How to be Back Strong and Beltless — Part 2
Belts, are they as good as people say they are?
by Paul Chek

I won't kid you — this is an extremely difficult and comprehensive article. It would feel right at home nestled within the pages of a graduate level textbook. In fact, it's so technical and comprehensive, I had misgivings about running it in its current form!

However, I know Paul Chek doesn't soft-pedal anything, and I know with him, it's full bore, or no bore! Still, I think T-mag readers are smart enough to understand this article. And, even if it isn't everybody's cup of tea, we recognize that there are plenty of professionals out there that will eat this stuff up with a spoon.

Therefore, we've run it, in its full length. This is part one of a three part series.

— TC

Introduction

When it comes to lifting heavy, a weight belt is more often a fashion accessory than an essential piece of workout gear. How many of you remember the only time anyone wore a weight belt was in the gym and only when they were performing *heavy* squats, *heavy* dead lifts, or *heavy* overhead presses? Now it seems virtually everyone is wearing a weight belt! Regardless of how heavy someone's lifting or what exercise they're performing men, women, Arnold wannabes, weekend warriors, and even the elite few who make the cover of Powerlifting USA are all wearing weight belts.

You've all heard the mentality. Squats? "You MUST wear a belt." Bench presses? "You should probably wear a belt." Biceps curls? "To be on the safe side, wearing a belt may be a good idea." Getting a drink of water from the drinking fountain? "Hell, you may as well leave it on since you'll be wearing it for your next set." This scenario does not pertain to everyone, but the point I'm making is that a trend we never used to see in a gym, is one we're seeing more and more everyday.

It's getting ridiculous and way out of hand.

To make matters worse, the trend to wear a weight belt has extended beyond the gym. Trash collectors, truck drivers, and construction workers often spend their entire workday wrapped in a weight belt. Some companies have gone so far as to make it a mandatory safety policy that all their employees wear a back harness. Visit any Home Depot, Office Club, or take a look at the waist of your local UPS driver. What do these employees all have in common? They're all wearing weight belts! Next thing you know, it will not only be against the law to drive without a *seatbelt,* it will be against the law to operate a vehicle without a *weight belt!*

What's going on here? Do weight belts really protect our back? Will they make us stronger? Can the estimated 35-40% of people reporting back pain each year, or the 70% of the population who will suffer from at least one episode of back pain in their lives (1) find relief, and possibly even avoid surgery, by making a weight belt a habit?

Before I answer these questions, try to dig up recent pictures of the world's best Olympic weightlifters in competition, but not the American weightlifters who are losing the struggle to achieve international respect. Look at photos of European weight lifters who are continuously breaking records and winning world and Olympic titles. Isn't it interesting that Europeans never use belts when they perform the snatch lift? They're rarely seen using one for the clean and jerk! Even during training, you'll find that many of these lifters prefer to train without any forms of artificial support. In fact, IronMind Enterprises (2) sells videos of these athletes squatting over 300kg (660lbs) without a belt! Either these athletes are asking for an injury, or they know something we don't.

When Did Belt Use Get Started?

A look through David Webster's book, *The Iron Game,* demonstrates that there is a long history of belt use in connection with heavy weight training.(3) Thomas Inch, publisher of *Scientific Weight Training* (1905), is shown pressing two adult females overhead with one hand, "while wearing a weight lifting belt." This guy was no slouch either. He could clean and jerk 92.5 kilograms (203.5 pounds), perform the "Right Hand Anyhow and Bent Press" lifts with 96.8 kg. (213 pounds), and he could snatch 67.3 kg. (148 pounds). Not impressed yet? Perhaps I should mention that he performed all these lifts *using only one hand.*

American Olympic lifter J. Terpak is pictured wearing a weight belt during his gold medal performance in the 1937 World Championships in Paris, France. Later during the 1958 World Championships held in Stockholm, Sweden, an American athlete named Berger is pictured on the Bantamweight winner's platform wearing his weight belt. It's interesting to note however, that even though there are numerous pictures showing winning and highly accomplished lifters wearing weight belts in David Webster's *Iron Game*, there are even more pictures that don't.

One has to wonder, what is it that leads a lifter to use a belt? Is it direction from coaches, did these particular lifters have back pain in their lifting history, did they only wear the belts when performing competition or "max" lifts, or was a belt simply looked upon as an insurance policy?

