

Powernetics - A Comparative Analysis

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Editors Note: The NSCA believes that the strength coach should be aware of the various modes (types) of resistance methods and equipment on the market. Each has its own unique features that set it apart from the competition.

We have invited numerous equipment companies to "toot their own horn" and explain how their product's training mode achieves a training effect.

This series of articles will help you judge the modes of conditioning and hopefully allow you to make your future purchases based on your strength and conditioning needs.

We would like to extend an open invitation to any equipment company that would wish to contribute to this series.

Hydra-gym machines utilize hydraulic cylinders to produce a form of isokinetic overload which HYDRA-GYM has called "Powernetics". How does "Powernetics" differ from isometrics, isotonics and isokinetics?

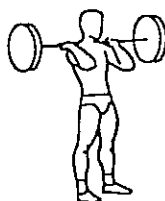
The following illustrations should clearly differentiate these four modes of training. In all cases, the example

DIAGRAM 1
Full Squat
300 lbs Strong



45 Degree
Knee Flexion

DIAGRAM 2
Fully Extended
600 lbs Strong



180 Degree
Knee Extension

will be one related to the front squat exercise beginning in a full squat position (see diagram 1) and progressing to the fully extended position (see diagram 2) with the example individual being 300 lbs strong at the full squat position and 600 lbs strong at near full extension. The athlete progressively gets stronger through the range of motion of the squat exercise due to increased muscle fiber recruitment, summation of joint forces, and increased biomechanical leverage.

- 1. Isometrics** is static contraction resulting in no movement of limb or object against which force is exerted. Maximal force generation (100% overload) as a result of maximal muscle fiber recruitment. It is limited to muscle fiber recruitment at the specific joint angle force is being exerted. Thus, for your athlete to receive maximal strength development through the full range from 45 degree knee flexion to 180 degree knee extension, he must perform an 8 to 10 second static contraction at every joint angle - which would be very time consuming.
- 2. Isotonics** is dynamic contraction involving movement of a weight. The weight provides the overload. The greater the weight the greater the overload. The maximum muscle overload exists only at the weakest joint angle in the range of motion. The weight cannot change resistance through the range of motion, therefore the overload varies with the increased or decreased muscle fiber recruitment and biomechanical leverage of the joint angle. The weight cannot provide maximal muscle overload (100%) at all joint angles throughout the full range of motion can not be achieved. In order to train at fast limb speeds the weight must be decreased considerably which results in increased acceleration and decreased muscle overload. Thus, if our example athlete were training with a one-rep maximum he would receive 300 lbs resistance at the beginning (100% overload) and 300 lbs resistance at the end (only 50% overload). Now, if our example athlete performs 8 repetitions with 80% of his maximum he would receive 240 lbs resistance at the beginning (80% overload) and 240 lbs resistance at the end (only 40% overload). However, as the muscle fatigues (after the first few repetitions) the percentage of overload increases due to the muscle's decreased ability to generate force and therefore the last few repetitions with 240 lbs may provide 100% overload at the beginning and 50% at the end (estimated power output, 1 set - 8 reps = approximately 1,920 lbs).
- 3. Isokinetics** is dynamic contraction involving limb movement at a pre-determined speed thus allowing for maximal force generation (100% overload) throughout the full range of motion. It is acceleration controlled because the mechanics of the machine only allows the lever arm to move at the pre-determined speed. One will only get maximal muscle fiber recruitment of fast and slow fibers at very slow speeds of movement. It can be thought of in terms of progressive isometrics. At fast speed settings you are still maximally overloading (100%) those muscle fibers that are capable of generating tension quickly (predominantly fast fibers) at these fast limb speeds; and maximally overloading them throughout the full range of motion. Although isokinetics allows for speed training against maximal resistance throughout the full range of motion, the coach has to guess what setting is optimal for each athlete.
- 4. Powernetics** combines the principles of isotonics and isokinetics. Both the resistance and the speed vary throughout the range of motion. The resistance is maximal (100% overload) throughout the range of motion. The speed of movement, although pre-determined, will vary with the recruitment and

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strength potential of the user and thus be optimal throughout the range of motion for each and every user. Thus, at the slowest speed setting, which allows for maximal recruitment of all fast and slow fibers, our example athlete would receive 300 lbs resistance at the beginning of the squat (100% overload) and progressively increase to 600 lbs resistance near the end (also 100% overload). As the muscle fatigues the mechanics of this system automatically adjusts so that the athlete is still working at 100% overload (100% of what his muscle is capable of generating at that time) throughout the full range of motion (estimated power output, 1 set - 8 reps = approximately 4,000 lbs).

Throughout my discussion, I've referred to maximal resistance and maximal overload. These terms are synonymous with **100% intensity**. Intensity of exercise, combined with duration and frequency of exercise are what produce increases in cardiovascular endurance, muscle strength, muscle endurance and muscle power. Basically, the greater the intensity and duration of exercise, the greater the quality and total amount of work performed, and thus the greater the overload on the muscular and cardiovascular systems. The greater the overload, the greater the training adaptation or increase for a thirty minute duration, on a proper Powernetic circuit will produce dramatic increases in cardiovascular endurance, muscular strength, muscular endurance and power. These increases will be noticeable after the first few weeks. However, I would recommend twelve weeks as an adequate pre-season conditioning program and I would continue this schedule throughout the competitive season.

