Is it possible to be too stable?

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Prescription of "core stability exercises" has become common practice in both health care and community settings. Definitions of "core stability exercises" vary, but usually involve some form of lower abdominal muscle contraction which is then progressed to multiple variations of loading situations requiring co-contraction of the trunk muscles (arm and leg loading, stability ball exercises, use of unstable surfaces, etc.). These types of exercise programs are often prescribed to patients with low back, pelvic girdle, and hip pain.

It is interesting to note that it is not uncommon for patients to report having previously participated in a committed and regular program to "strengthen [their] core", but they report no change or improvement in their symptoms, and on occasion even have worsening of symptoms. On examination, these patients exhibit excessive tone and activity in several of the superficial trunk muscles (e.g. thoracic erector spinae, external oblique, internal oblique, rectus abdominis) and hip muscles (e.g. external rotators, long adductors, tensor fascia latae) in both static positions and dynamic loading tasks. Assessment of the deep stabilizing muscles such as transversus abdominis and/or deep lumbar multifidus reveals a lack of recruitment or asymmetrical patterns of timing and activity, along with excessive tone in the superficial muscles when an isolation of the deep muscles is attempted. Given the dysfunction present in the deep stabilizing muscles, it would seem that exercises to restore function of these muscles would be a logical treatment prescription. So why do core stability programs fail for these patients?

There are several possible answers to this question. It is possible that the exercises were being performed incorrectly, or that a few inappropriate exercises created continued exacerbation of symptoms while other exercises were actually beneficial. It is also possible that regardless of the cues and corrections patients are given, no matter what the exercise the patient is simply unable to contract the desired muscles. They are unable to change their current motor patterns and instead continue using strategies that train their asymmetries and perpetuate imbalances between the deep stabilizing muscles and the superficial trunk muscles. So what may be the reason it is so difficult for these patients to change their strategies? The answer to this question may also reveal why many therapists find teaching recruitment and training of the deep stabilizing muscles difficult and frustrating, and report that many patients "just can't get it".

It is well-established that patients with low back pain exhibit trunk muscle recruitment patterns that differ from those in healthy controls. Many studies have shown an increase in the activity of the superficial trunk muscles, and recent data have shown that different patients can show different patterns of change in superficial muscle activity. That is, when multiple superficial muscles are considered, subjects with low back pain have greater activity overall as compared to controls, but different subjects increase activity in different superficial muscles. These studies reflect the diversity in possible changes in the motor control system and that subgroups of low back pain patients exist, with different changes in muscle recruitment patterns. The central nervous system has multiple strategies to increase stability via the myofascial system. In patients with low
back pain, some of these strategies may be adaptive and beneficial. Alternately, some of these strategies may come at too high a cost, including excessive joint compression, loss of mobility, excessive increases in intra-abdominal pressure, restriction of ribcage mobility for respiration, and reduced postural control. So, although these strategies create stability, they also can be a reason for continued pain and dysfunction.

It is proposed that patients who gain no benefit or who have worsened symptoms from core stabilization programs, and who have difficulty learning how to recruit the deep stabilizing muscles, exhibit specific movement and postural strategies that achieve larger increases in stability with higher compressive costs. Consider two strategies that can increase compression in the lumbar spine; increased activity in the lumbar erector spinae or increased co-contraction of the thoracic erector spinae and external obliques. Both strategies increase stability; however the compressive loading, loss of mobility, and restriction of the ribcage will be greater in the second strategy due to the anatomical attachments of the muscles being used. Increased trunk co-contraction has also been shown to decrease control of postural equilibrium. These patients do not respond to exercises that aim to increase stability because their systems are already under excessive compression - that is, they are already “too stable”.

Therefore, although patients with low back pain have dysfunction in the deep stabilizing muscles the treatment priority is not always going to be to start training these muscles. The question that needs to be answered is “what is the best strategy to train for this patient - given the stage of healing, the amount of structural damage (ligament, joint, bone, nerve), and the requirements for function at this time?” Clinical tests, combined with a clinical reasoning process, are required to differentiate when treatment should aim to decrease stability or increase stability.