With a long history of corset use in the medical field, particularly for back injury, perhaps the lifters have been influenced by the medical approach to treating back pain. Corsets have been used since the early 1900's for the treatment of Scoliosis (4) and back pain (5) and quite possibly much longer. Therefore it is logical that a lifter, wanting to make the right decision, would choose to use a belt based on the medical establishment's use of belts, especially considering the history and treatment of back pain dates all the way back to 1500 BC!(1)

Did Developmental Man Wear Weight Belts?

Regardless of your opinion about the origin of man, if you believe in God, you have to wonder why he didn't provide weight belts as standard-issue equipment.(Figure 1) On second thought, maybe he did, and we just don't know how to use them correctly. Perhaps we abuse our bodies, which creates a dysfunction in our "natural weight belt" and causes us to be reliant on an artificial one.

Figure 1

A Look at The Belt God Gave You

Today, our understanding of the stabilizer system is at an all time high, thanks to the works of people like Richardson, Jull, Hodges, Hydes,(6) Vleeming, Snidjers (7) and Gracovetsky.(8) Because of them and others, we have been able to progress beyond the developmental knowledge of medical doctor Robert W. Lovett (4) and Anatomist Raymond Dart.(9) In 1912, Lovett created detailed diagrams indicating how the musculature of the torso worked together to stabilize the spine. Later, in 1946, Dart described the double spiral mechanism of the spinal musculature, expanding beyond the concepts described by Lovett.

What modern researchers have been able to do is more clearly define two major stabilizer systems of the body, the *inner unit* and the *outer unit*.(6,7,8) The stabilizer system considered as our "God-given weight belt" is the inner unit.(Figure 2)

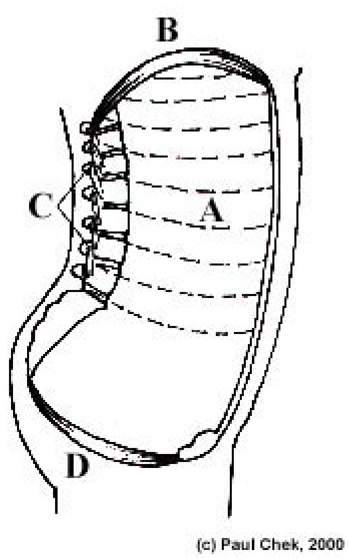

Figure 2. The Inner Unit — Sagittal View

The Inner Unit serves to stiffen the axial skeleton in preparation for work. The Inner Unit muscles are
A) Transversus Abdominis and the posterior fibers of obliquus internus,
B) Diaphragm,
C) Deep Multifidus,
D) Pelvic floor musculature.

The inner unit is composed of the transversus abdominis (TVA), some fibers of the obliquus internus (IO), the musculature of the pelvic floor (PFM), the multifidus and the diaphragm.(6) Although there is a definite working relationship among the inner unit muscles, the TVA appears to be the key muscle of the inner unit system.

In studies of people without back pain, it was found that the TVA fired 30 milliseconds (ms) prior to shoulder movements and 110 ms before leg movements.(6) It should also be noted that though there are slight variations in timing relative to the motor pattern selected or direction of the postural perturbation, there is synergistic recruitment of all inner unit muscles. However, the TVA appears relatively consistent in its activation pattern, regardless of movement plane or pattern.(6,10,11,12) Researchers propose that the nondirectional, specific activation of the TVA relates to the dominant role played by the TVA in providing *spinal stiffness.* (6,10,11,12,13,14)

The TVA, in concert with other inner unit muscles,(Figure 2) activates to increase stiffness of spinal joints and the sacroiliac joints.(6,7,15) Activation of the inner unit provides the necessary stiffness to give the arms and legs a working foundation from which to operate. Failure of the TVA to activate 30-110 ms prior to arm or leg movements respectively has been correlated with back pain and dysfunction.(6, 16) The inner unit is part of a system of stabilizer mechanisms, all of which are dependent on the integrated function of all inner unit muscles. To better appreciate how the inner unit creates stability in the body, let's look at each of the proposed mechanisms of stabilization: Thoracolumbar Fascia Gain, Intra-Abdominal Pressure and the Hydraulic Amplifier Effect.

