Core Stability

CHAPTER 11

In recent years an understanding of the concept of core stability has changed the way in which we rehabilitate our patients. We have chosen to use the term 'core stability' in this book but there are many other interchangeable terms (Table 11.1).

All these terms are a description of the muscular control required around the lumbopelvic–hip region to maintain functional stability. Particular attention has been paid to the core because it serves as a muscular corset that works as a unit to stabilize the body and spine with and without limb movement. In short, the core serves as the center of the functional kinetic chain. The core has been referred to as the 'powerhouse', the foundation or engine of all limb movement. All movements are generated from the core and translated to the extremities.

We use the term 'stability' rather than 'strength' because strength is just one component of the dynamic stability required. Dynamic stabilization refers to the ability to utilize strength and endurance in a functional manner through all planes of motion and action despite changes in the centre of gravity.[1] A comprehensive strengthening or facilitation of these core muscles has been advocated as a preventive, rehabilitative and performance-enhancing program for various lumbar spine and musculoskeletal injuries.

Table 11.1 Terms used to describe core stability

Lumbar/lumbopelvic stabilization
Dynamic stabilization
Motor control
Neuromuscular training
Neutral spine control
Muscular fusion
Trunk stabilization
Core strengthening

The 'core' has been described as a box with the abdominals in the front, paraspinals and gluteals in the back, diaphragm as the roof, pelvic floor and hip girdle musculature as the bottom, and hip abductors and rotators laterally.[2] All these muscles have direct or indirect attachments to the extensive thoracolumbar fascia and spinal column, which connect the upper and lower limbs.

Stability of the lumbar spine involves both passive stiffness, through the osseous and ligamentous structures, and active stiffness, through muscles. A bare spine, without muscles attached, is unable to bear much of a compressive load.[3,4] Spinal instability occurs when either of these components is disturbed. *Gross instability* is true displacement of vertebrae, such as with traumatic disruption of two out of three vertebrae. On the other hand, *functional instability* is defined as a relative increased range of the neutral zone (the range in which internal resistance from active muscular control is minimal).[5] Active stiffness or stability can be achieved through muscular co-contraction, akin to tightening the guys of a tent to unload the center pole (Fig. 11.1).[6]

A major advance in our understanding of how muscles contribute to lumbar stabilization came from recognizing the difference between local and global muscles. Global (dynamic, phasic) muscles are the large, torque-producing muscles, such as the rectus abdominis, external oblique and the thoracic part of lumbar iliocostalis, which link the pelvis to the thoracic cage and provide general trunk stabilization as well as movement.

Local (postural, tonic) muscles are those that attach directly to the lumbar vertebrae and are responsible for

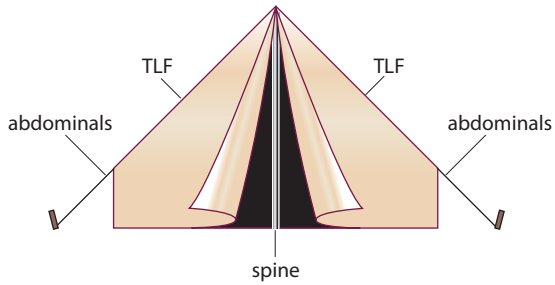

Figure 11.1 Active stability is achieved through muscular co-contraction via the thoracolumbar fascia (TLF). This is similar to the stability imparted by the guys of a tent ADAPTED FROM PORTERFIELD[6]

providing segmental stability and directly controlling the lumbar segments during movement. These muscles include lumbar multifidus, psoas major, quadratus lumborum, the lumbar parts of iliocostalis and longissimus, transversus abdominis, the diaphragm and the posterior fibers of internal oblique (Fig. 11.2).

Whereas previously the major emphasis in rehabilitation has been to strengthen the global muscles (e.g. the use of sit-ups as a treatment for low back pain), we now understand that both groups of muscles must be working efficiently. We have also come to realize that strength is not the only, nor indeed the most important, quality of the muscle. Muscle activation and endurance are probably more important than strength and any rehabilitation program should reflect this.

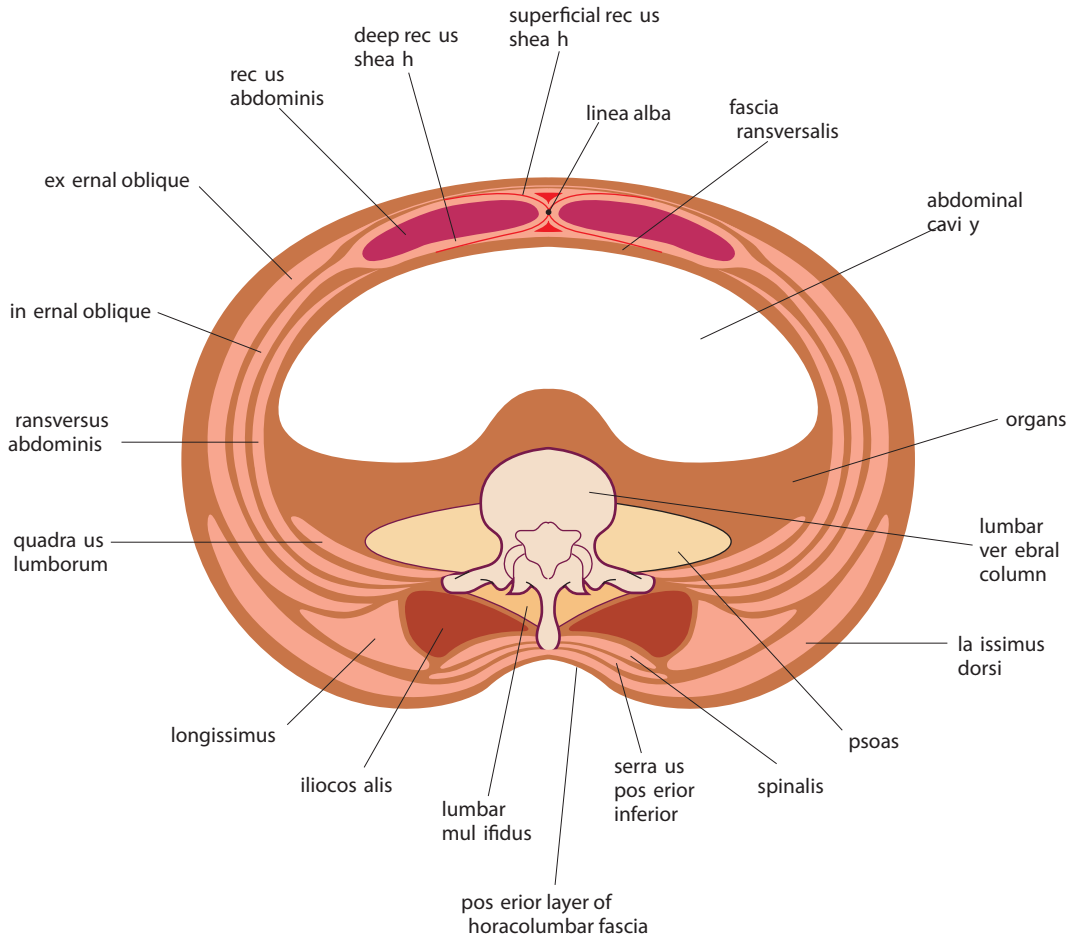

Figure 11.2 Cross-sectional anatomy of the lumbar spine