The Efficacy of Core Training

John Hobbs Med, RN

It has become commonplace to hear the terms "core" and "core training" (CT) in most athletic fields. However, the claimed benefits and subsequent athletic improvements due to engaging in CT are often incorrect. Various studies and subsequent reviews have identified the role these exercises play in the training of an athlete is limited.

The origin of the trend is founded in scientific studies. This common practice, however, is a case of empirical work and data at a basic level being extrapolated out. This is not uncommon in the scientific community. However, subsequent work confirms the various assumptions as they progress. When this verification does not occur and is mixed with unsound anecdotal opinions, inaccurate claims can snowball with only a small portion being accurate. In the fitness industry where fads can rapidly take hold, this can lead to scientifically untested or inaccurate claims to become "common knowledge" and the subsequent implementation of ineffective practices. In that event, trends like CT become doctrine. In these instances, it is important to evaluate what a training program truly accomplishes and what possible benefits and detriments may be. With this in mind, it is not the purpose of this article to denote CT as something to be avoided. If an athlete enjoys this aspect of training and the practice does not interfere with the accomplishment of other training goals, there is no reason to eliminate it. However, if an individual has limited time or is engaged in extremely taxing training, it would be prudent to allot their limited training resources to be spent on the accomplishment of goals. With this in mind, it is important to have an understanding of the arguments against CT as a means of injury prevention and the core as a limiter in many athletic activities.

Injuries and Lower Back Pain

A common accolade of CT is its role in the prevention and treatment of lower back pain and other injuries. However, this is based off of several assumptions from limited data sets. Mix this with the fact that the reasons for CT initially sound plausible, especially to those who have limited to no depth of understanding of muscle function and motor control, it is easy to understand how the wave of CT gained momentum. The review of literature by Lederman (2010) attempts to dispel many of the myths surrounding the concept of CT and the purported injury prevention. While we are evaluating the arguments from this one single work, this piece evaluates the injury prevention perspective based on data and on basic physiological functions and is an in-depth analysis of a number of works on a variety of points.

As Lederman notes, the transverse abdominals are largely attributed with injury prevention, along with other muscles, and unrightly so. By evaluating the occurrence of back pain in populations where the strength and function of this muscle group are impaired, the limited role of this muscle is illustrated. The primary populations used by Lederman are the obese, pregnant/post-partum women, and cases where surgical intervention altered muscle function. In the case of obese populations and pregnancy, the abdominal muscles

are stretched and no longer offer the same level of force production. Evidence does suggest an association between obesity and an increased risk for developing lower back pain (Shiri, Karppinen, Leino-Arjas, Solovieva & Viikari-Juntura, 2009). Lederman, however, notes that if core strength is directly related to lower back pain, the incidence of injury would be much higher, mirroring the rates of obesity. With pregnancy, the key to identifying the lack of relationship with core strength and injury is the post-partum period. Works are cited by Lederman showing that the deformation of abdominal muscles that remains post-partum is not manifested by incidence of back pain. In fact, back pain associated with pregnancy is resolved with days of giving birth, long before the recovery of the abdominal muscles and measured function returns to normal.

In the evaluation of back pain in the obese and post-partum populations, etiology of the altered muscle function is secondary to other events and physiological processes. This leads to the possibility of other unevaluated factors contributing to the lack of injury. However, Lederman's evaluation of surgical manipulation decreases the use of these extraneous factors to rendering the argument invalid. As the author notes, the result of several invasive surgical procedures is either a temporary or permanent deformation of various core muscles due to trauma or intentional alterations of insertion points. However, the limited incidence of back pain after these procedures lends evidence that the role of core strength to injury prevention may be overstated.

Lederman's work also traces the concept of core training back studies that show an alteration in the activation patterns of muscle groups in individual afflicted with lower back pain. The link is through an observed alteration in the patterns of muscle activation between those afflicted with chronic back pain and those without. With this finding, it was presumed that training the core muscles would return the activation patterns to normal. However, this is a "chicken or the egg" situation. Lederman notes that it is not uncommon for muscle recruitment to change in response to an injury as a protective mechanism. So, the question stands as to if the observed differences occurred as a result of the injury.

