Core Strength – Core Stability: Controversy regarding definition - does it ensure enhanced athletic performance?

Most of us are familiar with the term "Core Strength or Core Stability". An internet search reveals a plethora of exercise programs 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 vs 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 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. When the muscles in the hip, shoulder girdle, and trunk work together, they form a functional segment called the core. Others modified the definition of core stability to describe it as the ability of the core muscles to work in an efficient and coordinated fashion to maintain correct alignment of the spine and pelvis while the limbs are moving.

The core muscles are the superficial and deep spinal extensors muscles, abdominal muscles, pelvic floor muscles, and shoulder girdle and hip girdle muscles. The term core strength refers to the strength of these core muscles. 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 to measure 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 ones 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, the forward leg does not deviate to either the right or the left. Accomplishing this maneuver 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, 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 risk of injury?

Controversy exists on whether greater core muscle strength actually improves athletic performance. 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 economy or running posture. It should be noted the subjects in Staton's study were not participating in simultaneous programs designed to improve running economy. SF Nadler (2002) examined collegiate athletes who incorporated a core strengthening program to their training program, 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. My opinion is core training should strive to simulate the athletic activity. Much of the core training that is practiced involves abdominal exercises lying on the ground. The only sport I know of in which you are laying on the ground on your back is when a wrestler is loosing a match. Ideally abdominal strengthening exercises should progress to a standing position, while striving to hold the trunk and spine still while the extremities are moving. 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 which require endurance. Of course it should involve some reaction to changes in surface, or out side forces.