Excerpt from *The Core* by Matt Wallden (2004) www.ptonthenet.com (technical editor: Paul Chek)

… To produce a conditioning or rehabilitation program for any client, it is first critical that you should be able to effectively assess that client's needs and function. Cyriax, a famous orthopaedic surgeon and author of many text books states the treatment can only be as good as the assessment (Ellis, Frasier & Gilles, 1990). Hence, you should be comfortable with a series of screening assessments or be able to refer out to someone who can perform such assessments so that you know the level at which you need to design their program.

Can your client walk after they've left you?

Some trainers, and therapists in particular, are notorious for over-descending their client's exercise program. If the client is able or likely to walk after they leave their appointment with you, you can use this as a guideline to see if you have descended their rehabilitation too far. There is little point, for example, in you prescribing that your client does prone TVA contraction to "condition" their abdominal wall in isolation, unless they are going to spend the rest of their week between appointments lying on their stomach! This is not how the body works – it operates in motor programs derived from central pattern generators.

To create new (or relearn old) motor patterns, the new pattern has to be generated cognitively. This is one of the great misgivings of manual therapy in general; the patient can not and will not change the way they move, unless they are put through a cognitive process of motor re-education (Lederman 2000, 2003, Schmidt & Wrisberg 2000). Therefore, massage, manipulation, mobilisation of joints, fascial release and every other kind of passive manual therapy has serious limitations in how it will change your client's movement patterns and biomechanical utilisation; such therapies must be a means to an end. Your clients need to know how to integrate their new found skill into purposeful and practical activities of daily living, such as walking, bending, lifting, squatting.

There are many manual therapists who vehemently reject the idea that their client with a disc bulge should be taught how to perform a functional activity, such as squatting. However, the point such therapists may be missing is that it was the inability to squat with proper form that probably caused their client's disc problem in the first instance. If the client is truly in a state where they should not learn to squat, then their pain should be so severe that they cannot sit and should only get into bed via a mechanical crane – they certainly should not be driving, as just getting into a car usually requires a single legged squat with a twist – a challenging movement pattern for even the most "functional" back! (Note: If your evaluation reveals TVA inhibition secondary to axial loading, inner unit training in non-compressive positions becomes justified.)

Some clients will respond better to organised rehabilitation, such as a structured exercise program three times per week. While others will respond better to an unstructured program which may include visual cues setting off specific exercises (such as every time you see a red car when driving, engage

your TVA for 15 seconds), or auditory cues – such as every time you hear a phone ring check your sitting position and ergonomics. Other ways to do non-specific exercises is to place red sticker dots (Comerford & Mottram 2001) on specific household implements – such as on the kettle, on the tap in the bathroom, on the top of your computer screen, on your TV remote control) and whenever you see this stimulus you perform your designated exercise.

Firstly, the transversus contracts before voluntary or reactive movement of the fore or hind limb (arm or leg) – therefore the old paradigm of the legs initiating movement is flawed; movement emanates from the core. This pre-contraction, or feed-forward mechanism, is essential to minimise micro-trauma to the passive structures of the spine (as described above) which houses our central nervous system, and carries our control centre, the head balanced atop of it. With a functional pre-contraction of the inner unit, the outer unit musculature (sling systems) are to some extent relieved of postural stabilisation of the osteo-articular system and can focus more of their energetic expenditure on mobilising the organism. This will result in greater force generation and better performance.

Secondly, for the primary mobilisers of the core to start to generate force effectively, the TVA first has to contract – this is described in Figure 6.

