

## THE VIRTUAL FORCE SWING

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At Westside Barbell we use the dynamic method throughout the year. Its purpose is not to build maximal strength but to improve the rate of force development and explosive strength. Of course, the lighter the load, the faster the rate of force development.

Yuri Verkhoshansky is referred to as the father of plyometrics.

His work on shock training is well documented from the early 1970s.

Exercises consisted of depth jumps, plyometrics, bounding, and medicine ball work, leading to a few special devices.

What is the shock method? It's a system of impulsive actions of the shortest duration of time beginning at the end of an eccentric phase and the beginning of the concentric, or overcoming, phase. It is a process of a fast stretch followed by a voluntary action.

At near Earth, the speed of gravity is 9.8 meters per second.

When an athlete drops off a box to the floor then immediately rebounds, the energy is kinetic energy. This kinetic energy is transferred into the soft tissue and connective tissue of the body. Remember, one should be able to squat 2 times bodyweight before attempting to use plyometrics.

A 300 pound man may not safely land from a high-altitude drop of the same magnitude as a 150 pound man. Why? It's dangerous. Kinetic energy

increases when mass or velocity is increased:  $KE = \frac{1}{2}mv^2$ . From this

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equation, one can see that increasing the velocity of an object has a greater effect on the kinetic energy than increasing the mass of an object. As you increase the velocity, the kinetic energy becomes exponentially greater.

Velocity can be increased through the use of bands. If you merely drop off a box and land on a surface, you are moving at 9.8 meters/second. The kinetic energy is proportional to your mass and speed. Two different masses fall at the same speed, but a larger mass will have more force upon landing and even greater force when acceleration is added by attaching bands with a great amount of tension at both the top and bottom of the landing.

Newton's second law states that  $\text{force} = \text{mass} \times \text{acceleration}$ .

Awhile ago, we did a study at Westside to measure the effect of bands. We found that when box squatting with weight only, the eccentric phase was approximately 1.6 seconds with 550 pounds on the bar. However, when using a large amount of bands and a small amount of weight, the eccentric phase was 0.52 seconds, 3 times faster. Here, a virtual force occurs, i.e., a force that is present but not recognized.

For example, a certain thickness of ice can support a 50 pound ball without breaking. If the ball is dropped from a distance, moving at 9.8 meters/second, it breaks the ice on landing. Although it still weighs the same, it had acceleration in the second case. This is the case when squatting with bands. When we land on the box, a virtual

force occurs due to acceleration.

We do not use depth drops. Rather, we use a swing. It is much like

the one in Figure 6.12 in the book *Science and Practice of Strength Training*

by Zatsiorsky. That swing can be changed by increasing the mass and range of

motion. Our Virtual Force Swing does the same. In addition, we can adjust the amount

of speed desired. It is designed to convert potential energy into kinetic energy.

We know through physics that increasing the mass is not as effective as increasing the velocity in order to increase kinetic energy.

When inanimate objects such as pool balls collide, no kinetic energy

is lost; this reaction is referred to as perfectly elastic. However, in humans,

it is somewhat different, due in part to the inhibition of myotactic reflex receptors.

Mechanical efficiency (ME) has been studied for years. In studies by Margaria (1968),

Kaneko (1984), and Acra and Komi (1986), they show that the velocity of shortening

or stretching influences the value of ME. It is also known that the stretch-shortening cycle will cause very different loading conditions with different ME

(*Strength and Power in Sport*, Komi). Having said this, it is easy to see why the Virtual Force Swing (patent pending, 2004) is so effective.

Potential energy of the tendons and soft muscle tissue can be

released two ways. If it is done slowly, the energy is released slowly.

If done fast with a short amortization phase, it produces a high level of power. Just imagine the advantage of a swing where it is possible to adjust mass and velocity.

There is much known about the eccentric phase. It causes most muscular soreness or delayed onset of muscular soreness. This soreness can reduce dynamic strength and damage the myofibrils and connective tissue (Friden, 1983). Eccentric work can generate much higher forces due to the tension-generating capacity of the connective tissue. This can cause an increase in tensile strength of the tendons and other elastic components of the muscle complex (Garrett, 1986). When high-velocity eccentric work is introduced progressively, it enables the connective tissue to resist high-impact forces that accompany high-impact activities such as jumping, running, and depth jumps.

High-speed or overspeed eccentrics are vital to superior training and results. When squatting or benching, during the eccentric phase you will invariably descend slower as the weight grows heavier. This is not conducive to speed strength. It's as simple as this: if lowering a barbell slowly is right, then plyometrics are wrong. But we know that's not true. Remember our experiment with overspeed eccentrics using a high percentage of band tension versus a lower percentage of bar weight? The same is true for the Virtual Force Swing. Using a large amount of bands to increase velocity and adding weight plates to change mass will produce a very

positive training effect. Increasing velocity has a much greater effect on kinetic energy than increasing mass. This kinetic energy is transformed into reversal strength.

The Virtual Force Swing is essential for sports requiring extreme strength or explosive power during take-offs and landings and for jumping, sprinting, or lifting. Its value cannot be duplicated in any other way due to the fact that one will invariably use more eccentric muscle tension and slow the yielding phase, causing a lessening effect on the reversal phase.

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