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The middle crossed syndrome — New insights into core function

In the Rehabilitation and Prevention section of this edition, two papers have been selected which have investigated core function looking at two different aspects, evaluating two different trains of thought. The first of these papers, by Pardehshenas et al. *Lumbopelvic muscle activation patterns in three stances under graded loading conditions: Proposing a tensegrity model for load transfer through the sacroiliac joints*. This is a review of the current proposed mechanisms for sacro-iliac joint stability and proposes evidence for an alternative — or additional — tensegrity-based mechanism.

The second relevant paper, *Immediate improvements in activation amplitude levels of the deep abdominal muscle following a sacroiliac joint manipulation during rapid upper limb movement* by Barbosa et al. (2014), also evaluates the sacro-iliac joint, but assesses the effect of local muscle EMG following sacro-iliac joint manipulation (Grade V/cavitation).

This second study suggests that manipulative intervention alters local muscle recruitment and may aid understanding of one mechanism for how HVLA, a long-established and evidence-based form of treatment for low back pain patients, may interact with the recently emergent field of motor control in low back pain groups.

It is with these two new pieces of research in mind, that the focus of this editorial is on a clinical observation that this author has made, which may offer similar insights into the growing understanding of the function of the core musculature.

A remarkable insight

In 1979, perhaps one of the most useful clinical insights in 20th Century manual medicine was published. The world of bodywork and movement therapies would never be the same again as the influence of the muscular system on the joints was described by Vladimir Janda in his lower-crossed, upper-crossed and stratification (or "layered") syndromes (Janda, 1979).

Muscle imbalance

Muscle imbalance physiology has been a very useful tool to help to better understand the joint-oriented focus of manual therapies, such as osteopathic and chiropractic; how a joint becomes "tight", for example, and how disruption to a joint's optimal instantaneous axis of rotation may occur as a result of such imbalance; and the potential ramifications of this across time.

Janda explained that, in his observation, certain muscle groups that had a greater tonic activation during infant development, such as the flexors and adductors of the hip, or the shoulder protractors, are more prone to shortening and facilitation. As such, Janda commented that the lower crossed syndrome was the "mother" syndrome and that the upper crossed syndrome would be born as the result of the lower crossed occurring (see Fig. 1).

However, in the clinical experience of the author, working primarily in the United Kingdom, it would seem that from a prevalence point of view, the layered or stratification pattern is by far the most common muscle imbalance sequence to be observed in the clinical population. Why this is, is difficult to say for sure. Speculatively, Janda was working primarily with hospitalized patients in the Czech Republic, so this may have skewed his observations in one direction. By the same token, working in the Western 21st Century environment, it is rare to find a patient whose abdominal wall muscles function as they should (and probably once did as a child), and rare to work with a patient who sits for any less than 10 h of their day. It is possible that the deep longitudinal system, as described by Vleeming (1997) may correspond with Janda's observations of the layered syndrome; where instability or pain in the sacroiliac joint as studied by Hungerford et al. (2003) may increase activation of the biceps femoris, presumably in an attempt to increase lumbo-pelvic stability? However, it may be that with increasing levels of obesity and deconditioning that the requirement for compensatory strategies to help stabilize the pelvis have increased since Janda's original observations?

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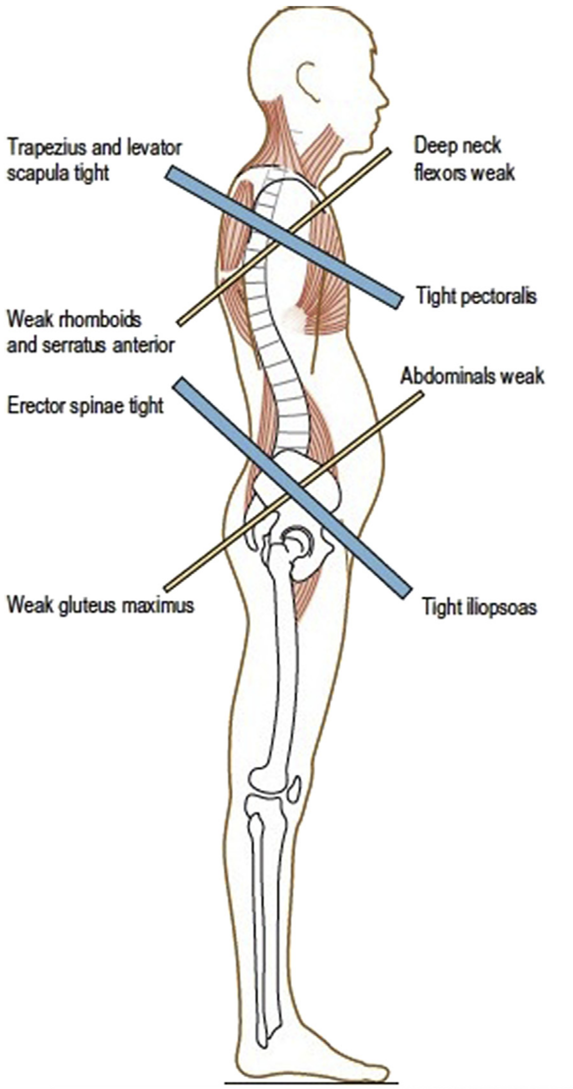