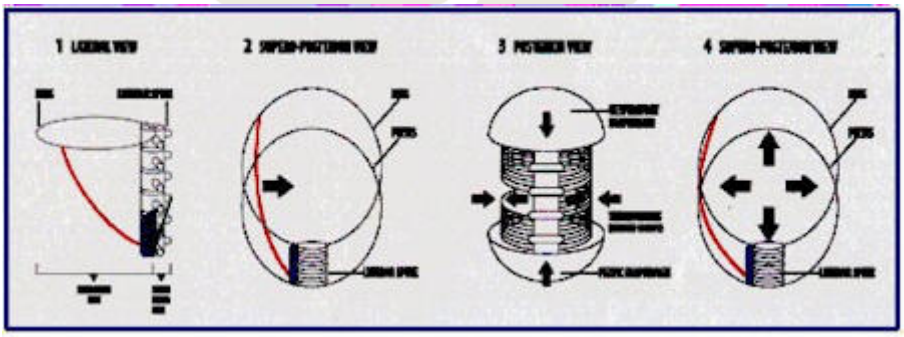

Figure 6: The visceral fulcrum theory. *The counterforce generated by the viscera when the diaphragm, TVA and pelvic floor contract together results in a functional cylinder, as described by Hodges (1999) – diagram 3. If there is no "cylinder", when the fibres of the more superficial internal oblique (diagram 1) contract, they will "cut into" the lateral body wall; exerting more of a lateral / sagittal flexion moment (diagram 2). It is proposed that one function of the pre-contraction of the transversus abdominis is to create a fulcrum about which the obliques slings can generate an effective rotary torque (Wallden 2000).*

Thirdly, a classic study by Rizk (1980) shows that the three layers of the human abdominal wall are all intermeshed in the anterior midline (at or around the linea alba). It emerges that the TVA fibres of one side eg the right, blend with the TVA fibres of the opposite side, but at a lower (more caudal) level – therefore potentially exerting both a compressive and a rotary force. In fact, Rizk (1980) suggests that the TVA should be called the "profundus obliquus" – as many of its fibres are not technically transverse!

Even more significant is the fact that all 3 layers of abdominal wall interdigitate with another – like the warp and weft of a textile. The TVA interdigitates with the internal oblique of the opposite side. The internal oblique interdigitates with the TVA of the opposite side and with the external oblique of the opposite side. The external oblique, as well as connecting to the opposite internal oblique, connects to the external oblique on the opposite side. See Figure 9 below.

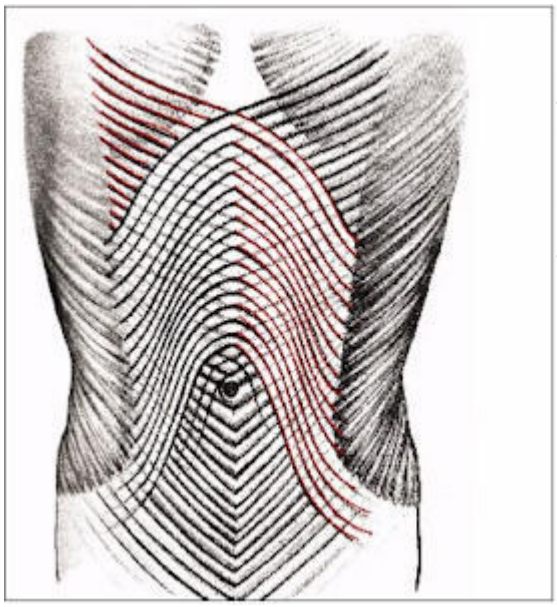

Figure 7: The abdominal wall. *This is a diagrammatic representation of Rizk (1980's) findings; that the internal oblique fibres of one side (in this case the internal oblique is coloured red on the left side) run in to and attach to the external oblique fibres of the opposite (right) side. This image is adapted from Gray's (1993), where it has actually been pasted into the book upside down (but must have missed the editors' attentions)!*

The end result of all this is that there are many triangular fibre arrangements – like a kind of triangular chain-mail of our muscular armour, designed both to protect our organs, and to stabilise / move our skeleton. Only triangulated structures are inherently stable (Levin 1997) and therefore the triangulated abdominal wall is designed for strength and stability.

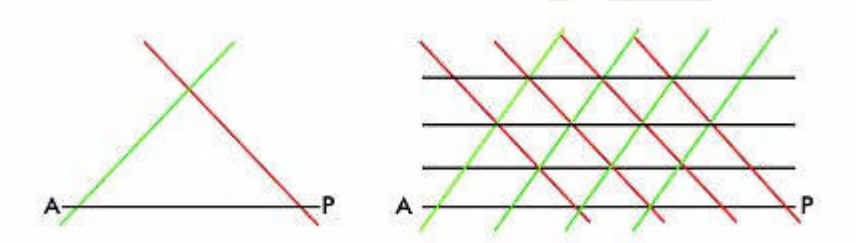

Figure 8: Schematic representation of the triangulated nature of the abdominal wall. 1) *One **TVA fibre** (black), one **IO fibre** (red) and one **EO fibre** (green) form one triangulated structure, whereas **2)** four fibres from each muscle forms a multiplicity of triangles. How many you can you count? Did you include the upside-down triangles?!*

Hence any kind of movement, muscle contraction or co-contraction is going to pre-tension and therefore stimulate the spindle cells in all other parts of the abdominal wall.

