



This article is an excerpt from
The Optimal Athlete's **Functional Power**.
To view the entire issue, please [click here](#).



TRAINING for POWER:

the basics



Joshua Rucci, CSCS

Zatsiorsky, the author of *Science and Practice of Strength Training* hit the nail right on the head when he stated that “to be a strong athlete does not mean to be a power athlete.” (6) Hmmm, you may be scratching your head at that statement, but it is in fact the truth. We will come back to that statement, but first let’s lay down the groundwork so that we may better understand what Zatsiorsky is trying to convey.

First off, strength is the ability to produce force, easy enough right? Well sort of, there are different forms of strength, including maximal strength and power, which is sometimes referred to as rate of force development. Maximal strength is simply the maximum amount of force that can be generated against an external object whether that is a 300 pound lineman or 500 pounds loaded on a barbell, and does not take into account the time it takes to move that linemen or barbell. This is where power comes into the picture, which can be defined as the product of force and speed. Thus when referring to power we must now take into account the weight of the external object and the time it takes to move that object.

The importance of delineating between these two types of strength is really dependant upon the sport or activity that you are programming or training for. For example, if you are coaching or training for maximal strength,

such as in a bench, squat, or deadlift competition where the only goal of the competition is to lift the most weight with no regard to movement time, your training should focus on developing maximal strength. Well duh, but how do we do that? According to Bompa, maximum strength is developed with loads of 90% or more of the heaviest weight you can lift for one repetition (1 RM) with slow execution. (1) So

as well as why these delineations exist.

Oh the drama, I know all of you probably do not have enough in your life already, so I will fill the void. Previous researchers such as Yessis suggested that training with heavy loads in the 1-4 repetition range will only develop strength, and not power, because the movement is performed at low speeds. (5) Yessis claimed that in order to develop speed-strength,



let's say that we are training to improve our 1 RM in the squat, we would first want to test our 1 RM in the squat so that we can calculate what 90% or higher would be, and once we have figured that out we can start training in the 1-4 repetition range to help increase our maximal strength.

According to Yessis, explosive movements must be employed to develop speed-strength.

Good stuff, right? Yes and no. Focusing strictly on increasing maximal strength should only be used in the case as illustrated above in which the primary goal is to move as much weight as possible with movement time being negligible; however, there are exceptions. Most training programs for athletic events will include a maximal strength phase in their periodization scheme, this is a means to an end and the end goal is ultimately increasing power production.

Ah yes, we have reached the section of power production, also known as rate of force development. The holy grail of all training programs for sports involving jumping, throwing, sprinting, and hitting, all of which require rapid movement as well as rapid force production. But this is where, unfortunately, things start to get a little complicated. I would love to be able to present you with a cookie cutter approach and be able to say "work at a given percentage of your maximum for a given amount of reps and "poof," you are now a powerful athlete," unfortunately research has not definitively agreed upon the most efficient way of developing or increasing power production. Another thing about power that you may run across is the delineation between strength-speed and speed-strength. We will not go into detail about these delineations, but the underlying premise between the differences in these types of power will be addressed

An advertisement for Coffee's Gym. The background is a photograph of a man in a white t-shirt and blue shorts lifting a large, red dumbbell. The text is overlaid on the image. At the top, "COFFEE'S GYM" is written in large, bold, black letters. Below that, the address "1800 Lower Roswell Rd. Marietta, GA 30068" and phone number "(770) 321-6900" are listed. At the bottom, the text reads "The South's premiere location for competitive weight lifting and sports performance training." in bold black letters.

