

Strength **AND** HEALTH

A PUBLICATION OF THE YORK BARBELL COMPANY
FALL 2001

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In Memorium - 9-11-01

A Practical Approach to Power Training

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One of the most important aspects of performance potential is power. It's no surprise that coaches and athletes constantly look to improve this valuable physical quality. A closer look at power may provide some insights on how best to train.

What is Power?

Before discussing how power can be improved, it is important to understand the meaning of the term. In physics, power is defined as "work divided by time." Since work is further defined as "force times distance," it follows that power is also "force times distance divided by time."

Another definition of "power" is "force times velocity." The term

"velocity" is defined as "distance divided by time." Once again, it follows that power is "force times distance divided by time."

So power has three variables: force, distance, and time. Manipulating any of these three variables affects power.

Methods for Improvement

Based upon the equation "power equals force times distance divided by time," you can improve power output three different ways: (1) increase the amount of force; (2) increase the distance of application; and (3) decrease the time of application.

1. Increase the Amount of Force

If you increase the amount of force

applied, but keep the other two variables in the equation the same – namely, the distance over which you apply the force and the time it takes to apply the force – you will produce more power. Here's an example: If you can bench press 160lbs a distance of 18 inches (1.5 feet) in 2 seconds, your power output is 120 foot-pounds per second. [160lbs x 1.5 ft ÷ 2 sec = 120 ft-lbs/sec.]

Suppose that in the future you increase your bench press to 180 pounds. Assuming both the distance you move the resistance and the time it takes to move the resistance remain the same, your power output is now 135 foot-pounds per second. So, by increasing the amount of force

applied, you improve power output.

How do you increase the amount of force applied? The short answer is to increase the strength of your muscles. If you increase strength, the muscles produce more force; if they produce more force, you have the potential to produce more power.

How do you improve strength so that you can produce more force? While there is no shortage of opinions, any strength training program will be productive if - and only if - it incorporates the Overload Principle. Arguably, this principle is the most important underlying construct for improving physical performance - whether it is strength, endurance, or even flexibility. As far as strength training is concerned, this principle suggests that in order for a muscle to increase in strength it must be stressed - or "overloaded" - with a workload beyond its present capacity.

You can overload your muscles by using the Double-Progressive Technique. When implementing this technique, overload is accomplished by two means. One way is to make the resistance - or the "load" - progressively more challenging over time; another way is to do more repetitions with the same resistance. A muscle will adapt to the "overload" - from using a heavier amount of resistance or performing a greater number of repetitions - by increasing in strength. Without imposing greater demands, there is no compensatory adaptation

because a muscle literally has no reason to get stronger. Stated otherwise, a muscle must be exposed to demands that it has not previously experienced.

It matters little whether a muscle is loaded with resistance from machines, barbells, dumbbells, stretch cords, sandbags, bricks, or even other human beings. A muscle does not possess the ability to distinguish between different modes of resistance. It simply responds to being loaded.

2. Increase the Distance of Application

If you increase the distance over which you apply the force and do not change the other two variables in the equation - the amount of force applied and the time the force is applied - you produce more power. Another example: If you can squat 300 pounds a distance of 21 inches (1.75 feet) in 2 seconds, your power output is 262.5 foot-pounds per second. [$300\text{lbs} \times 1.75\text{ ft} \div 2\text{ sec} = 262.5\text{ ft-lbs/sec.}$] Suppose in the future you increase your range of motion in the squat and now displace the resistance a distance of 24 inches. Assuming that the resistance lifted and the time it took to move the resistance do not change, your power output is now 300 foot-pounds per second. By increasing the distance over which you apply force, you improve power output.

How do you increase the distance over which you apply force? One way is to become more flexible. If you become more flexible, you increase the ranges of motion of your joints; if

you increase the ranges of motion of your joints, you have the potential to produce more power.

How do you improve flexibility so you can apply force over a greater distance? Like strength training, there is no one optimal program for improving flexibility. Successful flexibility programs have several commonalities. To avoid injury, stretch under control without any bouncing, bobbing, or jerking movements. Hold the stretched position for about 30 - 60 seconds. Similar to strength training, make flexibility training progressively more challenging. You can do this by attempting to stretch a bit farther each time. Finally, it is important to stretch each major muscle group and do so on a regular basis.

3. Decrease the Time of Application

If you decrease the time it takes to apply force and keep the other two variables in the equation the same - namely, the amount of force applied and the distance over which you apply the force - you produce more power. Here's an example: If you deadlift 400 pounds a distance of 18 inches (1.5 feet) in 2 seconds, your power output is 300 foot-pounds per second. [$400\text{lbs} \times 1.5\text{ ft} \div 2\text{ sec} = 300\text{ ft-lbs/sec.}$] Suppose in the future you increase your speed of movement in the deadlift to 1.5 seconds (that is, you did the repetition faster). Assuming the resistance lifted (400 pounds) and the distance you moved the resistance (18 inches) remain constant, your power output is now 400 foot-pounds

per second. By increasing the speed at which you apply force, you have improved power output.

How do you decrease the time that it takes to apply force? One alternative is to perfect your technique (in your chosen sport). If you perfect technique, you can perform the skill more quickly; if you perform the skill more quickly, you produce more power.

How do you improve technique so that you can decrease the time that it takes to apply force? The motor-learning literature is in general agreement as to how this can be best achieved. It is important that you learn how to do the skill correctly. In addition, you must perform the skill over and over again until you can execute it without conscious effort. The skill must be practiced in a flawless manner. Remember: practice makes perfect but only if you practice perfect.

Lastly, the skill should be practiced exactly as you would use it in competition. Tim Wakeham, assistant strength and conditioning coach at Michigan State University, offers this insight: "Students do not study algebra to take a geometry test even though those are similar subjects. Both subjects are under the umbrella of mathematics, and because of their similarities, studying one may positively affect test results in the other. But it should be obvious that the best results would come from preparing for an algebra test by studying algebra."

Power to You!

A powerful athlete can apply a large force over a long distance in a short period of time. As demonstrated earlier, power output can be improved by three different means: (1) increase the amount of force you apply; (2) increase the distance over which you apply the force; and (3) decrease the amount of time it takes to apply the force. These can be accomplished by improving your strength, flexibility, and technique.

Be forewarned, however, that just because you can produce more power during a given exercise in the weight room does not mean you will automatically produce more power during a given skill in the athletic arena. Simply stated, there is no legitimate, scientific evidence that the ability to produce power transfers from one activity to another.

Think about it: If doing power cleans or another explosive-type movement improves your vertical jump, for example, then doing vertical jumps should improve your power clean. But they do not. The bottom line is, producing power in the weight room is one thing and producing power on the playing fields is another.

*Matt Brzycki has written more than 200 articles on strength and fitness. He is the author of several books, including *A Practical Approach to Strength Training*, and the editor of *Maximize Your Training*, a 455-page book that features chapters written by more than 30 strength and fitness professionals.*