CT's Modern Strength
Newsletter for the Serious Strength Athlete
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The Beast Speaks

Last week was a good one for this beast. I was featured in two online interviews, one with Charles Staley which was an exclusive for his private members group, and the other one which is available at www.sportspecific.com. That last interview is over 24 minutes long and we're actually scheduled to have a part II next week.

I am also preparing for the upcoming joint workshop with Mike Mahler which will be held August 28th, 2004 in NYC. For those who register before May 20th, the cost is 195.00$, afterwards the cost will be increased to 250.00$. The location is still to be determined but it will be announced shortly. As a special offer I will also give a copy of either one of my books to those who register before May 20th. You can register by contacting Mike at: **mahler25@yahoo.com**, believe me you won't get a better deal than that anywhere else. Two great strength coaches at such a low price is not something you see everyday!

In this issue

Exercise of the month

Upper body power is something very important in most sports. The ability to produce a large amount of force and acceleration with the upper body is key for many athletes. This month we will present one of the most effective upper body power drill: **the ballistic bench press**.


To properly execute this drill follow these instructions:

1. Lie down on the bench (using the Smith machine) and hold the bar at arms length with a shoulder width grip.

2. Very quickly lower the bar to the chest.

3. As soon as you reach the lowest portion of the movement you throw the bar up into the air.

4. Catch the bar with stiff arms.

The important coaching points are as follow:

1. Keep your body stable; we only want to use the arms in this movement.

2. Think minimum coupling time. Immediately after you reach the chest you must throw the bar quickly up into the air, don't wait!

3. Use a load that is 10-25% of your maximum bench press

This drill is one of the most effective ways to quickly gain upper body pushing power. It is highly effective for sports like football, baseball, hockey and especially field events. And most of all, it's fairly easy to master, so you'll be able to get the most out of the exercise right away.

The use and benefits of electromyostimulation for athletes

Electromyostimulation (EMS) has gained some visibility because of the modern use of EMS gadgets sold to the general public. These cheap substitutes are often quite ineffective because they don't offer the proper current modulation and contract/relax time necessary to produce results. Because of the inefficacy of these popular devices, EMS in general has taken a step back in the eye of many athletes and coaches. This is bad news, because EMS offers many things that could be of great benefit to anybody wanting to improve his physical capacities and muscle mass.

EMS is very popular with European athletes (Justine Henin-Hardenne and Hermann Maier to name a few) and has been researched extensively (and on athletes, not sedentary subjects) with very positive results.

I believe that EMS can be of great use to athletes, whether it is for increased strength, power, speed, or recovery. I will present to you the benefits of such training methods so that you can make up your own mind.

Benefits of EMS

I. Preferential recruitment of fast-twitch fibers
II. Increase in muscle strength
III. Increase in muscle mass
IV. Increase in jumping height (power)
V. Improvement in running speed
VI. Increased recovery
VII. Prevention of atrophy

Preferential recruitment of fast-twitch fibers

During voluntary contractions motor recruitment is done according to a rigid pattern known as the "size principle" or the "Henneman law." According to this principle, the smallest motor units (slow twitch), which have the lowest recruitment threshold, are activated first. As the demand on the muscle increases, the bigger motor units (fast twitch), which have a higher recruitment threshold, are brought into play. This pattern doesn't change except for a few noted exceptions (maximal eccentrics for example).

With EMS there is an inverted recruitment pattern. This means that the bigger motor units are actually recruited first. Why? There are three reasons:

1. Because EMS works the following way: The electric current stimulates the nerve cells (and not the muscle fibers themselves as it is believed by some), which then innervate the motor units. Without going into too much physiology, motor units with bigger axons are more responsive to an external current; bigger axons are more excitable

(Blair and Erlanger, 1933; Solomonow, 1984). Fast twitch motor units have been shown to have larger axons; the bigger the axon is, the more likely it is part of a fast-twitch motor unit. So understandably, EMS will preferentially recruit the bigger, fast-twitch motor units first (Solomonow, 1984; Enoka, 1988; Duchateau and Hainaut, 1988)

2. EMS has also been shown to preferentially recruit superficial (closer to the skin surface) motor units over deeper motor units (Beulke, 1978). Snyder-Macier et al. (1993) have established that fast-twitch motor units have a tendency to be closer to the surface. So, since EMS works best on superficial muscle fibers, this also explains the preferential fast-twitch recruitment pattern.

3. Stimulation of the cutaneous receptors (skin receptors) tends to increase the recruitment of fast-twitch fibers over slow-twitch fibers (Garnett and Stephens, 1981; Kanda and Desmedt, 1983). Since the electrode is placed on the skin and the electric current must go through the skin, this could also increase fast-twitch motor unit activation.

