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## Core strengthening and stabilization in therapeutic exercises

**Abhilash SS and Dr. George Joseph**

### Abstract

“Core”- the area of the body made up of the lumbo-pelvic-hip complex. It is made up of 29 muscles which include the lumbar spine muscles, abdominal muscles, and hip muscles. It acts and operates as an integral unit and helps the structural components to operate optimally. The various concepts of core stabilization are

- Improvement of dynamic postural control, muscle balance, dynamic functional performance, and increased neuromuscular efficiency.
- Spinal stabilization
- Postural considerations
- Neuromuscular considerations

Guidelines for core stability training include comprehensive evaluation, systematic, progressive, and functional programme, muscle contraction spectrum, programme variation. Core stabilization exercise should include a proprioceptively rich program, and continuum and should be safe and challenging. It should stress on multiple planes and incorporate a multi-sensory environment. It should be activity-specific and progressively functional.

**Keywords:** Core strengthening, stabilization, therapeutic exercises

### Introduction

Most of us are familiar with the term “Core Strength or Core Stability”. An internet search reveals a plethora of exercise programmes and equipment purported to improve core muscle strength. There appears to be a consensus agreement that it is important to have good core strength or core stability in order to perform well in athletics/dance and to prevent spinal injury. There is less information and less agreement on the definition of core muscle strength or core stability.

### Definition of Core Strength and Core Stability

Core strength should be distinguished from core stability. In the Physical Therapy literature, the historically older term is “Core Stability”. In the latter part of the 1980’s a concept of a “neutral spine” developed among physical therapists and physicians who were treating individuals with back pain. Dr. Panjabi (1992) defined spinal stability as consisting of three subsystems, passive components of the spinal column, active control by spinal muscles, and neuromuscular control or coordination. Core stability relates to the bodily region bounded by the abdominal wall, the pelvis, the lower back, and the diaphragm and its ability to stabilize the body during movement. The main muscles involved include the transverse abdominis, the internal and external obliques, the quadratus lumborum, and the diaphragm. The diaphragm is the main muscle of breathing in the human and so breathing is important in providing the necessary core stability for moving and lifting. It is the action of these muscles contracting together upon the incompressible contents of the abdominal cavity (i.e. the internal organs or viscera) that provides support to the spine and pelvis during movement.

Core stability is a misunderstood term. Typically, the core is associated with the abdominal muscles groups, and stability is associated with isometric or static strength. However, in actuality, the core consists of the abdominal muscle groups (transverse abdomens, internal

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obliques, external obliques, rectus abdomens), hip abductors/adductors, hip flexors, and the pelvic floor, and lumbar spine. In addition, it is the lumbar spine that is primarily responsible for posture and stability providing the strength needed for stability especially utilized in dynamic sports.

Whenever a person moves, to lift something or simply to move from one position to another, the core region is tensed first. This tension is usually made unconsciously and in conjunction with a change in breathing pattern. An example to try is to sit in a chair and reach forward over a table to pick up a cup. This movement is first accompanied by tension in the core region of the abdomen and can be felt by placing one hand on the abdomen as the movement is made.

As the load increases the key muscles contract around the viscera, which are incompressible, to form a stable ball-like core region against which the forces are balanced in coordination with posture. In martial arts there is a saying that power is generated from the ground up' and core stability is necessary for the transfer of force and power from the ground across the body into any movement.

Core muscle strength is usually operationally defined by a measurement of the strength of core muscles, either in terms of how much weight/resistance a muscle can lift, how many repetitions a muscle can perform, or how long a muscle can hold a neutral stable position.

Some experts argue that measuring core muscle strength when the spine is moving is not an appropriate measure of core muscle strength; because the more important measure is how well the core muscles can hold the spine/trunk still and relatively stable while the extremities are moving. One measure of core muscle strength is how long an individual can hold a prone or side plank position. Others have measured the amount of force a hip muscle can hold an isometric muscle contraction. Others use a sequence of lying leg lifting while maintaining the spine in a neutral alignment.

Measurement of core stability is more challenging to measure than core muscle strength as it requires incorporating parameters of coordination and balance. An example of testing one's core stability is a lunge. A lunge is a dynamic movement in which a large step forward bending the knee, and touching the opposite knee to the ground. The spine should maintain an erect posture, without tilting the pelvis or shoulders, the forward foot is directly under the knee, and the forward leg does not deviate to either the right or the left. Accomplishing this manoeuvre without deviation requires the deep trunk muscles to control the spine, pelvis, and hips while lifting the body's weight. A more challenging example of testing core stability would be the Olympic weight lift of the "clean and jerk. This requires very strong core muscles, and correct spinal alignment while lifting a progressively heavier weight. Another example is to maintain the spine and trunk in a stable alignment while, sitting, or standing on an unstable surface such as a gym ball, or balance board while lifting weight with the arms or legs.

### **Can Core Strength/Stability improve performance and decrease the risk of injury?**

Controversy exists on whether greater core muscle strength actually improves athletic performance. There is little support in research for the core stability model and many of the benefits attributed to this method of exercise have not been demonstrated. At best core stability training has the same benefits as general, non-specific exercise (review by Lederman 09) and walking. Trunk or core-specific exercise has failed to demonstrate preventative benefits against injuries

in sports or to improve sports performance.

