

“THE CORE”

PART ONE: What you think helps to develop the “CORE”, probably doesn’t

The CORE has received a lot of attention. There are many books, articles, gimmicks, and research conducted on this perennial hot topic. But WHY? Some people train it for aesthetic reasons. Athletes train under a belief that it will improve performance. But will it? Currently there is no research to support this concept^{12, 13, 30, 31}. But absence of evidence is not evidence against. Before we continue we need to define the CORE and understand why people believe it will help with performance. We will discuss this topic from an anatomical and functional perspective.

AN ANATOMICAL PERSPECTIVE –IS THERE A BEGINNING AND AN END?

The abdominals and the low back muscles are the common muscle groups associated with the “CORE”. Increasingly within the strength and conditioning and health care professional fields the CORE is thought to include all the muscles that attach into the pelvis (including pelvic floor muscles), the spine, and the rib cage. More astute strength and conditioning professionals will also add muscles that attach to the scapula, and some even include muscles that attach into the cervical spine and cranium. In essence, the entire body can be referenced when speaking about the core. The body is completely interconnected, and isolating a group of muscles is incredibly erroneous. Failure to appreciate this concept has led to a lot of confusion. We need another way to look at the “core”.

We should talk more about function and the muscles that support this function. But what is the function of the CORE?

WHAT IS THE FUNCTION OF THE CORE?

Athletes believe that training their abdominals or their core will help with force transmission³²⁻³⁵. Well they probably don’t say exactly that, but the rationale is along those lines. There are several studies³⁶⁻³⁹ which support this concept, where upper extremity explosiveness relies on transmitting forces developed in the legs through the core and applied into an instrument (ball or racquet) attached to the upper extremity.

Likewise when we look at a recent study by Butcher et al (2007) investigating jumping ability, the core is thought to play a role in the integration and transmission of power between the arms and legs⁴⁰. Creating spinal stiffness to transmit forces is thought to be a plausible rationale for the enhanced vertical jump performance following core stability training. Failure to properly transmit forces can be thought of as a **force leak**. Note force transmission applies to both the force we produce and the forces our body are exposed to from external sources. If we are unable to properly transmit a force, we will dissipate the energy most commonly through leaks within 5 common sites⁴¹⁻⁴⁴.

From a practical perspective we see force leakages in many explosive movements, at the knee, ankle, trunk and cranial-cervical junction. Note we did not use CORE in the last example. Force leaks will cause abnormal loads to be placed on various tissues. If these tissues are exposed to loads beyond their tolerance, or if they are exposed to repeated micro trauma an injury will develop^{14, 17, 18}.



So you may be asking, **what's the problem**

If the core relates to the muscles that support force transmission, which muscles are those?? Well there are a lot more than just the abdominals and back extensors. Basically, all muscles have a role with force transmission. Many strength and conditioning and health care professionals have a problem with this concept.



This is because in school and research, muscles are classified into a system where a single function (i.e. stabilizing muscles, prime movers, secondary movers, and many other categories) is assigned to a muscle^{45, 46}. This makes it much easier to communicate, however our muscles do not have a single function. Muscles contract according to signals they receive from the brain. Muscles have structural characteristics that make them more suitable for certain functions, but most have many functions. As a result we must take a different perspective and look at the “CORE” not as a group of muscles, however defined, but based on the body’s ability to transmit forces. Again, all muscles, for the most part contribute at some point to force transmission. As a result we have developed the concept of 5 Site Integrity™.

But before we talk about 5 Site Integrity™ let’s look at how the “CORE” is commonly trained for the purposes of force transmission.

COMMON PRACTICE, WRONG RATIONALE

Most core exercises have their origins either within the rehab literature or are based on traditional sit-ups and body-building techniques. In the later approach the abdominals and low back are “isolated” with specific movements. Did you identify a huge problem?? These exercises create movement of the abdominals and low back. We have just defined the core as muscles that help with force transmission. In this case, the core is generating the forces.

Let’s use sprinting as an example to illustrate this point. Observe the greatest sprinters in the world and watch their head and their belly buttons. You will notice that their head and belly button remain very quiet and still. Their arms and legs are moving incredible quick and producing tremendous force, and yet their trunk and head remain quite. Interesting!



