movement starts. This pre-activation sets the core and allows arm or leg movements to occur without too much movement in the trunk and the back.

After a back injury or when you have back pain, these muscles are slow to start firing. Think about how hard and painful it is for your acute patient to turn over on the table. This timing delay is the key dysfunction of the inner core. When these muscles don't activate at the right time, it means every time you move, your back suffers microtrauma. Every time you move, thousands of times per day, too much motion occurs in the back. This sets the stage for instability, creating excessive loads and contributing to wear and tear.

The good news is this timing delay can be corrected. Research shows a few weeks of consciously learning to pre-activate these inner core muscles (when they are not working right) will correct the timing delay and begin to restore this component of stability. These exercises are very specific, highly cognitive and nonfunctional; they are not easy to learn and are somewhat counterintuitive. You enhance these exercises not by adding load, but by unloading – putting less weight or load on the involved joint. These exercises are about recruitment and motor control training, not strength or hypertrophy. These exercises directly relate to pain control by stopping uncontrolled translation. These muscles are retrained by low-load, non-fatiguing exercise (at 20-30 percent of maximum), done in a slow and static way. These exercises can be boring, but they are necessary if these muscles have diminished function.

These are the abdominal hollowing exercises. What can these muscles do? These muscles are not strong enough, even when pre-activated, to control a direction of movement. They are not strong enough to take a load. Their job is simple: fire quickly (before the main action) and prevent translation (aberrant movement in the lower back).

These tonic muscles are low threshold and need early activation. The exercises to reawaken them are not physically demanding; you are only firing up to 30 percent of maximum, but they might require a high sensation of effort. They need to be done for one to two minutes, twice per day. This really is about neural adaptation and skill acquisition. The Feldenkrais model addresses this. The lessons consist of the student paying attention to simple or not so simple movements of their body and learning new pain-free ways to perform them.

Here is a simple way to tune into the activation of the multifidi. Stand in a walking gait position, right leg in front of the other (as if you are about to walk). Put your fingers on your lower back at L5, next to the spine on the left side. Now shift your weight slowly forward. As you rock forward, feel the activation, the swelling of the muscle on the rear left side. If you or your patient cannot feel it at all, put all the weight on the front foot by lifting the rear foot backward, and feel the muscle swell. In more normal function, the activation will occur early as you begin to rock forward. If the multifidi have a timing delay, you won't feel the swelling as early in the forward weight shift. Typically, the right side of the multifidi has more timing problems; the left side usually activates earlier, even after injury.

To make this into an inner core rehab exercise, consciously keep the multifidi muscles turned on as you bring the weight back toward the rear foot. This is an example of unloading, using the conscious mind to override and train motor control. Initially, a high sensation of effort might be needed to perform this low-load motion. This implies an inefficient facilitation of slow motor unit recruitment and dysfunction of normal muscle spindle responses. Once these inner core muscles are working, we shouldn't need to consciously pre-activate them, unless another injury or pain episode has intervened.

Global Stabilizers

The global stabilizer muscles need two different training strategies. First, they need motor control or recruitment training. The goal here is to control the core movement in multiple directions. In the dysfunctional back, the larger, faster muscles (the phasic mobilizers) are dominant and have taken over. So we need to get these global stabilizers active as they help maintain movement control in specific directions. This requires non-fatiguing, low-load exercise in the range of 20 percent to 30 percent of maximum effort. The definition Comerford uses is that the patient can hold the static position or do the slow movement for four minutes without pain or fatigue. This doesn't mean they are going to do the exercise that long. He recommends 10 reps of a 10-second hold with a brief release of contraction between reps.

We will keep the trunk in neutral (especially at the beginning stages) as we do these repetitions. We will challenge the trunk's stability by using different directions of slow limb movement. A unilateral, asymmetrical limb or trunk load can be used to facilitate this challenge. This critical stage of rehab often is ignored or misunderstood. You have to re-establish better motor control before you can effectively strengthen these key muscles. We are challenging the core, waking up the core, but doing it in a static or slow manner with a light load. This is a topic I will expand upon in my next article.

The second aspect of training the global stabilizers is to use asymmetrical trunk loading to strengthen the core. This is what most Pilates and other core stabilization programs usually emphasize. You are using the legs and/or arms to create a load, usually an asymmetrical load, and asking the core to stay stable. These are fatiguing exercises, done at slow or high speed in the training range of 40 percent to 70 percent of max effort. In this phase, we really emphasize rotation control with higher loads. We again attempt to

discourage the global mobilizers from taking over; we are primarily using the global stabilizers. In my opinion, this is frequently done poorly, at least for those who have back issues. Not enough attention is paid to whether these muscles are able to maintain a proper postural hold before asking them to assume a larger load.

The global mobilizers, the bigger phasic muscles, can be trained in traditional gym exercise. Training these does not automatically improve the core function. On the contrary, it can tend to further reinforce mobilizer dominance over stabilizers. For our patients, the key is for them to do these exercises at the right time and pay attention to optimizing postural control while doing them, keeping the stabilizers doing their job.

This article is just an introduction. Rehab research is expanding our understanding of proper rehab exercise. I want my patients to hold their adjustments, get well, stay well and have the tools to help themselves. This requires specific, individualized rehab, not cookie-cutter exercises. Unfortunately, in chiropractic, physical therapy and the personal trainer/gym exercise world, this is not the usual level of care. Remember, you are providing the cues, both verbal and nonverbal. If you don't think specific exercise has value, neither will your patient. If you know and effectively communicate to the patient that they can change their patterns through exercise, you will get better compliance and better results.

References

1. Comerford MJ. "Core Stability Training for Peak Performance - Return to Work and Return to Sport." Boston, July 25-26, 2008. www.kineticcontrol.com
2. Heller M. "Why Fusions Fail." *Dynamic Chiropractic*, Dec. 3, 2007, www.chiroweb.com/archives/25/25/07.html.