On top of the direct evidence supporting the preferential activation of fast-twitch fibers/motor units by EMS, we have some indirect evidence as well, provided by a recent study.

Maffiuletti et al. (2000) found that EMS training significantly increased eccentric strength and high-speed concentric strength, but not slow-speed concentric strength. We know that during maximal eccentric efforts the fast-twitch muscle fibers play a bigger role, and that high-speed concentric strength is highly dependent on fast-twitch fiber capacities. These results are thus highly indicative of a preferential fast-twitch recruitment pattern with EMS training.

Conclusion

Preferential recruitment of the fast-twitch fibers is very interesting for athletes. We know that under normal circumstances it is very hard to stimulate these fibers. The training means required to do so (maximal eccentrics, intense plyometrics) can often be extremely taxing on the CNS and joints. Because of this, EMS appears to be a good supplementary tool for the athlete. EMS enables the athlete to reduce his volume of maximal training (but not eliminate it) while still getting the same (if not superior) training effect.

Increase in muscle strength

Since the studies of Soviet sport-scientist Kots (1971) reported strength gains of up to 50% in minimal time, the possible applications of EMS training on muscle strength have been thoroughly researched.

The first studies on the subject came from Krcka and Zrubak (1970), who found an increase in strength in the biceps (45.8%) and calf muscles (61.5%) of 36 subjects after a short EMS training program. Then Kots and Chwilon (1971) trained a group of competitive wrestlers with EMS and reported gains of 27% after 900 total seconds of work (divided into several workouts) and 56% after 1900 total seconds.

A group headed by French sport-scientist Gilles Cometti has conducted the most interesting studies. The interesting aspect of these studies is the use of sportsmen with a significant training background, and not sedentary subjects.

In one study by Ratton and Cometti conducted on sprinters, EMS training using a Compex unit (a commercial EMS unit which includes pre-planned training programs) resulted in average strength gains of 52% in 3 weeks, using 3 EMS sessions per week, 10 minutes per session (5 second contractions followed by 15 seconds of rest).

On wrestlers' biceps, Cometti and Gillet (1990) stimulated strength gains of 14% using the same protocol as above.

Champion and Pousson (1991) used a similar protocol on the triceps of boxers and came up with strength gains of 18.5% in the same 3 weeks.

It is evident that EMS can indeed significantly increase muscle strength, especially maximum eccentric and high-speed concentric strength. And contrary to what some would have you believe, EMS increases strength via both structural (hypertrophy) and neuromuscular factors.

Neuromuscular adaptations to EMS?

Some people believe that since EMS replaces the CNS in activating the muscles, there are no neuromuscular adaptations. There is a lot of evidence showing that this is not true.

1. **EMG modifications**: It has been established that after a period of EMS training, EMG data (indicating the degree of muscle recruitment) increases (Hakkinen and Komi, 1983; Moritani and DeVries, 1979; Komi et al., 1988; Maffiuletti et al. 2002). This indicates that following short-term EMS training the neural activation of muscle is higher. This is one of the reasons for the increase in strength from EMS training. The study by Maffiuletti is particularly interesting, and concludes that EMS training can increase the recruitment of motor-units, possibly by lowering the activation/innervation threshold of the fibers, or by an increased CNS output.

2. **Cross-education of the opposite, non-trained muscle**: Several studies have reported strength gains in an opposite, untrained limb when using EMS (e.g. training the right biceps with EMS but not the left biceps). This cross-education effect has been thoroughly researched with concentric and eccentric training. It has previously been determined that neural adaptations are the cause of the transfer to the untrained limb. A recent study by Hortobagyi et al. (1999) found the cross-education effect to be the same with voluntary and stimulated contractions, indicating that EMS training indeed has a significant neuromuscular effect.

Now, the interesting part is that despite stimulating neuromuscular adaptation, EMS training actually has <u>little, if any, fatiguing effect on the CNS</u> (Weineck, 1996; Duchateau, 1993). This allows for a greater total workload and more adaptation without an increased risk of overtraining.

<u>Conclusion</u>

EMS training can increase strength and it can do so in a short period of time. These strength gains are mediated both through an increase in muscle hypertrophy and neuromuscular adaptations. However, one must still train using dynamic methods to be able to transfer these gains to dynamic, multi-joint exercises. EMS should not be seen as an alternative to dynamic training, but rather as a supplementary/complementary method.