It is often claimed that core workouts increase the firing rate of the muscles. With this, supposedly injury is decreased and performance increased. However, one principal of training that exercise physiologist consistently cite is that of specificity—the training must mirror the task performed. While it is true that training alters the activation of motor units (Pogrzebna & Celichowski, 2008), this does not translate in to altered firing patterns of muscle groups in all instances. As Lederman notes, the recruitment of patterns for motor control are complex. If the threshold of activation for particular muscles groups were to be lowered, this does not translate to altered patterns. As a result, CT would not result in decreasing injury risk or increase performance. And as Lederman notes, no studies have shown a reorganization of motor patterns to prevent back injury. Instead, training of the core musculature must be performed in a manner similar to or in the actual movement to which it is being used. Additionally, the notion that continual contraction of the core achieves injury prevention is also dispelled by the theory of specificity as conscious activation of the muscle groups is overridden by the motor patterns to achieve movement. An example of this would be extending the arm while attempting to achieve maximal contraction of the bicep. The arm still extends and the motion is made more complex. And with this, the movement becomes less efficient. Additionally, a variety of muscles are used to varying degrees at

different points in a movement making constant activation of core muscles for stability a farce.

When evaluating this review, several glairing points do emerge. First, Lederman's work is not a primary research article. Rather it is a review of literature citing various studies. While this does not make the points invalid, the distinction has to be made. With this, however, these types of articles do carry a high level of validity as all the points are based off of primary research articles and the review itself is a peer-reviewed work. Another note is that the review uses data sets to support arguments. This is an example of the extrapolation of information noted at the beginning of this article. However, the points are supported with the article culminating with significant data directly assessing the effectiveness of CT on injury prevention and treatment.

CT and Athletic Performance

The bulk of this article, up to this point, has focused on CT and injury prevention. The principals cited, however, also apply to sport and performance. The concept of specificity is the overriding theme. Motor learning, muscle recruitment patterns, and movement principals apply in the same manor in training for sport. There is one caveat to this, however. Various athletic endeavors have different demands and requirements with vastly different movements. Due to this, empirical evidence is still sought to evaluate the validity of CT in training for sport.

A review by Willardson (2007) cites many of the same principals and flawed conclusion as Lederman in regards to CT. However, he adds the addition of stability type exercises in to the evaluation. But the theme of specificity still predominates. Following various anecdotal claims, works are cited showing increased activation of core stabilizer muscles when exercises are performed on various aids, such as stability balls. However, it is also noted that the force production of the actual exercise decreased. This begs the question of does the increased stability muscle activation worth the value at the expense of the exercise? The answer is likely "no." Again, due to the principal of specificity, as Willardson explains, the core is activated at varying levels during a given exercise. Often, normal training practices address the needs of core conditioning with benefits seen with only minor adjustments, such as standing versus sitting for resistance training. As a result, the value of adding stability equipment may be significantly overstated.

A review performed by Reed, Ford, Myer, and Hewett (2012) resulted in similar findings. Various research articles compared groups who performed core stability exercises to those who did not. The results were mixed depending on the sport and measurement. In exercises directly related to the stability training, the treatment group typically scored better, as would be expected. However, in exercises and sports not specific to the core, it was found that results did not show consistent improvement between groups who had a normal training regime for their sport and those who had additional CT. The likely culprit of this is the fact that training for a sport already addresses the core muscles and does so in a way specific to the activities' demands. As a result, those muscle groups are not a limiter in performance.

