Functional Anatomy – Myofascial Core Slings

In University anatomy textbooks are the foundation to understanding human movement. And while they do an outstanding job laying this foundation most fall short in helping students understand the ‘whole’. Similar to the machine based training of the 80’ and 90’s; most anatomical text focus on isolated bones, muscles, & joints. Anatomy is primarily taught as origins and insertions of isolated muscle groups attached to 1 or some cases 2 joints. Muscle(s) are referred to as single or multijoint muscle(s). However, the human body is a complex ‘whole’ organism sustained via intricate hormonal, anatomical, physiological and neurokinetic interaction. The complexity of human movement is further complicated by the unpredictability of the environments we recreate, survive and work in. Most, if not all daily life and performance based activities require the involvement of multiple joints, through multiple ranges of motion, in a variety of directions. Therefore, while current anatomical textbooks may help researchers and surgeons isolate and study individual points of reference, the prevent hands on fitness and rehabilitative practitioners from easily incorporating their knowledge of anatomy into a true understanding of human movement and functional exercise prescription. With the recent shift of exercise prescriptions towards performance and function, fullbody, multijoint, multiplanar movements have begun to dominate the rehabilitative and fitness industries. Therefore, it’s imperative that the fields of rehabilitation, personal training, group exercise, and sport performance begin to align their understanding of anatomy to the prescriptions they are developing.

For the purposes of this article, the science and application of movement and the alignment of the rehabilitative and fitness industries, anatomically, the core’s outer unit is referred to as a

chad@arctraining.ca

www.fitnesssource.ca
series of kinetic chains or myofascial slings. Furthermore, with reference to the core inner / deep unit, we will predominantly examine the outer/superficial myofascial slings. In my opinion, all movement occurs from and relative to a person’s center of gravity. The core or torso of the body works to connect the lower and upper extremities and allow the body to function as a comprehensive unit. Therefore the foundation of movement and this article is the ‘core’.

Movements, anatomy, muscular coordination & function of the core units

In addition to extension (back bending) and flexion (fwd bending) of the spine, the core is designed to maintain the stability & create mobility required to generate the functional movements push, pull, stride, squat, lunge, chop, lift, & bend with multiple speeds and directions. The core has two major neuromuscular activation patterns 1) preACTivation and 2) sequential firing. Together they are referred to as the ‘set - fire sequences’.

- **Setting / PreACTivation** of the deep inner unit including TA, Multif, pelvic diaphragm, & thoracoabdominal diaphragm to stabilize the spine and pelvis 30-110 ms prior to movement or change of force (Richardson, Jull, Hodges & Hides 1999).

- **Firing / Activation** of core mobilizers, like the obliques, rectus, erectors, QL’s etc to create and dissipate movement (Celebrini & Mckechnie, 2004).

Together the *deep inner unit* forms an anatomically and therefore functionally continuous connection who’s function is designed to aid in coordinating breathing as well as spinal pelvic stability. It is deepest myofascial connection whose function is required prior to movement associated with muscle shortening and lengthening. If the inner unit’s activation is diminished, out of sequence or its timing delayed, dysfunction and chronic pain is often present (Vleeming & Lee, 2001). Beyond the scope of this article, if you require further resources on myofascial slings, I recommend you take any course or related material from practitioners Alex McKechnie, Rick Celebrini, Carl Petersen, Diane Lee or Paul Chek.
Inner Unit Anatomy & Function

Thoracoabdominal Diaphragm: functions to coordinate respiratory timing, postural control and core stability (Hodges et al 1997). It functions through 3 dimensional shape changes to the abdominal and thoracic cavities.

- Sternal portion: two small muscular slips from the Xiphoid Process
- Costal portion: from the lower 6 ribs where it connects with slips from the TA
- Lumbar Portion: consist of the anterior layer of the TLF over top of Psoas and QL, blending with the anterior longitudinal ligament and lower lumbar vertebrae.

Pelvic Diaphragm: functions in combination with the TD to control intra-abdominal pressure. It may also function to stimulate early TA activation and creates force closure through the SI and pubis symphysis.

- Levator Ani: consisting of Pubococcygeus, Puborectalis & Iliococcygeous
- Coccygeus

Lumbar Multifidus: functions to create segmental control of the intervertebral space. Also controls rotation and rotation in combination with flexion. Increases tension of the TLF via hydraulic amplifier effect (when the Erector Spinae muscles contract within this relatively non-expansible envelope, pressure is exerted against the fascia, which produces an extension force on the forward bend or flexed spine, Chek, Abs in or Abs https://www.chekconnect.com/

Transverse Abdominus: has a direct influence on transversalis fascia, is non directionally activated prior to displacement of the C of G or predictable load application, increases

chad@arctraining.ca

www.fitnesssource.ca
stability of the pelvis and spine via fascial connections and increases intra-abdominal pressure.