Thoracolumbar Fascia Gain

Studying the anatomy of the TVA makes it clear that contraction of this muscle can only produce one action, *drawing in the abdominal wall.* This is evidenced by movement of the umbilicus toward the spine.(Figure 3)

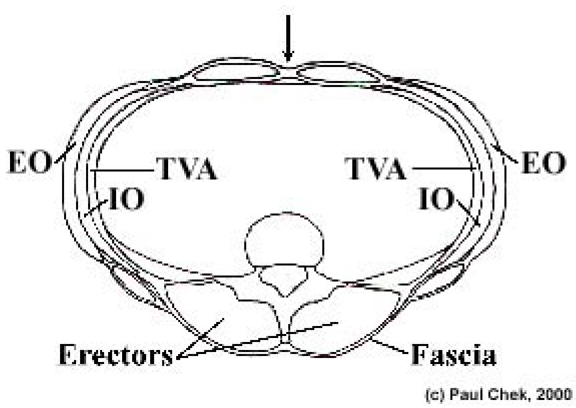

Figure 3. The Inner Unit — Transverse View

When activated, the transversus abdominis and posterior fibers of the obliquus internus draw the umbilicus inward toward the spine (see arrow). This creates intra-abdominal pressure and hoop tension, which serve to stabilize the lumbar spine.

The synergistic action of the TVA and IO produce a characteristic *hoop tension* through the thoracolumbar fascia (TLF),(Figure 4) which has been shown to create an extension force on the lumbar spine.(8,17) This is referred to as *thoracolumbar fascia gain.* TLF gain is thought to be an important element, buffering the transfer of force between the muscular and ligamentous systems during forward bending or rising from a forward bent position. The point at which the force transfer occurs is called the *critical point,* occurring at approximately 90% lumbar flexion.(17)

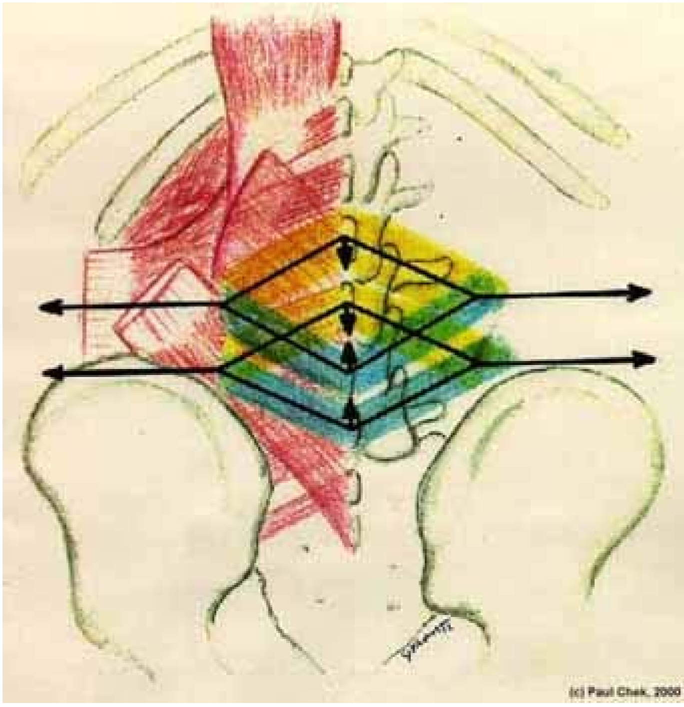

Figure 4. Thoracolumbar Fascia Gain Mechanism

Contraction of the transversus abdominis and obliquus internus generates lateral tension on the thoracolumbar fascia. The superficial lamina of the posterior layer of thoracolumbar fascia generates tension via its attachments at L2 and L3 (yellow), while the deep lamina generates tension upward through its attachments at L4 and L5 (blue). These mutually opposing vectors tend to approximate or oppose separation of the L2 and L4 vertebra and the L3 and L5 vertebra, creating what is referred to as "thoracolumbar fascia gain". (8,17,21)

Intra-Abdominal Pressure

As the TVA is activated, drawing the abdominal wall inward, the viscera are pushed upward into the diaphragm and downward into the pelvic floor, creating intra-abdominal pressure (IAP). The pressure of viscera upon the diaphragm and pelvic floor is referred to by Wirhed, as the *piston effect.* (18) When the viscera rise secondary to TVA contraction a lift pressure is created under the diaphragm. As you are likely aware, when lifting a heavy object or exerting yourself to throw or move an object such as in work or sports, it is natural to hold the breath. Holding the breath under load is associated with increased tension in the diaphragm. The concomitant elevation of the viscera against a tightening or tightened diaphragm from holding our breath produces a lift force through the cura of the diaphragm, which attach at the L2 and L3 level. Wirhed believes this to be a major contributing factor of spinal stabilization and joint/disk protection by reducing compression of the lower lumbar discs by as much as 40%.(18)(Figure 5)