Increase in muscle mass

Few studies have researched the impact of EMS on muscle hypertrophy in healthy individuals. One such study by Turostowski et al. (1991), performed on competitive triple jumpers, found muscle mass gains (quadriceps) ranging from 4 to 8% in 3 weeks (gains that were 2-4 times superior to the control group, which used regular strength training). Another study (Gillet and Cometti, 1990) found an average increase in biceps size of 4.5% after 3 weeks of stimulation on competitive wrestlers. An earlier study by Cometti (1988) found an increase in the quadriceps size of long jumpers ranging from 2-5cm in 3 weeks. Still earlier, Krcka and Krubak (1970) found increases in biceps (10.8%) and calf size (9.9%), while Kots and Chwilon (1971) reported hypertrophy gains in the biceps of 3.8%.

Recent studies have also determined that EMS training can cause muscle micro-trauma. In fact, Moreau et al. (1995) found that EMS training led to more micro-trauma than concentric training, which may indicate that EMS is at least as good as concentric training at stimulating hypertrophy gains. These findings were corroborated by Kim et al. (1995) who also found EMS to cause a significant amount of muscle micro-trauma.

Conclusion

Hypertrophy gains are indeed possible with EMS training. And since EMS has been shown to preferentially recruit fast-twitch fibers, it can be hypothesized that the hypertrophy from EMS training occurs mostly in these fibers. Increasing the relative surface of the fast-twitch fibers compared to the slow-twitch fibers.

Increase in vertical jump/power

EMS increases strength and preferentially stimulates fast-twitch fibers. So it would seem logical to assume that the capacity to produce power is also augmented by EMS training. Cometti also tested the impact of EMS training (3 weeks of training, 3 sessions per week, 10 minutes of stimulation of the quadriceps per session). They tested for quadriceps strength, squat jump (jump from a static start), and countermovement jump (jump with a dip, e.g. regular vertical jump test). The experimental group trained only with EMS, while the control group trained only with regular strength methods.

In both groups, quadriceps strength increased after 3 weeks of training (11.45% for the EMS group and 3.65% for the lifting group), squat jump performance improved (11.14% for the EMS group and 3.45% for the lifting group), but countermovement jump (CMJ) performance decreased slightly in both groups. However, after cessation of the EMS training there was a rebound effect causing CMJ performance to significantly increase.

We can conclude that EMS increases the muscle's capacity to produce power, however it neglects the impact of the stretch-shortening cycle (that's why there is an increase in squat jump and not in CMJ). We can hypothesize that adding a stretch-reflex regimen to the EMS program would lead to great gains in all power parameters.

This is indeed what research shows us. A study by Maffiuletti et al. (2002) found that EMS and plyometric training used in the same training session (repeated 3 times per week for 4 weeks) led to gains in both countermovement jump (8-10%) and squat jump (21%).

The same benefits can be stimulated when EMS and sport practice are coupled, if the sport is explosive by nature (Malatesta et al., 2003; Maffiuletti et al. 2000).

Conclusion

EMS can indeed increase a muscle's capacity to produce power. However, since EMS is basically isometric or quasi-isometric by nature, it neglects the elastic and reflex actions involved in dynamic power production. Thus, to get the greatest benefit out of EMS training for power, plyometric exercises should be used concurrently.

Increase in running speed

The simple fact that athletes such as Ben Johnson, Valery Borzov, and Jerry Rice extensively (and intensively) rely or relied on EMS training as part of their regimen speaks volumes for the possible impact of EMS on speed improvement. However, there have not been studies conducted on the subject of EMS' impact on running speed. But since EMS improves both strength and power, and it preferentially stimulates fast-twitch fibers, it seems evident that there is a potential running speed improvement to be had from EMS training.
However, one must be careful to stimulate all of the muscles involved in running equally to avoid developing strength imbalances that could actually decrease running speed. Training the quadriceps/rectus femoris, hamstrings, calves, and glutes is necessary for a maximal training effect.

Increased recovery and prevention of atrophy

Sub-tetanic (non-maximal) EMS utilized in a pulsating manner can act much like a sports massage. It can stimulate blood flow to the muscles by creating a pumping effect. It can also induce a state of relaxation in the muscles and help breakdown adhesions between muscle fibers.

One recovery method that I find to be particularly effective is to drink a protein and carbohydrate shake and have an EMS recovery session 15 minutes afterwards. This will bring a lot of amino acids and glucose to the muscle, speeding up its reconstruction and supercompensation.

