



Strength Training for Elite Athletes

Part III: Electrostimulation, Isokinetics, and Strength-Endurance Methods

Presented at the American Swimming Coaches Association

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Publication Date: 1987

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In this seminar I will cover the main methods of strength training, as follows: Bodybuilding, maximal weight, eccentric training, isometrics, electrostimulation, isokinetics, strength-endurance, and speed-strength.

Electrostimulation

Electrostimulation is an advanced form of isometric work. The muscular contraction is not initiated by a voluntary impulse from the central nervous system, but from electrical stimulation. The muscle can be stimulated directly, by an electrical pad placed on the top of the muscle, or

indirectly, by exciting the nerve with a needle innervating a muscle group. Besides not being practical, the second method is extremely painful.

Electrostimulation can be used alone, along with isokinetic equipment, or after other forms of strength training methods. Electrostimulation offers these five advantages:

1. The maximal activation and the longer duration of the tension of the contractile proteins greatly favors muscle growth.
2. Well-suited for rehabilitative training.
3. Produces minimal fatigue of the central nervous system.
4. Overcomes sticking points in advanced athletes.
5. Increases the cross-section of a muscle, thus favoring speed development. The form of training played a major role in the strength development of Ben Johnson.

Electrostimulation still casts a few doubts in strength training circles. Here are four reasons why:

1. The strength gains claimed by Eastern Bloc countries (up to 30 percent in one month!) have not been reproduced in North American studies.
2. Electrostimulation bypasses the guiding and protective functions of the proprioceptors, increasing the likelihood of muscle pulls.
3. In the case of the direct stimulation, only the external fibers are innervated supramaximally. As such, the major portion of the deeper fibers are not reached and do not participate in the contractile process (Beulke, 1978).
4. Electrostimulation is a more intense form of isometric work that lacks the benefits of dynamic work needed for optimal competitive performance.

Isokinetic Training

Isokinetic exercise is performed with special apparatus that provides accommodating resistance by controlling the rate of muscle shortening for every joint angle, thereby producing a constant speed of contraction. Hence, the term "isokinetic." Considerable research has been done on isokinetic training. However, many of the experiments have doubtful training protocol and most of the work has been done in a clinical environment. The following six points should be considered regarding this form of training:

1. The accommodating resistance at pre-set speeds of isokinetic equipment allows for a full effort throughout the range of motion at every angle. This condition provides the neuro-muscular system with considerable duration and intensity of contraction.

2. The optimal training protocol for isokinetic equipment has yet to be fully investigated. Theoretically, most methods described in the Bodybuilding Methods and Maximal Weights Methods sections could apply to this form of training.
3. The most effective strength gains have come from slower training speeds (60 degrees.s⁻¹ or less (Books and Fahey, 1984).
4. Isokinetic exercise is valuable during a rehabilitative phase, calls for shorter warm-ups, and produces less muscle soreness.
5. In sports where varying parameters of force development are predominant (throws, jumps, sprints, judo, and so on), isokinetic training is generally not indicated (Kruger, 1972; Schmidtbleicher, 1985).
6. Most isokinetic equipment do not provide eccentric loading, a prerequisite to achieve one's strength potential (Gundlach, 1972).

Strength-Endurance Methods

Strength-endurance is the athlete's ability to tolerate fatigue in strength performances of longer duration. It is one of the most important physical qualities swimmers must develop.

According to Zatsiorsky (1971), maximal strength ceases to be a critical factor in endurance performance under 30 percent of maximum. Here are three ways to increase strength-endurance:

1. Training for maximal strength.
2. Training for high repetitions with loads representing above 30 percent of 1RM.
3. Using the competitive movements but with a resistance higher than the one encountered in competition, such as swimming against a current.

