

Core Stability and Motor Control: *Train the Movement or Train the Muscle?*

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Introduction

This article discussed the effects of core stability vs motor control training. The 'older' theory of core stability training is based on the corset hypothesis of feedforward lumbo-pelvic stability. The 'newer' theory of motor control training is based on the hypothesis of muscle synergy and myofascial slings.

The corset hypothesis of feedforward lumbo-pelvic stability

- Here the 'core' refers to the Transversus Abdominis (TrA) and Multifidus.
- The understanding of this hypothesis is that a bilateral activation of TrA occurs prior to the onset of movement e.g. lifting an arm. This feed-forward response, through various mechanical activation patterns, increases the 'stiffness' of the segmental lumbo-pelvic region (i.e. it acts as an early pre-activated corset to stabilise the lower back).
- This hypothesis also infers that TrA is activated bilaterally and independently of the direction of perturbation i.e. the TrA activation does not contribute to the movement or postural adjustment.
- It is thought that there is a delay in TrA activation observed in individuals with low back pain (LBP) which shows a dysfunction in the corset mechanism and therefore a loss of normal segmental stability. It is sometimes suggested that this delay (or dysfunction) is a potential factor contributing to the pathogenesis of LBP / instability.
- The rehabilitation model based on this hypothesis involves training an isolated muscle action and then progressing towards functional tasks.

The Motor Control Theory

- The TrA is part of a synergy of muscles contributing to the control of the trunk and pelvis that acts in response to the impending movement e.g. when raising the right arm, the left TrA (and internal oblique) pre-activates; this is preceded by activation of the right biceps femoris (hamstring). This creates a diagonal sling and the activation of this sling is directly related to the control of the thoracic rotation to counteract the rotation induced by the planned unilateral arm movement. In simple terms, when one arm is raised, the opposite TrA is more closely linked to the same side internal oblique and opposite hamstrings than it is to the other TrA. Therefore, the TrA does not act as a 'corset' so much as 2 separate muscles (left and right).
- There is very little evidence of bilateral activation prior to single arm elevation. In fact, less than 20% of subjects in the studies had symmetrical activation of TrA.
- The TrA activation patterns have also been found to be directional specific.

How the two theories fit together

- Even though isolated TrA training programs may not be replicating a normal motor pattern does not mean it is of no use. That would be throwing out the baby with the bathwater
- In the cases of a so-called 'unstable spine', bilateral TrA training may be a compensatory strategy (i.e. a strategy which is not the normal pattern) but is an efficient and effective strategy to improve confidence and quality of movement
- Also, the focused, low load (non-jerky) exercises involved in isolated TrA training plays an important role in the afferent / sensory control mechanisms of lumbo-pelvic movement patterns. This raises the importance of the focused attention of lumbo-pelvic position and the 'proprioceptive cues' that the isolation skill acquisition drives.
- In combination with 'neutral spine', attention to high risk postures may show that the isolated muscle training is a potent influence of higher order and more complicated control systems e.g. body awareness and the ability to disassociate lumbo-pelvic regions could all improve with this focal attention to the pelvic position and this low load skill training.

Take Home Message

- Core stability training helps to improve confidence and quality of movement, but will return better results if incorporated with motor control training.