Also, since EMS has been shown to hypertrophy a muscle and to increase its strength, it can be used on a muscle or group of muscles when regular training is no longer possible. In this case, EMS will prevent (or significantly decrease) muscle atrophy from inactivity, which will facilitate the athlete's comeback once he can get back to regular training.

Since it is gentle on the CNS, it can also be used by athletes in-season to prevent losses in mass and capacities.

Stimulators

There are a lot of EMS devices available. I place them in three categories:

1. The clinical models
2. The gadgets
3. The pre-planned models

The clinical models offer the greatest possibilities. You can modulate every characteristic of the current (frequency, time of contraction, time of relaxation, waveform, etc.). However, these models can be hard to operate for somebody who hasn't gone through training on the proper use of EMS, and as a result can lead to sub-optimal results.

The gadget models refer to every abdominal belt and similar device that you can find advertised on infomercials. Obviously, these are not worth the effort you put into driving to the store to buy them!

I like the pre-planned models a lot. These include a myriad of different training programs for which the training variables are preset. You only need to choose the program type and level that are best adapted to your needs; then, crank it up! This is the best solution for athletes, as you are sure to get a program using the proper adjustments. However, it lacks variability, which may turn-off individuals with a lot of EMS experience.

The model I use is the *Compex Sport US*. Compex is the best brand on the market and certainly the most reputable. They offer several models, each with various training programs as well as a CD that will help you design a program according to your needs and present situation. We can also note such manufacturers as *Sporecup*, which is on par with Compex as far as efficacy goes.

Conclusion on EMS

EMS works, however it is not a substitute for regular strength training. Used as a supplementary training method it has several benefits that can be a goldmine for most athletes. However, understand that, as Charlie Francis wrote, "crank it up!" You must use the maximum tolerable current to get the most out of your EMS unit. If you do, you can expect rapid gains in strength, power, and hypertrophy.

Controlled repetition method

This form of training includes classic hypertrophy (i.e. bodybuilding) training and sport movements performed at a controlled pace (often times with loading). The best examples of the controlled pace sport movements are **heavy** sled-dragging and performing sports movements wearing a weighted vest. This leads to hypertrophy in the specific muscles involved in the action and specific conditioning (improvement in the energy system efficiency).

Resistance training using a bodybuilding approach (higher volume, lower speed of action, more isolation exercises) doesn't directly improve the athlete's performance. However, it can help strengthen the tendons, which can reduce the risk of injuries. Still, remember that increased muscle mass can be detrimental to performance for two reasons:

1. Non-functional hypertrophy (sarcoplasmic hypertrophy) doesn't lead to an improvement in the capacity to produce force, but it does lead to added body weight (thus you have to carry more weight without having more strength).

2. Excessive muscle hypertrophy constricts the vascular system, especially the blood vessels and capillaries in the muscles, which leads to decreased oxygen and nutrient transport to the muscle. This makes the disposal of intramuscular waste byproducts and recovery from training difficult.

Non-functional hypertrophy is an increase in the non-contractile elements of a muscle fiber and it has been shown to occur predominently with bodybuilding-type training (Zatsiorsky, 1996). Non-functional hypertrophy is equivalent to increasing the weight of a car but not the strength of it's engine (or adding wagons to a train). So ultimately it is understandable why it is not desirable.

To be fair, bodybuilding training doesn't only stimulate non-functional hypertrophy. As stated earlier, all training methods lead to functional and non-functional hypertrophy, but to various extents and in different proportions. In that regard, controlled training may have a place in an athlete's training, but only as an assistance method to the core of the training. I believe that it should be used to strenghen muscles which are subject to injuries (shoulders, rotator cuffs, lower back, abdominals).

Pros: Can increase tendon strength. Can lead to added muscle mass. It's safe to do. Not much stress on the nervous system so it is not likely to overload it.

Cons: Most of the hypertrophy gains are non-functional and may lead to lowered performance. Requires a lot of physiological energy for very little results.

When to use the method: I believe that for elite performance an individual should be training for function, and form will follow. However one can add several exercises to increase hypertrophy in relatively weak and/or fragile muscles (i.e. hamstring, shoulders). I believe that one can put more emphasis on gaining muscle mass early in the year, but even during that time of increased bodybuilding-type training nervous system training should remain the focus.

Shameless self-promotion

This is the portion of the newsletter in which I try to make some money out of you! Presently I offer the following:

Seminar (5 hours seminar at the location of your choice)	1000.00$ plus travelling fares
Individualized training program	100.00$/month
Individualized nutrition and supplement program	100.00$/month
Black Book of Training Secrets (hard copy)	30.00$
Theory and Application of Modern Strength and Power Methods (.pdf)	25.00$
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