OPTIMAL ECCENTRICS

By: Louie Simmons

What do we really know about eccentric (lowering) work? The eccentric phase causes most muscular soreness. This causes much of the burn that bodybuilders talk about. The eccentric phase, when performed slowly, greatly contributes to muscle hypertrophy (growth). We also know that in an attempt to raise absolute strength, eccentric training alone fails miserably.

In the late 1970s, Mike Bridges experimented with eccentric bench pressing. He told me that the only result he got from eccentrics was a pec injury. This is confirmed by research that shows that most injuries occur during the yielding, or eccentric, phase.

Vince Anello also experimented with eccentric work, doing eccentric deadlifts with as much as 880. When he returned to conventional deadlifts, to his dismay his deadlift had decreased. Vince told me that anything will make your deadlift go up--except eccentrics.

What does this mean? Are eccentrics a waste? Well, yes and no. Eccentric training alone is a waste. However, a strength-shortening cycle, eccentric training followed by a concentric phase, can be very beneficial when done correctly, i.e., with optimal speed.

When doing pure plyometrics--dropping from a prescribed height--the speed of descent is about 9.8 meters/second, or the speed of gravity

near earth. With depth jumps there is an immediate rebound, causing a powerful stretch reflex produced from the kinetic energy of the dropping phase.

Plyometrics were developed by Verkhoshansky in 1958 after he watched a triple jumper train. He was astonished by the energetic rebounding after each landing in the triple jump. That energetic response was the basis of plyometrics. Plyometrics have proven vital in the training of explosive as well as absolute strength.

It is known that training with heavy weights will add strength potential to muscles and that light weights with a rapid concentric phase will increase speed and explosive strength. It is obvious that without the lowering, or eccentric, phase there would be no sudden stretch preceding a voluntary effort. Kinetic energy is gathered in the eccentric phase. This causes a sudden release of elastic energy stored in the tendons and soft tissues of the body. Heavier weight will not add to the rebound phase as effectively as using an overspeed eccentric phase.

How can this be done? Using Jump-Stretch bands will cause a forced overspeed eccentric phase. This is maximal powermetrics. The combination of eccentric and concentric actions forms a natural type of muscle functioning called the stretch-shortening cycle (SSC) (Norman and Komi, 1979; Komi, 1984).

There is no eccentric phase in a depth jump. By definition,

in an eccentric action the muscle must be active during the stretching phase. The energy created by the body dropping is gravitational potential energy. When the body lands on a surface, it becomes kinetic energy, which is transfered in the body as a stretch reflex.

In the calculation of kinetic energy, increasing velocity is much more important than increasing mass. This is because velocity is squared in the equation $KE = (1/2)mv^2$.

This is why the squat-under in Olympic lifting is so important.

When the lifter falls under the bar, he is producing kinetic energy for reversing the direction of the bar. This dropping under the bar should not be confused with an eccentric phase. For an eccentric phase to occur, muscle tension must accompany the action. The squat-under has no such muscle tension.

We know that 40-50% more muscle can be used during the eccentric phase, and this is where a real problem occurs. As the barbell grows heavier, one tends to lower the bar slower and slower. However, this is counterproductive. When slowing down the eccentric motion, we are limiting the energy that can be stored in the muscles and tendons. The myotactic relex occurs when a muscle is stretched by an external force. Yes this causes a stretch reflex, but the faster the eccentric phase, the greater the stretch reflex. This, of course, can have a negative effect on the Golgi tendon reflex. The Golgi tendon reflex helps prevent extremely high and potentially dangerous loads to the tendon. With overspeed

eccentrics, we try to override this phenomenon.

In `!Science and Practice of Strength Training`! Zatsiorsky states that elite athletes develop very high forces of elastic energy in the tendons rather than the muscles. This should alert us to lower the barbell at an optimal speed as weights grow heavier. If the barbell slows down as the weight grows heavier, the length of the muscle is stretched and the muscle tension increases, which could lead to injury. Because this myotactic reflex is counterbalanced by the Golgi tendon reflex, an inhibition of muscle action occurs, causing a less than maximal concentric phase. Of course, this limits the potential to overcome heavier loads in training or at meet time.

The answer to this dilemma is to use only enough eccentric muscle tension to control the barbell in the correct path. If, in fact, one uses 40-50% more muscle tension to lower weights, does it not make sense to use only up to 50% of your eccentric strength when lowering a weight? This will contribute to a stronger concentric phase, producing a higher result.

Using the Tendo unit, we found that when doing speed strength work in the bench press and squat, the eccentric phase moves at a rate of 0.7-0.8 meters per second (m/s). This is basically the same as the concentric phase. This maximizes the stretch reflex. Simply said, the faster down, the faster up. With near-maximal weight, the same trend was observed: the eccentric and concentric phases were both 0.45-0.6 m/s.

Band and bar weight were used to achieve these results. When all resistance was from barbell and plate weight, the lowering time was considerable longer.

The eccentric phase was 0.4 m/s on speed squat and bench and 0.6 m/s for the concentric phase. With near maximal weight, the eccentric phase was 0.37 m/s and and concentric phase was 0.40-0.50 m/s.

This means that bands can play a valuable role in increasing the eccentric phase of barbell lifts. This will teach you to use less eccentric muscle action. As weights grow heavier, the bar speed should find an optimal speed regardless of external resistance.

The above data was collected using eight 900+ squatters and eight 600+ benchers. The results were nearly equal for both phases, each 600+ lifter varying less than a tenth of a meter/second eccentrically or concentrically. With circa-max weights, I was the slowest by a small margin during both phases. Dave Tate was the fastest. On speed work, the same results were obtained. J. L. Holdsworth was the fastest, and Chuck Vogelpohl was the slowest. Again, only one-tenth of a meter/second separated the eccentric and concentric phase of each lifter. The same results occurred in the bench press.

In the above test, all bench subjects benched in T-shirts. All squatters wore standard groove briefs, no knee wraps, and squatted on a box. All subjects were at the same level of general physical preparedness.

The key to lifting larger weights is concentrating on the eccentric phase, especially with the overspeed eccentric method, i.e., using a large amount of tension. Learn to relax to reduce some muscle tension in the eccentric phase to prevent inhibiting the stretch reflex, and watch your total go crazy.

At the 2004 WPO qualifier in Baton Rouge we gained our fifth 2400+ total. The results speak for themselves.

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