This then would seem to confirm McGill's (2002) contention that abdominal bracing is more effective at stabilising the spine than abdominal hollowing – which is designed to isolate the TVA. However, despite there being great debate distinguishing between bracing and hollowing, if abdominal hollowing truly tensions the TVA bilaterally, so the internal oblique and, sequentially, the external oblique will be contracted as a result of spindle stimulation; resulting in the same abdominal bracing that McGill (2002) refers to!

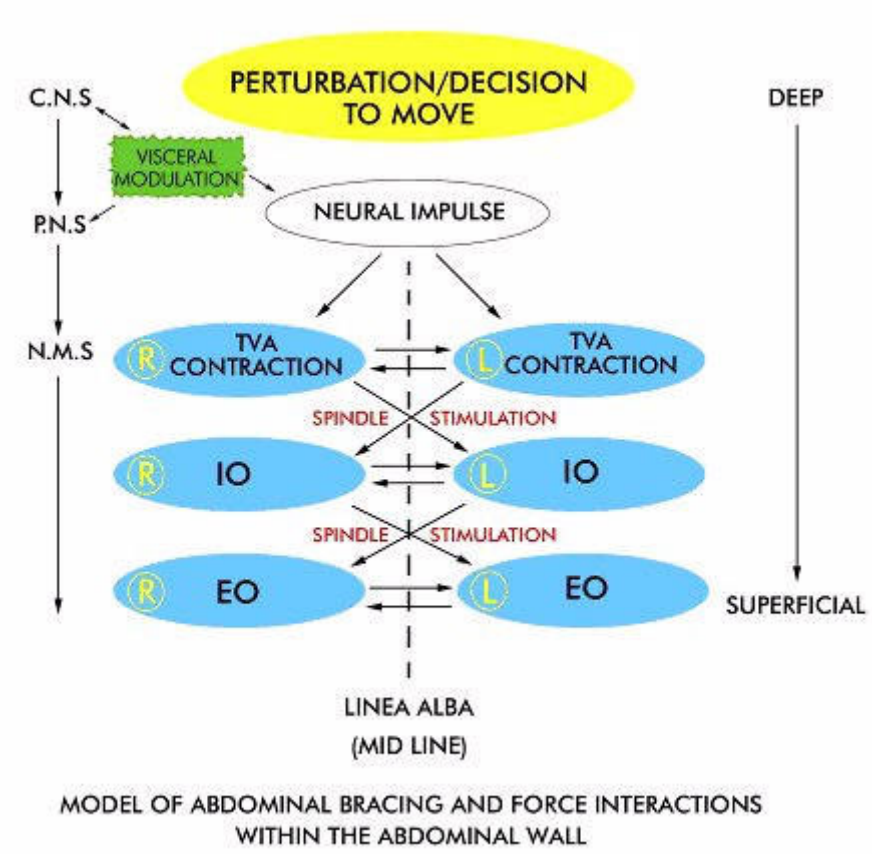

Figure 9: Abdominal Bracing and Force Interactions within the abdominal wall. *Either the body consciously decides to move, sending a neural impulse to the TVA, or it is perturbed and sends an impulse to the TVA – the message being "to stabilise". When the TVA contracts on one side (usually the neural impulse would be bilateral), it stimulates the contralateral TVA through stretching of the muscle spindles. Additionally the contralateral IO will also receive the same muscle spindle stimulus and will contract as a secondary effect of TVA contraction. Finally, the ipsilateral EO will contract through spindle stimulation as a tertiary effect. Although this discussion is hypothetical based on the applied anatomy, it is supported by the work of Richardson et al (1999) who show that the timing of onset of TVA-IO-EO contraction is as one would expect based on the applied anatomy. This further makes sense as the TVA is composed of more slow twitch fibres (less fatiguable) IO of more fast twitch fibres, and the EO of even more fast twitch fibres. This is a general principle in the body where deeper tissues have a higher preponderance of slow twitch and more superficial tissues the opposite. If there is gut inflammation, uterine inflammation, current low back pain or a history of low back pain, the TVA is likely to be inhibited and the process gets cut off at the top of the cascade. In such an instance, the body must introduce a compensatory strategy which is dysfunctional, but better than no compensation at all.*

This also leaves us with a problem; if the entire abdominal wall is used for stabilisation of the lumbar spine (one of the more vulnerable parts of the spine due to its lack of costal support), which muscles mobilise the lumbar spine?

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