Most coaches believe that the most important training adaptation is an increase in muscle size. Therefore, most coaches design their training programs to increase muscle bulk. Powernetics can supply that muscle bulk much easier and safer than any other system; 1st, by setting the speed valve on a very heavy setting and working with intensity, causing complete contraction of both the fast (white) and slow (red) muscle fibers; 2nd, by setting the valve at a speed which enables you to achieve a rep

per second, then work til burn-out. Powernetics is excellent for burn-outs. It automatically unloads resistance as your strength decreases.

The principle of specificity states that an athlete should simulate in practice as closely as possible those actions and movements that lead to successful performance in competition. Thus, if you want your athletes to perform at maximal speed with powerful movements, then according to the principle of specificity they should train at maximal speed as well. Only Powernetics systems allow for limb speed increases with accommodating resistance.

In recent years a few isotonic exercise equipment manufacturers have produced what they call variable resistance systems. These manufacturers claim that due to the mechanics of their equipment design the resistance provided by a weight stack actually increases or decreases to allow for increases and decreases in strength at different joint angles throughout the range of motion. Although we know that these systems are in fact variable, I have yet to read a research paper that measures exactly how much the resistance changes or varies. Since none of these manufacturers claim to provide 100% overload throughout the range of motion, your athletes are not getting 100% overload when they train on these isotonic systems.

Power is the most important commodity the athlete can possess for performing his task in each sport. Usually he has 10 to 20 seconds per play or event, to apply this power. He is going to automatically respond in the manner he has trained (specificity). Consider this Powernetic illustration, please. The Powernetic Bench Press works two (2) muscle groups during each repetition. It works a concentric (agonist) muscle group on the upward push; then it works a separate concentric (agonist) muscle group on the downward pull. Both movements being a proven benefit for the athlete mentally and physically. The power out-put on this Bench Press/Bench Row is approximately 5,500 lbs with 1 set, 10 reps of 200 lbs off the chest strength (weak angle). Compare this out-put to an isotonic weight bench press; power out-put approximately 2,500 lbs with 1 set, 10 reps of 200 lbs off the chest strength. Which power out-put would you want your athlete's automatic reflex system to respond with; 5,500 lbs of power out-

put or 2,500 lbs of power out-put? The athlete is going to do in the game what he does in practice (specificity)! When training isokinetically or with Powernetics, your athletes cannot work against resistance in a negative direction. They can only exercise in a positive direction or concentrically - as they do when they perform in competition.

Most Powernetic machines can exercise both the agonist and antagonist during the same repetition. Thus, using the arm curl as an example, your athletes would overload the biceps on the upstroke and the triceps on the downstroke. Since you want to develop both these muscle groups, it makes sense to train them together for proper balance as well as to reduce your work out time in the weight room thus giving you more time on the practice field. This same principle applies for the quadriceps/hamstrings, hip adductors/abductors, hip flexors/extensors and all the other agonistic/antagonistic muscle groups.

In summary, the advantages of POWERNETICS, as I see them are:

1. Utilizes the Isokinetic exercise principle to provide an optimal accommodating resistive overload through the full range of motion with no guess work involved. This means that the resistance at all joint angles will be maximal thus providing optimal positive increases in muscular power, strength and endurance.
2. Allows for differences in skeletal leverage as well as allowing the resistive overload to change (without the exerciser physically making any adjustments to the machine) as the force out-put of the muscle changes due to fatigue, weakness or pain from a previous injury.
3. Allows **100% intensity training** for each set and for the entire workout which means that the total amount of work performed per workout is greater than that for any system based on less than 100% intensity workouts (isotonic systems). This is important because positive changes in muscular power, strength and endurance are a result of both the quality (100% overload) and quantity (total amount of work done) of the workout. Also, I might add,

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the football coach does not say to his lineman, "Now, I want you to fire out with 70% intensity" No, he says, "Fire out with 100% intensity". For it to be an automatic reflex, it has to be repeated thousands of reps!!

4. Allows for high speed power training to develop useable strength or power (force out-put per unit of time) without muscle bulk as well as slow (almost isometric) strength training to develop muscle bulk. The hydraulic cylinders can be adjusted so that the muscle gets a maximal overload regardless of whether the speed is adjusted for fast or slow-training. This aspect is very important since, with the exception of body builders, athletes are dependent upon power for their success and not brute strength.
5. Develops balanced muscle groups by working both the agonistic and antagonistic muscles during the same exercise set. This reduces the workout time and produces a rhythmic pumping of blood (no occlusion as occurs in negative training) through the muscles which aids in the removal of harmful waste products from energy metabolism (lactic acid) that builds up in the muscle.
6. Safety - the user is never put in a situation where he/she is trying to lift a weight greater than what his/her muscle is capable of. This means that Powernetics can never cause a muscle strain (tear) as a result of the machine pulling the muscle in the wrong direction.
7. Will not produce residual muscle soreness when used properly. The agonistic muscle works as the opposing muscle relaxes and visa/versa, which produces the rhythmic muscle pumping action that removes harmful waste products.
8. Can be safely used by all ages, sexes and body sizes to produce optimal changes in muscular power, strength and endurance as well as significant cardiovascular (aerobic) training. This can all be accomplished during 30 minute workout (two set of 20 seconds duration on each machine) three times per week.
9. Has built-in gauges for accurate measurement and testing at any joint angle of the force out-put.
10. Provides an optimal workout for all three energy systems of the muscle (alactic, lactic acid and aerobic) as well as for the contractile properties (muscle metabolites, enzymes and proteins) of both the FAST TWITCH and the SLOW TWITCH muscle fibers.
11. Almost noiseless operation. No clanging and banging of weight stacks. The hydraulic fluid flows smoothly and quietly in a sealed self cleaning cylinder. ●