The following tests are a few of several clinical tests that can assist the clinician in determining 1) whether it is appropriate to start exercises to increase stability or 2) whether techniques to decrease compression (stability) should be used first in a treatment plan. They must be combined with consideration of the integrity of the passive system, nervous tissue, and stage of healing. For example, in acute stages of injury increased muscle tone (which increases stability) is a beneficial protective strategy. When significant trauma to the passive system has occurred, strategies that increase muscle activity are adaptive to compensate for the lack of integrity in the passive system. Reducing muscle activity in these situations is not likely to be the treatment of choice.

**Active Straight Leg Raise**

**Patient position: supine**

**Test:** the patient is asked to lift a straight leg off the table, then repeat on the other side. The patient is then asked to note any difference in effort required to lift the leg, especially on initiation of the movement, between the right and left sides (“Does one leg seem heavier or harder to lift?”). The strategy used to stabilize the thorax, the low back and the pelvis during this task is observed. The remainder of the test is performed with the leg that the patient feels is most difficult to lift (the positive side).

**Compressions:**

The pelvis is then compressed passively and the ASLR is repeated; any change in effort and/or pain is noted. The location of the compression can be varied to simulate the force which would be produced by optimal function of the local muscle system. Although still a hypothesis, clinically it appears that compression of the anterior pelvis at the level of the ASIS’s simulates the force produced by contraction of lower fibers of transversus abdominis and compression of the posterior pelvis at the level of the PSIS’s simulates that of the sacral multidus. Compression of the anterior pelvis at the level of the pubic symphysis simulates the action of the anterior pelvic floor whereas compression of the posterior pelvis at the level of the ischial tuberosities simu-
lates the action of the posterior pelvic wall and floor. Compression can also be applied to one side anteriorly and simultaneously to the opposite side posteriorly. You are looking for the location where more (or less) compression reduces the effort necessary to lift the leg: the place where the patient notes “That feels marvellous!” (from Lee and Lee, 200428).

**Decompressions:**

Simulation of the effect of decreasing activity in the thoracic erector spinae: the therapist uses one hand under the posterior thorax to capture the specific hypertonic fascicles of the relevant part of the thoracic erector spinae (longissimus, iliocostalis, or spinalis). The direction of the hypertonic fascicle is noted. The therapist’s other hand is placed on the anterior ribcage at approximately the same level as the posterior hand. Both hands then create a traction force from the centre of the muscle hypertonicity to pull the thorax cranially; the line of pull corresponds to the same line as the muscle fascicle direction. The decompression force can be more focused to the anterior ribcage to simulate release of the abdominal muscles.

**Indication to use exercises to increase stability:**

The pattern of compression that results in the biggest improvement in the ASLR (easier to lift) directs the therapist to prescribe exercises that train the muscles capable of producing the same vectors of compression that produced the improved ASLR. Response of the deep muscles to verbal cues to contract should be assessed, and combined with the rest of the assessment will guide whether to start with Transversus abdominis (TrA) training or deep multifidus (dmf) training or asymmetrical patterns of TrA and dmf.

**Indications to use techniques to decrease stability:**

If none of the compression patterns improves the ASLR, with some of the patterns making the ASLR worse (harder to lift, provocation of pain), this is an indication that the system is already under too much compression and that it is not appropriate to start exercises that increase stability at this stage in treatment. The ASLR should be retested using thoracic decompression and if the decompression improves the ASLR then techniques to decrease compression (neuromyofascial release, release with awareness, breath work, oscillatory joint mobilizations, etc) should be performed first and then the ASLR and compressions retested to decide the next step in treatment planning. The pattern of decompression that results in the most improvement in the ASLR indicates which muscles should be targeted for techniques to decrease muscle tone (thoracic iliocostalis vs. longissimus vs. external oblique).
Rib cage wiggle for thoracopelvic rigidity\(^{29,30}\)