**COFFEE'S
GYM**

**1800 Lower Roswell Rd.
Marietta, GA 30068
(770) 321-6900**

**The South's premiere
location for competitive
weight lifting and
sports performance
training.**

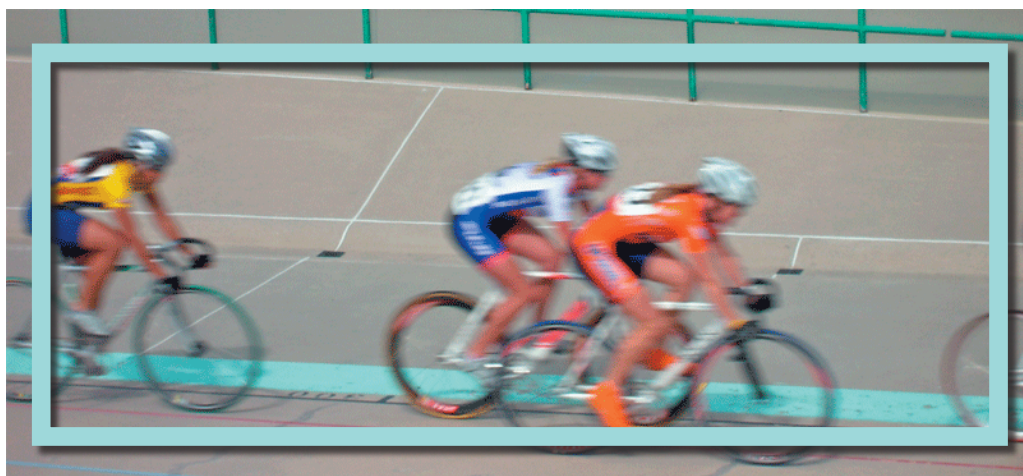
explosive movements must be employed in the training regimen. (5) The theory of using explosive movements to develop power led way to the use of lighter weights with an emphasis on movement velocity, which gained some support after researchers found that maximum power can be generated at about 30% of maximum force (1RM). Still others argue that training with heavy loads is most effective and preferable to light loads for the development of power. Schmidtbleicher, another researcher on the subject, notes that maximum strength is the basic quality that affects power production. Increasing maximal strength may affect power due to the idea that a given load would represent a smaller percentage of maximum, thus making the load easier to accelerate. (4) There is also evidence that as a result of strength training there are several power-improving alterations that occur both in the skeletal muscle and the neuromuscular system. (10) In short, the exact relationship between maximum strength and peak power and their effects on explosive strength with different loads remains unclear.

While there are different lines of thought and evidence as to what the best method of developing power is, which can be quite confusing, there is an easier way to organize the information that we have so that we can better apply it to ourselves or our athletes. We already know that in most cases, strength training for sports such as basketball, football, baseball, lacrosse, and other team and individual sports is aimed toward improving power and in the past maximal strength has been regarded as a prerequisite for high movement velocity and power output. So let's stay with that school of thought for the moment. We know how to increase strength in our athletes thanks to Bompa, so we now can focus on taking the strength gains that we or our athletes have made and transform that into gains in movement velocity/power.

When selecting strength exercises for power training, the athlete or coach must be attentive to the working

muscles, types of resistance, time and rate of force development, velocity of movement, and the direction of the movement. When selecting exercises for developing power you should select exercises that work the muscles involved in the main movements of the given sport and the type of resistance should closely mimic the sporting actions. Alright, now that we have our exercises and the type of resistance selected, let's focus on time and rate of force development, as well as the velocity of movement. In many sporting movements, the time available for force development is short (less than 0.3 s). Thus, it is important to focus on rate of force development rather than maximal strength. Movements that have a short duration of effort do not allow enough time for maximal force values to be achieved, so enhancing the rate of force development is much more important than developing maximal strength.

So, according to Zatsiorsky, to enhance rate of force development, exercises with maximal fast bursts of muscle action against high loads should be selected. (6) With high loads, the movement velocity may be low but the rate of force production is very high. Typically these exercises should be performed in a rested state, post warm-up, and a common routine consists of 3 to 5 sets with 3 to 4 repetitions per set against a load of about 90% of 1RM. (6) While this may sound similar to the maximal strength training protocol described earlier, the difference between the two is in the exercise selection and the intent to move



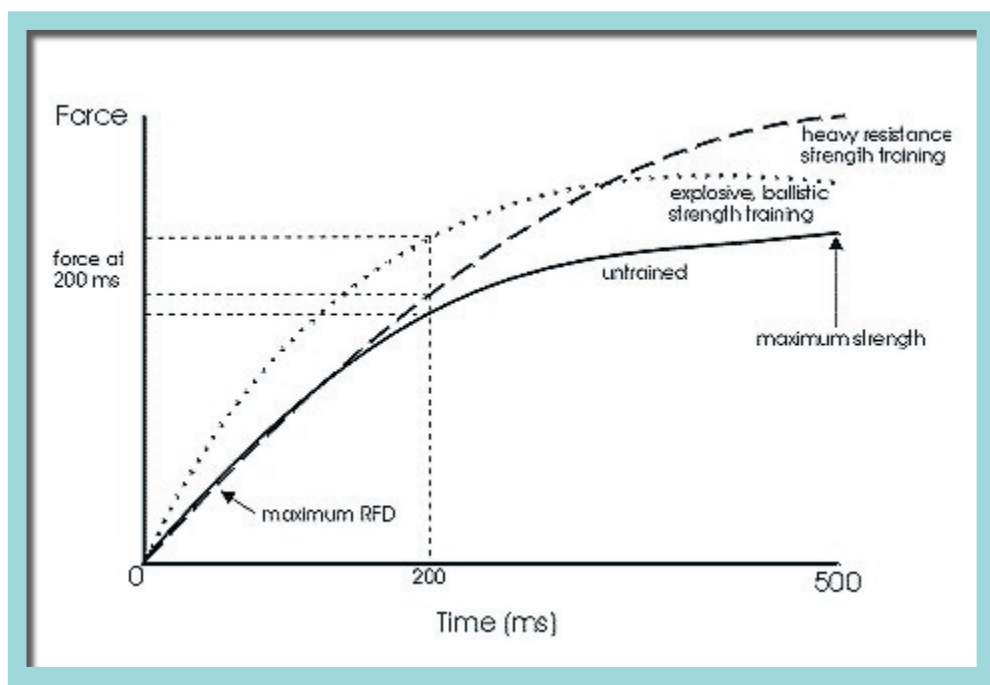
as explosively as possible. Let me explain in further detail. Typically when training for maximal strength the exercise selection consists of bench press, squat, and deadlift, which are the primary lifts performed in maximal strength competitions; however, when