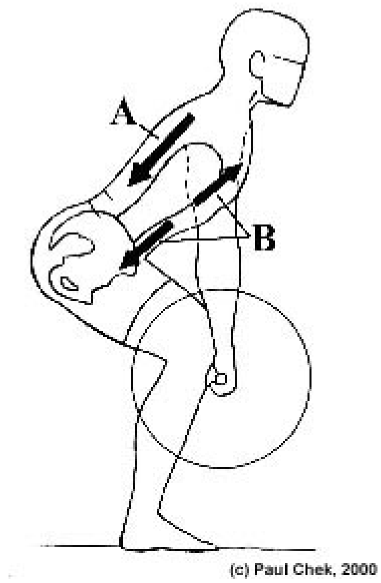

Figure 5. Intra-abdominal Pressure Mechanism Applied

When lifting any heavy object, the load is transmitted downward through the spine to the legs (A). To stabilize the axial skeleton and minimize compressive loading of the lower lumbar segments, the transversus abdominis and posterior fibers of the obliquus internus should draw the umbilicus inward. The hoop tension created by activation of the deep abdominal wall pushes the viscera upward into the diaphragm and downward into the pelvic floor (B). Because of the innate tendency to hold one's breath while under load, there is increased tension in the diaphragm. Wirhed proposes this mechanism may decompress the L4 and L5 segments by as much as 40%. (18)

White and Panjabi (19) used an analogy of a football in the abdominal cavity, stating that IAP and thoracic cage pressures may be factors in providing mechanical stability to the spine. (Figure 6)

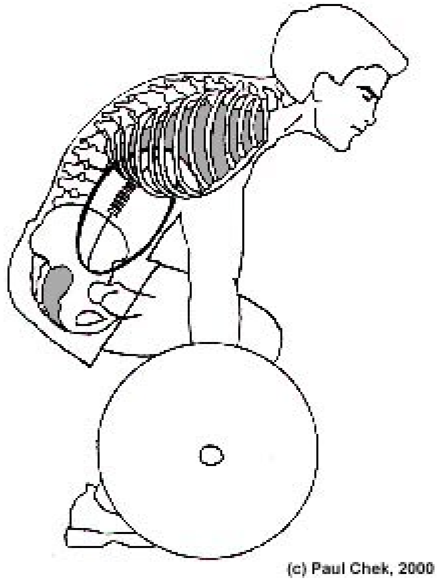

Figure 6. White and Panjabi's "Football" Concept of Intra-abdominal Pressure

It is theorized that intra-thoracic pressure created by filling the lungs and intra-abdominal pressure (demonstrated here as a football in the abdominal cavity) work against each other to support the torso when lifting an object. Practical experimentation in the gym will show that the trunk is stiffer when filling the lungs as opposed to not filling the lungs with inhalation.

More recently, it has been shown that IAP does provide a stiffening effect on the lumbar spine, but that IAP is most effective at stabilizing the spine when applied in concert with co-activation of the erector spinae muscles.(20)

It has also been suggested that IAP does not stabilize the spine. Standing firmly *against* the notion that IAP provides any significant stabilizing mechanism for the spine are Gracovetsky and Bogduk.(21 p.122) These experts have sited the following reasons for the ineffectiveness of IAP as a stabilizer of the spine, contrary to previous belief:

· To generate any significant resistance to the heavy loads being lifted by athletes and workers, the pressure required would exceed the maximum hoop tension of the abdominal muscles.

· Such pressures would be so high as to obstruct the abdominal aorta.

· When the abdominal muscles contract to produce IAP, they produce flexion of the trunk, which would negate any extension quality produced by IAP.