From the aspect of performance, the overall limiters must be identified and addressed. As already stated, training addresses core strength and stability. As a result, these factors typically do not limit an athlete's

performance. However, as Reed points out, there are a small number of studies that show an improvement that is attributed to CT. However, these involve movements that are very closely mirrored by the selected exercises. In fact, the programs were developed specifically for the motions and did not involve many of the typical CT exercises. Instead, the workouts consisted of movements similar in type and velocity to those seen in the selected sport, again emphasizing specificity. Contrary to this, Reed also points out that research regarding CT and running has produced mixed results. Also noted is the fact that while a benefit may have been seen, it may not have been due to the increased core strength and function, but rather increased training in another aspect or muscle group. One possible exception to the lack of affect could be an untrained individual. This, however, is not necessarily significant as in these cases, usually most training regimes will provide a benefit due to the low starting point. And even then, benefits due to CT may not be seen as illustrated by Shilling, Murphey, Bonney, and Thich (2013).

The one noted difference between typical CT and stability centered training is the possibility of decreased injury. However, as Willardson points out, the purported benefits do not follow many of the common claims. Data indicate that the injury prevention likely does not protect the back, but rather possible lower extremity injuries. It is hypothesized that this is due to the fact that many muscles involved in knee movement originate in the lower back. Additionally, the benefits may not come from increased strength, but rather through the reflex system. However, this does not necessarily mean an increase in performance as Stanton, Reaburn, and Humphries (2004) demonstrated with running economy being shown not to increase with a prescribed core stability training regime.

In light of these arguments, coaches and athlete must evaluate if implementation of CT provides a benefit, through performance injury prevention or satisfaction with a training regime. In a select few sports, such as rock climbing, some of the traditional CT exercises may mirror movements and provide a benefit. However, in many endurance sports, exercises such as planks and leg lifts do not address specific needs under the concept of specificity nor address a limiter of performance. However, it may be beneficial to incorporate stability type training in athletes in sports with dynamic lateral movements as a means of injury prevention.

SOURCE ENDURANCE

References

Lederman, E. (2010). The myth of core stability. *Journal of Bodywork and Movement Therapies, 14*, 84-98.

Pogrzebna, M. & Celichowski, J. (2008). Changes in the contractile properties of motor units in the rat medial gastrocnemius muscle after one month of treadmill training. *Act Physiologica, 193*, 367-379.

Reed, C., Ford, K., Myer, G., & Hewett, T. (2012). The effects of isolated and integrated 'core stability' training on athletic performance measures: A systematic review. *Sports Medicine, 42*(8), 697-706.

Schilling, J., Murphy, J., Bonney, J., & Thich, J. (2013). Effect of core strength and endurance training on performance in college student: Randomized pilot study. Journal *of Bodywork and Movement Therapies, 17*,278-290.

Shiri, R., Karppinen, J., Leino-Arjas, P., Solovieva, S., & Wiikari-Juntura, E. (2009). The association between obesity and low back pain: A meta-analysis. *American Journal of Epidemiology, 171*(2), 135-154.

Stanton, R, Reaburn, P., & Humphries, B. (2004). The effect of short-term swiss ball training on core stability and running economy. *Journal of Strength Conditioning Research, 18*(3), 522-528.

Willardson, J. (2007). Core stability training: Applications to sports conditioning programs. *Journal of Strength and Conditioning Research, 21* (3), 979-985.

Quiz Questions

Name:
USAC #:
Email:

1. Stability training is associated with decreased injury through
   a. Increased core strength
   b. Alterations in reflexes
   c. Changes in muscle group firing patterns

2. The use of post-partum women in evaluating the roles of the abdominal muscles illustrated that:
   a. Lower back pain is associated with the stretching of the muscles
   b. Likelihood of injury of lower extremities increases with pregnancy
   c. The role of the abdominal muscles in preventing back pain is limited as shown in a population with decreased abdominal function

3. An athlete performs CT two times a week for ten minutes as part of a group exercise regime with close friends. His or her sport is competitive cycling. A prudent coach should discourage the use of CT due to it interfering with proper adaptations in the leg muscles.
   a. True
   b. False

4. Specificity dictates that planking exercises would be beneficial for movements with requiring rapid rotation of the trunk.
   a. True
   b. False

5. Core Training provides increased economy of endurance athletes by providing increased control of upper body mass.
   a. True
   b. False