training for power in athletics, the exercise selection consists of the Olympic lifts including the clean and jerk, the snatch and the various variations of these lifts. The reason these lifts are selected is due to the idea that these exercises are performed as explosively as possible on every single rep. Another integral part of training for power, whether you are performing the squat or the clean, is the intent to move as explosively as possible with each rep. Research has been conducted pointing to the idea that velocity specificity of an exercise may not play as large of role in facilitating gains in power and rather the intent to move as explosively as possible with each rep yields increases in the functioning of the neuromuscular system (brain to muscle system) which in turn leads to increases in power, independent of the velocity of the movement. The bottom line when training for power is that every repetition should be performed as explosively as possible.

Alright, now let us focus on movement velocity, as this is a vital feature in training for power. Obviously we would like to increase movement velocity due to the principles of power; if we can move a given resistance faster after training we have increased our power. While there is much controversy about how to train to increase power and movement velocity as previously discussed, Zatsiorsky notes that “training results depend on exercise velocity, and in order to improve the velocity with standard resistance, an athlete must exercise in the same force-velocity range as in the main sport exercise.” (6) Let us delve a little deeper into that statement. For example, training with heavy resistance and low velocity favors a gain in movement velocity with high resistance and as a result performance will be improved with heavy implements. On the flipside of that, if we were to train with low-resistance but at very high-velocities, we would yield gains in performance using lighter implements.

Table 1 illustrates what we have just touched on. We can now see that with heavy resistance training increases are expected in the high force end of the curve and low resistance-high velocity training (ballistic, explosive) would effect the rate of the rise in force rather than the maximal force. (3) For substantial gains in performance, choose exercises that are in the both the low resistance, high velocity range as well as the high resistance, low velocity range. This is how elite athletes train and their success should serve as evidence for implementing both methods of training.

Table 1 Training Adaptations




So “to be a strong athlete does not mean to be a power athlete” may make a little more sense now. Just because an individual trains for maximal strength and can squat 500 pounds does not necessarily mean that they can run a sub 4.4sec 40yard dash or have a vertical jump close to 40 inches. Training programs must include both high resistance, low velocity and low resistance, high velocity exercises to maximize sport performance.

Joshua Rucci, CSCS currently serves as a Graduate Strength and Conditioning coach for Olympic Sports at the University of Georgia. He is mostly involved with men’s and women’s cross country as well as men’s and women’s golf, men’s and women’s basketball, men’s and women’s swimming and women’s gymnastics. Rucci received his Bachelor of Science degree as an Exercise Specialist from Bowling Green State University. Rucci has previously served as a volunteer student assistant at Bowling Green State University and as an intern with the Chicago Bulls under Al Vermeil. Rucci is a member of the National Strength and Conditioning Association (NSCA) and is a Certified Strength and Conditioning Specialist (CSCS).

References:

1. Bompa, TO. *Theory and Methodology of Training*. Dubuque, IA: Kendall/Hunt. 1983.
2. Hakkinen, K. (1994). *Neuromuscular adaptation during strength training, aging, detraining and immobilization*. *Crit. Rev. Phys. Rehabil. Med.* 6:161-198.
3. Lamont, H. Stone, M. *Coaches’ Information Service: Explosive Exercises*. Retrieved from the World Wide Web, <http://coachesinfo.com/article/242/> on July 25th, 2007.
4. Schimdtbleicher, D. (1992). *Training for power events*. In: *Strength and Power in Sports*. P.V. Komi, ed. London: Blackwell Scientific Publications, pp. 381-395.
5. Yessis, M. *Speed-strength training*. *Track and Field Quart. Rev.* 89(4):43-45.
6. Zatsiorsky, VM. *Science and Practice of Strength Training*. Champaign, IL: Human Kinetics, 1995, pp.202-208.

Table 1 adapted from Lamont, H. Stone, M. *Coaches’ Information Service: Explosive Exercises*. Retrieved from the World Wide Web, <http://coachesinfo.com/article/242/> on July 25th, 2007.



Optimal Nutrition

Sports Nutrition

Weight Management & Body Composition

Corporate Wellness

Ilana Katz MS, RD, LD
Registered, Licensed Dietitian
ilanakatz@onforlife.com

"Optimal Nutrition for Optimal Performance"