Therefore, it is likely that the stiffness of the abdominal muscles generating the IAP increase spinal stability. In other words, activation levels of all trunk muscles determine the stability of the spine, regardless of the magnitude of IAP.(20) Although, as suggested by Gracoskevetsky, we can not rely on muscles alone because mathematical modeling shows that Olympic athletes would not be strong enough to lift the loads they currently are lifting during competition.(8) We must look to the fascial system of the body for a missing link, the *hydraulic amplifier effect.*

Hydraulic Amplifier Effect

The *hydraulic amplifier effect,* originallytheorized by Gracovetsky (8) to increase the strength of the back muscles, was later proven mathematically to increase the strength of the back muscles by 30%.(21 p.124-125) The hydraulic amplifier mechanism is composed of the TLF surrounding the back muscles to create a relatively stable cylinder.(Figure 7) (22) As the back musculature contract within the cylinder created by the investing fascia, a hydraulic effect is created, aiding in the erection of the spine from a flexed position.

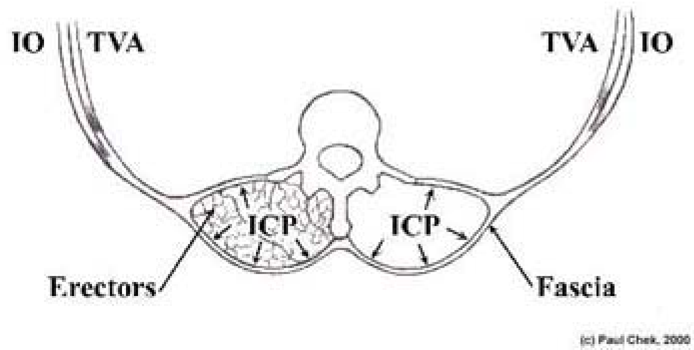

Figure 7. The Hydraulic Amplifier Mechanism

Gracovetsky (8) has demonstrated with mathematical modeling that the extension force produced by expansion of the erector spinae muscles within the compartment created by the thoracolumbar fascia and lamina groove of the spine is a significant contributor to one's ability to lift a load. The expansion of the muscles within the thoracolumbar fascia produces intra-compartmental pressure (ICP). The cylinder is stabilized by synergistic activation of the transversus abdominis (TVA) and posterior fibers of the internal oblique (IO).

To better understand how the hydraulic amplifier effect works, imagine taking a spine model and gluing a bicycle inner tube along each side of the spinous processes in the lamina groove. Once adhered, if you were to begin pumping up the tube (back muscles) inside a stable cylinder (TLF), it would begin to erect the previously flaccid spinal column (Figure 8) This is the basic premise of the hydraulic amplifier.

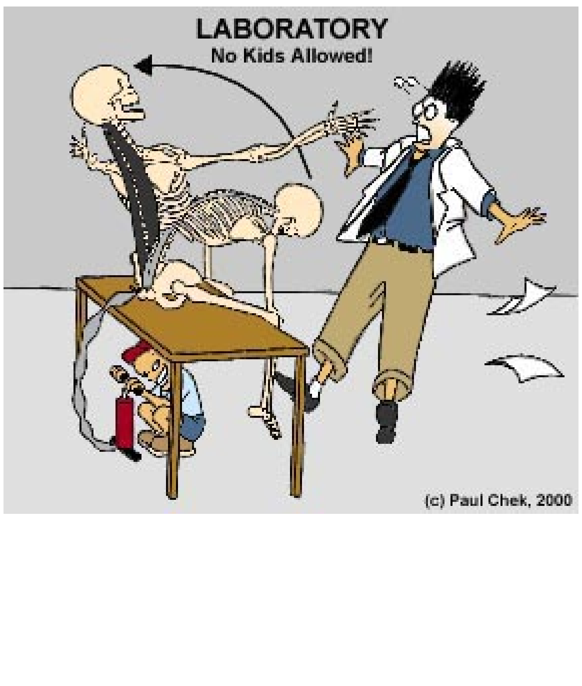

Figure 8. The Hydraulic Amplifier Mechanism Demonstrated

As demonstrated by this junior scientist, a bicycle inner tube pumped up inside a cylinder representative of the thoracolumbar fascia will create an extension force.

The Outer Unit

The outer unit consists of many muscles such as the obliquus externus, obliquus internus, erector spinae, latissimus dorsi, gluteus maximus, adductors and hamstrings working in concert with the inner unit musculature and fascial systems.

A simplified version of the inner/outer unit systems, seen in Figure 9, depicts a pirate ship's mast as a human spinal column. While the inner unit muscles are responsible for developing and maintaining segmental stiffness, the bigger muscles, shown here as guide wires, are responsible for creating movement.