Anatomy & function of the superficial outer unit

<table>
<thead>
<tr>
<th>OUTER UNIT MUSCLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal Sling or Superficial Back Line: Erector Spinae, Sacrotuberous Ligament, Ischial Tuberosity, Hamstrings</td>
</tr>
</tbody>
</table>
Posterior Oblique (POSling): Rhomboids, Latissimus Dorsi, Intervening ThoracoLumbar Fascia, contralateral Gluteus Maximus

Anterior Oblique (AOSling): Pectoralis Major, Serratus Anterior, External Oblique, intervening Anterior Abdominal Fascia, contralateral Internal Oblique, and Adductor muscles (same side as internal oblique)

Lateral (LSling): Quadratus Lumborum, Gluteus Medius and Minimus, Tensor Fascia Lata and opposite (contralateral) Adductors of the thigh
A closer examination of outer superficial unit function quickly helps one understand how different individual joints of the body are linked forming a continuous line of muscular pull and function across 2 or more joints. In simple, this means if you lengthen or shorten a muscle in your foot or toes, the myofascial connection or line of pull can extend all the way to the top of your head (Myers, 2006). One ex is the superficial back line (Myers, 2006; 2008). This fascial and therefore muscular connection runs from the plantar fascia on the bottom foot, all the way up the back half of the body and over the top of your skull connecting on the ridge of your brow.

When we walk, run, stride, bend, lift, chop, press, push, pull, squat, lunge and move, multiple joints with multiple muscles and fascial connections communicate to the CNS to produce the desired full body movement. It’s reasonable to assume that one muscle, the primary muscle required to complete the task will be activated and overloaded to a far greater extent than muscles whose roles are secondary and distant from the primary activation. However, due to these connections the primary muscle’s action is dependent and affects the secondary muscles movement; neither working in isolation to create the desired movement. An example of the superficial back line’s functionality would be the following. If u are facing forward standing on bus or train while it comes to halt, each
and every one of the muscles connected by the superficial back line will be forced to contract in a well timed, coordinated matter to ensure you center of gravity doesn’t move outside your center of balance (i.e. so you don’t fall over). Depending on the plane, speed, and distance of the desired movement this chain of muscular action must occur to produce or in this case prevent movement. If this neuromuscular chain has not been well trained or muscular adhesions / myofascial trigger points are present in either of the muscles along this chain, muscle stability and mobility can be compromised, leading to inefficient mechanics, loss of strength / power, range of motion and or coordination. The take home story is this. If you want to create fluid, pain free movement you must move beyond individual muscle and joint explanations and begin to understand and embrace the complexity of human movement.

A rehabilitative ex. will help highlight the myofascial connections between peripheral joints and the myofascial core slings. Often when I see young female athletes, they have a unilateral internally rotating femur and / or abducting femoral head often causing the knee to drop inwards. They are often complaining of same side anterior knee pain or have been diagnosed with patella femoral syndrome. Most practitioners tend to isolate and eccentrically train the glute medius, glute max complex on the same side. While this weakness may indeed be part of the problem, in my experience, more appropriately one should examine a little farther up the kinectic chain. Unilaterally, the anterior sling is often weak causing the pelvis to tilt upwards and therefore creating an instability between the hip, spine and pelvis, weakening the associated glute complex. As soon as the anterior sling is activated, pelvic hip spinal stability improves causing a significant improvement in the same side glute strength and femoral stability (i.e. the knee no longer drops inwards.

Another ex. of myofacial of sling coordination is flexion (landing or decelerating) and extension (jumping or accelerating). To create this movement the lower body joints and associated muscles work in triplicate. Therefore, the primary muscles of the hips, knees and ankles must all cooperate in order to produce the desired outcome. It is wrong to think that the calves, quads, and glutes produce all of the forces necessary to create
extension / acceleration / jumping. Not only do these muscles have deceleration counterparts (i.e. anterior tibialis, hamstrings and hip flexors) working in a coordinated fashion to help dissipate excessive torque, muscle trauma & ligament strain but the muscles of the trunk and spine also play a distant but important secondary, yet important stabilizing role. The lumbar spinal erectors are helping to eccentrically stabilize the pelvis prior to a concentric contraction and spinal extension. Similarly, the same muscles that worked to accelerate, work eccentrically to decelerate upon landing. Also triple flexion is not self contained to the knee ankle and hip.

Together a functional deep inner unit and superficial outer units work in a coordinated, synergistic fashion to create both muscular mobility and segmental joint stability. When individual muscle tightness and weakness exist there is an associated and predictable myofascial chain of events. The diagnosis of muscular injury and prescription of functional exercise must be associated with the knowledge of these myofascial connections.

REFERENCES


chad@arctraining.ca

www.fitnesssource.ca