Now look at people who aren’t fast. You’ll notice that when they try to run fast their head is moving in all directions and their trunk is going all over the place. Likewise if you examine their hips, knees and feet you will notice that their hips are falling from side to side, their knees are likely moving in, and their arches are probably collapsing and toeing out. They are unable to coordinate and properly transmit the forces they are developing between their upper and lower bodies.

In rehab exercises the spine remains in a neutral position and arms and legs are moved to place loads on muscles that maintain neutral spine alignment^{47, 48}. This approach is fantastic for rehab. But these exercises do not prepare the muscles that maintain neutral spine alignment sufficiently for sport. In sport the magnitude of the forces acting on the spine can be 10 times the amount exposed to spine during rehab exercises. Likewise the rate of loading, and the direction of loading, is extremely rapid and variable in sport. Not to mention the fact that most rehab exercises are performed on the floor, where as in sport you are at least on your feet if not jumping, rapidly changing directions or experiencing contact with an opponent. These facts are rarely addressed with rehab exercises. Something must change.

Question! Take a look at the images below. Which exercise will better develop the “CORE” as we have defined (based on function) for sport. The answer will be explained at the end.

This is our general framework to evaluate an athletes' structure and kinematics during movement. It is based on a fundamental appreciation that structural relationships must be maintained during all movements for proper force transmission. Deviations are not acceptable, unless there are clear structural abnormalities - which we identify during our MSK screen. The key areas we examine are:

- 1) Ankle
- 2) Knee
- 3) Lumbopelvis
- 4) Scapulothoracic
- 5) Craniocervical

Side Bridge



Squat



QUESTION: Which exercise will better develop the “CORE?”

IT IS IMPORTANT TO APPRECIATION THE FOLLOWING POINTS:

1. The body is made of links / chains where motor control and muscular capacities are necessary to maintain proper area relationships.
2. If one area is compromised all areas become compromised.
3. Violations lead to injuries and suboptimal performance
The **longer** the violation the more difficult it is to correct
5. Correct anatomical relationship lead to improved joint positions, more efficient movement patterns, reduced risks of injury, and improved performance
6. Violations are most likely due to deficiencies in capacities as opposed to balance problems.
7. Fatigue or poor work capacity will effect an athletes ability to maintain 5 site integrity
8. While we looking at five key areas other abnormalities may occur

If we identify a problematic area we address it immediately. We give specific exercises to develop the capacities, while tending to any damage that has been done to various neuromusculoskeletal tissues. The main types of damage / dysfunctions that are caused are:

- 1) myofascial adhesions
- 2) neuromuscular tension
- 3) biochemical: inflammation
- 4) altered muscle activation patterns
- 5) joint position dysfunctions

To summarize, we must examine and build the body functionally, by maintaining 5 Site Integrity™. In doing, we properly transmit forces, reduce injury rates, and improve performance.^{12, 13, 30, 31}

In the next part we will explore exercises to test your 5-Site integrity. We will explain test that you can perform and based on the test results we will provide three basic workout routines to help guide you to improving your 5-Site Integrity, which will be part-three.

Thanks for reading. Don't be shy. If you have questions you can either email or call me.

ANSWER: To answer this question a college measured the forces each exercise exerts on lower spine stability. The greater the force equals a great challenge to lower spine stability. Because we are looking at developing an athlete appropriately merely having a higher load is not necessarily better. Higher loads expose the spine to increased disc pressure, increased destabilization, which both increases the risk of injury.

For those that are curious the loads to the lower spine are 70nm vs. 444 nm for the side bridge and the squat (75% of a person's maximum, which is equivalent to a load an athlete is able to lift 10 times) respectively.

That being said jumping from a two foot box will have higher lower spine destabilizing forces that either exercise – easily doubling the forces exerted by the squat. Likewise most high powered activities in sport will exceed the loads being placed on lower spine stability by either exercise. More importantly the rate these forces act on the body are much faster than either exercise.





Figure 1: Landing from a two foot box. Notice how the athlete displays dynamic knee valgus (in ward movement of the knee) and the shift of the spine and pelvis.

Therefore the answer depends. If the athlete is injured they will need to perform exercise according to their abilities. In this case the side bridge is a great place to start, especially if they have low lower spine stabilizing capabilities.

However, if the athlete is healthy and is able to perform a side bridge for over 2 minutes, then this exercise will not help protect them. Rather the squat is a much better choice, given the loads that the athlete will experience during training and competition. We will explore more about how we select appropriate exercises in the next part of this article series.