The rib cage wiggle reflects the amount of activity in the superficial muscles that connect the thorax and pelvis. It can be performed in any position, and reflects the muscle strategy that the patient uses to transfer loading in the specific task. The therapist places their hands bilaterally on the lateral aspect of the rib cage. A gentle translation force is applied in one direction followed by an opposite lateral translation force with the other hand. Several oscillatory translations are repeated while the amount of resistance to the applied force is noted. There should be a symmetrical amount of lateral movement with only a small application of force. In positions of lower load (e.g., supine lying) there should be more of this ‘wiggle’ movement as compared to higher load tasks. A patient who maintains significant activity in the thoracopelvic muscles in both low and medium load tasks has an inability to modulate activity in these muscles, which indicates inappropriate use of these muscles for the specific tasks. Loss of rib cage wiggle indicates high levels of co-contraction rigidity and excessive muscle activity, especially if no wiggle is present in supine lying when the patient is ‘relaxed’.

Seated trunk rotation range of motion\(^{11}\)

Significant increases in thoracopelvic muscle activity can impact thoracic rotation range of motion if the muscle activity is not appropriately modulated for the task. In healthy normals, activity of the contralateral longissimus muscle should decrease during rotation.\(^{22}\) That is, during left rotation, the right longissimus muscle should exhibit decreased activity. Patients with co-contraction rigidity often do not exhibit this pattern, and muscle activity in the contralateral thoracic erector spinae may even increase. Range of motion will also be decreased (in both directions or one direction, depending on the pattern of superficial muscle hypertonicity/overactivity).

The findings from these tests are used in conjunction with observation of postural and movement strategies during functional loading tasks and regional movements, and then combined with findings from the rest of the objective assessment (passive joint mobility, palpation of muscle, neurological system status, etc.). The impact of excessive compression from the myofascial system will be evident throughout the rest of the clinical examination and ultimately all findings are correlated in order to make clinical decisions about when to use techniques to decrease stability instead of prescribing core stabilization exercises. It is our clinical experience that when there is excessive compression from the superficial global muscles evident in multiple tests, it is extremely difficult to train recruitment of the deep trunk muscles (TrA, dmf, pelvic floor) unless the superficial muscles are first released. That is, the "old strategy" needs to be removed in order to create the opportunity for a new strategy to be learned. Once the excessive compression is released, it is no longer redundant to add stability from the deep muscles, and the benefit of using the deep segmental muscles to provide stability is that the associated costs are much reduced. Contraction of the lower fibres of transversus abdominis for example, can create intervertebral and intrapelvic stiffness (increased stability)\(^{33}\) but due to differences in torque production and anatomical attachments, likely with less increases in joint compression, intra-abdominal pressure, and much less restriction on trunk mobility than contraction of the superficial muscle.\(^{14,20,34}\) The treatment principles in the chart below summarize this clinical approach.

Summary

Restoration of optimal function for patients with low back and pelvic girdle pain requires consideration of multiple factors - biomechanical, psychological, social, and emotional. Ultimately our goal is to restore optimal load transfer through the system. Some questions therapists need to consider when assessing patients are firstly, “What are the current stabilization strategies of this patient and how do they relate to their symptoms and functional limitations?” And secondly, “What is the best way to change and optimize this patient’s stabilization strategies?” Clinical diagnosis requires a multimodal examination that assesses functional load transfer strategies, form closure, force closure, motor control, and the impact of the emotions and awareness. Effective treatment prescription, including prescription of core stability exercises, should be based on a clinical reasoning process and individual assessment. Not all patients with low back or pelvic girdle pain need a core stabilization program as part of their initial treatment program. Effective treatment for many patients will first involve techniques to decrease stability through release of the superficial muscles and changing movement strategies that overly recruit these muscles. It is then that new strategies can be trained. Thus, a multimodal treatment plan using manual therapy, neuromyofascial release, movement with awareness, breath work, and exercise is most optimal to achieve change in how the central nervous system uses the myofascial system. Ideally, we aim to restore choices and options so that there is modulation
of activity in multiple muscle slings for multiple tasks. This will result in just the right amount of compression across the appropriate joint surfaces and just the right amount of tensile forces through the fascial system to provide stability without rigidity of posture and without episodes of collapse - "Stability with Mobility".

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References