Studies exist to support the role of core stabilization in protecting the spine from unnecessary shifting and shearing of vertebral structures. The core stability model consists of passive and active stabilization structures as well as a third, often disregarded subsystem, called the neuro-motor system. This vital system is required for the active structures such as muscles to provide pre-emptive or rather quick responses to the body's demands.

A recent study by Michael Tse (2005) looked at college-age rowers who performed core muscle strength training and demonstrated improved core strength measurements. The subjects failed to demonstrate improved rowing abilities. Robert Stanton (2004) examined high school athletes. The subjects participated in a short-term Swiss ball core stability training program. They demonstrated improved measurement of core stability but failed to demonstrate improvement in running the economy or running posture. It should be noted the subjects in Stanton's study were not participating in simultaneous programs designed to improve the running economy. SF Nadler (2002) examined collegiate athletes who incorporated a core strengthening programme to their training programme, and found there was no significant change in the occurrence of low back pain. Conversely DT Leetun (2004) demonstrated basketball and track athletes who did not sustain an injury during the season demonstrated greater amounts of muscle strength in hip and back muscles.

Currently, there is limited and conflicting evidence that improving core stability or core muscle strength improves athletic performance or prevents injury. Perhaps the lack of agreement on the definition and measurement of core strength and stability contributes to the lack of hard scientific evidence and conflicting evidence. Despite the lack of hard scientific evidence and conflicting evidence, intuitively it makes sense that increased core strength should improve athletic performance and prevent injury. Core training should involve dynamic movement progressing from slow to fast. Ideally, it should involve diagonal movements as most athletic activities involve rotation of the trunk and spine. It should involve activities that require endurance. Of course, it should involve some reaction to changes in surface, or outside forces.

Training methods for developing and maintaining core stability include:

- Pilates
- An exercise ball, also known as a Swiss ball, stability ball, yoga ball, Pilates ball, or fitness ball
- Isometric exercises
- Concentric isotonic exercises

### **Exercise for strengthening the Cervical Thoracic and Lumbar spine**

The cervical, thoracic and lumbar spine is composed of a total of 24 pre-sacral vertebrae and their main functions are to protect the spinal cord and provide an attachment site for many muscles of the body. They also function by distributing one's body weight when standing upright. Many injuries to the spine occur as a result of vehicle accidents, falling, and sports and recreation. While it is impossible to prevent such events from happening, by increasing intra-abdominal pressure and strengthening the musculature in your back and the ability to keep a neutral spine, one is able to minimize preventable injuries like hernias, strains, and sprains.

### **Achieving a Neutral Spine**

The spine is naturally curved in segments: the cervical spine

is curved inward or anteriorly (lordosis), the thoracic spine is curved outward or posteriorly (kyphosis), and the lumbar spine is curved inward or anteriorly (lordosis). In order to ensure even distribution of stress on the spine, maintaining a neutral spine can maximize the support provided by these structures. A simple exercise that may require some practice is called the “Pelvic Tilt.” The individual is lying on their back with their knees bent and their feet flat on the floor. Next, the individual will engage their abdominals in order to pull their lower back flat on the floor. This may be difficult for some at first so aim for holding this contraction for approximately 10–15 seconds for a total of 5 repetitions.

### **Intra-Abdominal Pressure**

The correlation between having a significant amount of core strength and spinal health has been well documented by many studies in the past. Some of these studies were able to quantify the effects that antagonizing abdominal muscle had on stabilizing the lumbar spine by increasing the amount of intra-abdominal pressure in order to maintain a straight lumbar spine and avoid rounding during physical activities and by using simple techniques such as the “Valsalva manoeuvre”. A simple exercise used to strengthen the abdominals (rectus abdominus, internal/external obliques, and transverse abdominus) is using the isometric or “static” hold known as the plank. The plank simulates the need to resist movement rather than create it and when focusing on spinal stability this is exactly what we need. In order to execute the move, one can begin in a pronated position and either support one’s self on their forearms or hands (like a push-up position). The objective of the movement is to keep the spine in proper alignment while keeping protracted shoulders and maintaining the spine in alignment. This can be done by remembering to keep a tight core as well as consciously contracting the gluteus group of muscles.

### **Strengthening back musculature**

Simply by working to keep a neutral spine and remembering to increase intra-abdominal pressure before performing a movement that could compromise the spine, you are able to drastically decrease your risk of sustaining a back injury. If you were looking for ways to both strengthen and increase the stability of the musculature of the spine one could perform various bodyweight exercises, one of them being what is known as the “contralateral bird-dog.” To perform this exercise, one will begin on their hands and knees with their palms flat and under their shoulders and their thighs directly under their hips. Next, while maintaining a neutral spine and a braced abdomen, the individual raises their right arm and left leg simultaneously forming a straight line with their spine as shown in figure 3 below. If possible hold this position for a total of 10 seconds on each side for 5 repetitions and once you are able to perform these, and then you can add touching the contralateral (opposite) elbow to the knee.

### **Conclusion**

While our brains are “wired for movement, not musculature”, we must learn to move properly by utilizing proper biomechanics and ensuring our posture and alignment are in optimal positions to execute the task safely while minimizing the possibility of injury. If we can learn to remember to keep a neutral spine, increase intra-abdominal pressure, and we continue to strengthen the musculature of our back and core, we will live a pain-free life.

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