Figure 1 Janda's upper and lower crossed syndrome patterns.

Limitations of the muscle imbalance syndromes are mainly in their interpretation. Like many other clinical entities, it is tempting to rule them in or rule them out, based on absolutes rather than the shades of gray usually observed in clinic. The textbook case is the exception, not the rule.

It is possible to see, for example, most of the features of a lower crossed syndrome on one side of the body, with a layered syndrome on the opposite side, which may result in the classic pelvic torsion often treated by manual therapists.

In addition, Janda's muscle imbalance syndromes are dealing primarily with sagittal plane mechanics. Other's, such as Portafield and DeRosa (1998), have discussed frontal plane mechanics, including the lateral system, which incorporates the hip adductors and abductors on one side, and the quadratus lumborum on the opposite side (and, due to motion coupling, must include influences in the transverse plane). However, there has been little focus on transverse plane mechanics; yet it is locomotion in the transverse plane that human beings uniquely master across the first 5—7 years of life (Haywood and Getchell, 2005), to move with maximum efficiency through the gravitational field.

The transverse plane

Motion in the transverse plane is complex as it requires bilateral engagement of the hemispheres, but in an asymmetrical firing pattern. There are many descriptions of transverse plane or spiralic muscle chains around the trunk (Beach, 2010), from as far back as Da Vinci, yet the two that have received most clinical attention are the anterior and posterior oblique slings. These two slings are engaged in any speed of human gait above 0.75 m/s (in other words, any speed beyond "ambling") and serve as systems of reciprocal contraction and elastic recoil, creating a very efficient way to store energy and to move forwards.

Anterior oblique sling

The anterior oblique sling is described variably (Chek, 1998; Lee, 1998), as including the adductors of the hip, the internal oblique of the same side, the external oblique of the opposite side, the external intercostals and the pectoral group of the opposite side. When one leg is behind in gait, the opposite arm is behind, creating a stretch through that sling, a stimulation of the spindle cells, and a recoil which drives them through as opposing limbs reciprocate in gait's next step.

Posterior oblique sling

The posterior oblique sling is described (Chek, 1998; Lee 1998; Vleeming, 1997) as including the gluteus maximus of one side and the latissimus dorsi of the other side joining together over the midline via the superior lamina of the posterior layer of the thoracolumbar fascia. When one leg is ahead in gait, the opposite arm is also ahead, creating a stretch through that posterior oblique sling, a stimulation of the spindle cells, and a recoil which activates them to engage and drive the body forward (while at the same time their opposing limbs reciprocate during the gait cycle's next step) (see Fig. 2).

The premise of Janda's muscle imbalance syndromes is that as certain muscle groups differentiate into tonic dominance or phasic dominance they develop the tendency to either shorten or tighten (tonic dominance) or to lengthen or weaken (phasic dominance). This differentiation is believed to occur primarily during infant development, but will also continue into adult life based on which groups are over-utilized or under-utilized; and in what length tension relationship this occurs. For example, someone who sits slumped at their desk for many years will develop lengthening of their thoracic erector group and shorting of their upper rectus abdominis.

As far as this understanding is accurate, would it not also be reasonable to suggest that handedness or laterality patterns (discussed in Wallden, 2011) will also influence muscle usage, recruitment, length-tension relationship and differentiation of function?