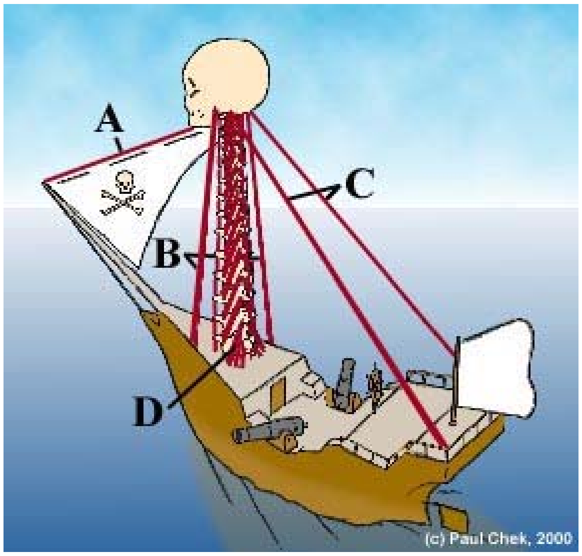

Figure 9. The Inner and Outer Units Simplified

The outer unit muscles of the trunk demonstrated here (A) rectus abdominus, (B) internal and external oblique, (C) erector spinae; the outer unit actually contains other muscles, which have been excluded for simplification. The inner unit, which contains all the muscles demonstrated in Figure 2. is demonstrated here as (D); the multifidus acting as segmental stabilizers for the purpose of controlling joint stiffness. To tighten the guy wires (A-C), which provide *gross stabilization* of the ship's mast without synergistic tightening of the *segmental stabilizers* (D) would obviously result in increased potential to buckle the mast. The mast represents your spine!

As you can well imagine, if the inner unit were to fail or even suffer altered function under the load of outer unit functions, the mast (spine) could easily buckle, resulting in spinal injury. Judging by the statistics on spinal injury, and the authors of clinical experience, it is evident that the population at large commonly suffers from an imbalance between the inner and outer units.

When the inner and outer units are functioning synergistically, there is a characteristic look to the abdominal wall.(Figure 10 A-B) There is a noticeable oblique line and the umbilicus moves toward the spine as the torso moves through the zone of the critical point.(23) Although an explanation of the outer unit is beyond the scope of this article, a reader interested in more information may review "The Outer Unit" (24) as well as references (7), (15) and (23) for a comprehensive understanding of the outer unit system.

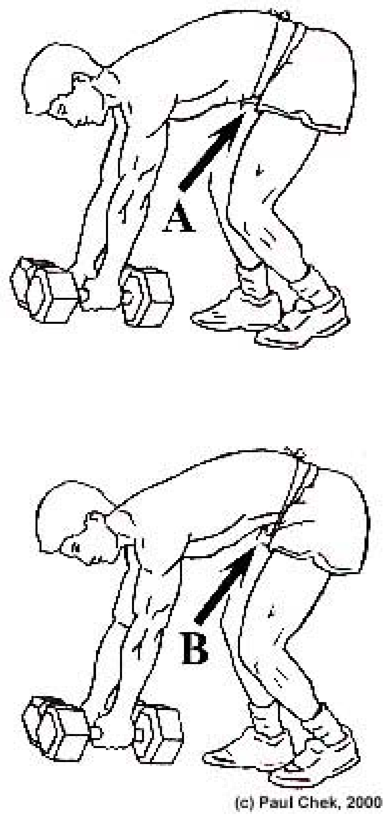

Figure 10. Inner Unit and Outer Unit Synergy

A) If your outer unit is dominant over your inner unit, as you bend forward to pick up a load, a string placed around the waist will become tighter as you pass through the critical point (~90% lumbar flexion). If the load is significant enough to require activation of both inner and outer units, the string will have become loose as you bend forward and tight as you lift the load.

B) When the inner unit is strong enough to provide adequate stabilization, you will stay under the stabilization threshold as you pass through the sticking point. Staying under the stabilization threshold is indicated by the fact that the rectus abdominis and external oblique musculature have not shortened and thickened, pressing on the string.

Now that you have a better understanding of how our own internal weight belt works and how it functions to stabilize our spine, Part II of this article will analyze some commonly sited reasons and supposed benefits for using a belt. I will show that the reasons most people use belts may actually be providing a false sense of security and potentially setting the belt user up for injury.

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