There is considerable research needed on the optimal way to increase strength-endurance. However, the fundamental condition for strength-endurance training is the highest possible amount of work against resistance higher than that of competition (Harre, 1982; Keul and Halarambie, 1977). The standard methods recommended for the development of strength-endurance are as follows:

1. 3-5 sets of 10-20 repetitions at 40 to 60 percent of 1RM, rest intervals: 0.5 to 1.5 minutes.
2. 4-6 sets of 30 repetitions at 20-40 percent of 1RM, rest intervals: 0.5 to 1 minute.

Here are three variations of methods for the development of strength-endurance that could boost your program:

1. The 100 Repetitions Method. Athletes are paired in a competitive setting and are instructed to perform 100 cumulative repetitions with a 20RM weight in as few sets as possible.

Group together two swimmers with roughly the same strength levels. Give them a resistance they can perform for 20RM. For example, swimmers Al and Bernie will do upright rowing. Swimmer Al performs a 20-rep set with 40 kilos. Immediately, Swimmer Bernie performs as many repetitions with his weight (45 kilos). As soon as Bernie is finished, Al performs a set of maximum repetitions with his weight. Let's say 17 repetitions for illustration purposes. Now, Bernie must match or surpass the amount of repetitions that Al did with his weight. Bernie, having watched all the Rocky movies, performs 18 repetitions and therefore has completed 38 (20+18) repetitions. Al is trailing at 27 cumulative reps and performs another set of maximum repetitions right after Bernie completed his 18RM set. Once they do a total of 100 cumulative repetitions, they are finished with this exercise for the workout. At first, as many as 10 sets may be required to complete the 100 reps.

The athlete should only rest during the completion of his partner's set. Once they can each perform 100 repetitions within 4 sets, upgrade the resistance 5-7 percent. This method, besides improving rapidly the strength-endurance levels of your athletes, provides them with a competitive environment in training.

2. Uni-Angular Tri-sets. Uni-angular tri-sets call for the use of three slightly different exercises working on a single muscle groups. All exercises are performed in a sequence for sets of 10-20RM. No rest is taken until the three exercises are completed. Three sequences are performed with 0.5 to 1.5 minutes rest between them. Use three exercises that work with the muscle in the same plane. When changing the exercise you can change one or all of these factors: resistance implement, grip and starting position. Here is an example of a uni-angular tri-set for the elbow flexors where all three factors are varied.

Exercise 1: Seated dumbbell curl

Exercise 2: Standing EZ barbell curl

Exercise 3: Close-grip, lying pulley curl

This method offers the advantage of training various aspects of the strength curve of a muscle.

3. Descending sets (aka, rail-roading, strip downs, triple drops). Descending sets consist of the following:

1. Perform an 8-10RM set.
2. Rest long enough to remove 10-15 percent of the resistance.
3. Perform the maximum amount of repetitions that you can do.
4. Same as 2.
5. Same as 3.
6. Rest 1-1.5 minutes.
7. Repeat steps 1 to 6, 2-3 times.

The following about speed-strength should be considered:

A. Speed-strength training be performed in a refreshed and wakeful state, or no training effect will occur (Schmidtbleicher, 1985). Fatigue conditions will lead to decelerations, a condition that is not optimal for training the nervous system.

B. Adequate rest intervals are also crucial in speed-strength training and should remain long between sets (5-10 minutes).

C. To develop power, the development of strength is of prime importance since speed trainability is very low.

D. Empirical evidence seems to point out that speed-stretch methods should be utilized close to competition to derive its benefits for optimal athletic performance.

E. Speed-strength work should be performed prior to endurance or strength phases of a training unit.

F. Acceleration is the prime stimulus for speed-strength development.

Kulesza (1985) recommends these two forms of speed-strength training depending on the nature of the sport. For Acyclical sports (jumps, throws, judo, wrestling, racquetball, and so on):

Intensity: 50-80 percent of maximum

Reps: 1-10

Sets: 5-10

For Cyclical Sports (kayaking, swimming, speed skating, rowing, and so on)

Intensity: 30-50 percent of maximum

Repetitions: 10-30

Sets: 5 or more

In Part IV of this series, I will discuss speed-strength methods and plyometrics.

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