

*Theory and Application of  
Modern*

**Strength**

*and*

**POWER**

*Methods*

*Revised and Augmented Edition  
By Coach Christian Thibaudeau*

# **Theory and Application of Modern Strength and Power Methods**

*Modern methods of attaining super-strength*

**By Coach Christian Thibaudeau**

**Edited by Tony Schwartz**

**Foreword by Thomas J. Myslinski, Jr.**

## **About the editor**

Tony Schwartz is a strength and conditioning coach based out of the Midwest-region of the United States. Tony specializes in program design for strength and power athletes. His methods and modalities for increasing strength and power have been described as both unorthodox and unusually effective. He is currently working towards perfecting synergistic training, nutrition, and supplementation systems that can be used by elite and amateur athletes alike.

In addition to his work in the strength and conditioning field, Tony is also a research assistant in the field of exercise physiology.

Tony is available for private training in the Chicago, IL area, as well as in the Bloomington, IN area. In addition, he also designs personalized training, nutrition, and supplementation programs online. If you would like more information on Tony's methodologies and programs please contact him at [schwartztony@hotmail.com](mailto:schwartztony@hotmail.com).

## Foreword

*“Let the truth be told, the veil of secrecy has been raised!”*

In the “Theory and Application of Modern Strength and Power Methods,” Christian Thibaudeau creates a self-explanatory training masterpiece that encompasses specific research and applications of the world’s grandest strength coaches. From the practical experiences of the “father of pliometrics,” Yuri Verkhoshancki, and Germany’s Jurgen Weineck, to the more recent work of France’s Gilles Commetti and Christian’s own personal coach, Canada’s Jean Boutet, evolves a simplified, straightforward approach to understanding the complexities of the Conjugate Sequence System. Methodically and systematically constructed, this manuscript is fully referenced and packed with current scientific evidence, which in turn sheds light on previously guarded training systems.

Quite often, as teachers, we try to improve an athlete’s total performance, creating a state of paralysis through over-analysis, which confuses those who are trying to learn. Understanding that time is of the essence, we have to utilize our athlete’s time wisely and invest it to the fullest extent. Using the part-whole motor skill developmental approach adopted from the former Eastern Bloc countries, Christian identifies and breaks down a variety of means, methods, and systems into easily learnable components. Then, after each independent skill is thoroughly explained, the whole is reassembled and integrated into a new, complete, superior operating motor program and applied in a functional-specific training regime. This part-whole process allows complex procedures to be broken down into controllable segments, which ensures that the time invested is time well spent.

Furthermore, as a veteran the National Football League, I whole-heartedly understand the personal accountability that accompanies that earned position. In order to perform at an elite intensity, day in and day out, year in and year out, one’s performance level always has to be within an optimal range. Since every athlete is unique, possessing his/her own strengths and weaknesses, the programs must be individualized depending upon personal needs and the motor demands of their sport. Ultimately, the final burden of preparation resides with the athlete. Shouldering responsibility involves taking an active approach in one’s organization of training and making educated decisions. While the motor requirements, motor abilities, training stimulus, type and amount of application are rooted in science, their application is an art.

Undeniably this book will open your mind to strength applications rarely seen in North America and, in the process, you will walk away a more educated student in the lessons of strength, as I did. Complacency has no part in athletics - one should always be in “pursuit of the holy grail.”

Thomas J. Myslinski, Jr.

Strength and Conditioning coach, *Cleveland Browns*

# Part 1

# The Science of

# Strength



*Using science and practical experience to find the most effective training methods*

## **Introduction**

This second book of mine (the first one being *The Black Book of Training Secrets*) is a gift to myself. I've wanted to write something specifically for athletes and strength coaches for a long time; put something out there that would revolutionize how high level athletes undertake their training. But I'm not utopic. I don't believe that this book will usher strength & power training into a new era. However, I'm sure that all of you will learn a lot of new training means, methods, and methodics from this book. What it will do is add a few tools to your coaching/athletic toolbox, allowing you to reach a new level of success in your training (or your athlete's).

This book covers strength and power training very thoroughly. You'll learn about the scientific basis of strength and power methods, and then you'll learn how to apply these methods in the real world. There will also be information on how to plan a long-term program using the outlined techniques as well as more than 30 power exercises demonstrated and described.

This is an easily understandable book as it's written with the coach and athlete in mind, yet it's also scientific since I'll teach you the "whys" behind all the techniques presented. I firmly believe that it's important to understand something that we use to reap the optimal amount of benefit from it.

This first part of the book will focus on the broad categories of training methods and will explain the scientific basis behind each of these methods:

- Eccentric action training
- Concentric action training
- Isometric action training
- Kinetic Energy Accumulation Training
- Contrast training

The second part of the book will deal with all the possible applications of these broad methods as well as how to use them in a training regimen.

The third part will deal with program design, or correctly arranging the training methods selected into a logical and effective training plan.

The fourth part will give you the low-down on electromyostimulation training for athletes, its benefits and limitations.

The fifth part will provide you with over 30 different high power/shock exercises to maximize your sporting performance.

Finally the sixth portion will address the myths of strength training for female athletes.

Enjoy the ride!

## **Eccentric action training**

The eccentric action of a muscle refers to a resisted lengthening of that muscle; a muscle exerting force while it's being lengthened. This type of action has also been called the *yielding* action (as opposed to the *overcoming* action which refers to the actual lifting of the resistance) as well as the *negative* action.

Eccentric action is present in most free-weight and machine exercises. However, since concentric strength potential is lower than the eccentric strength potential the yielding portion of a movement is rarely fully stimulated. In other words, the relative weakness of the overcoming portion prevents a complete overload during the yielding portion of the exercise.

As I will explain, it is the yielding portion of an exercise which gives us the greatest bang for our buck. So an individual seeking maximum results should plan training methods emphasizing eccentric overload.

## **Eccentric stress as a superior stimulus for strength improvements**

It's been a while since we've known that the yielding (eccentric/negative) portion of an exercise is responsible for more strength gains than the overcoming (concentric/miometric/positive) portion. For example, a study by Hortobagyi and coworkers found that the total maximal strength improvement from eccentric-only training brought more strength gains than a concentric-only program followed for 6 weeks. By total maximal strength I mean the sum of maximum concentric, isometric, and eccentric strength. In that parameter, eccentric training gave a mean improvement of 85%, while concentric training led to an improvement of 78%. Furthermore, this study used submaximal yielding actions and maximal overcoming actions. Surely this tells us a lot about the potential of yielding strength training, at least when maximum strength gains are the concern. And it is to be noted that these results are in accordance with the body of scientific literature on the subject. For example, a study by Higbie et al. (1996) found a combined strength increase (concentric strength improvement + eccentric strength improvement) of 43% with an eccentric-only regimen compared to one of 31.2% with a concentric only regimen. We should also note a study by Hilliard-Robertson and coworkers which concluded that "*A resistance training protocol which includes eccentric as well as concentric exercise, particularly when the eccentric is emphasized, appears to result in greater strength gains than concentric exercise alone*". This is in accordance with an early study by Komi and Buskirk (1972) who recorded greater strength increases after an eccentric training regimen than after a concentric-only regimen.

It was also found that omitting eccentric stress in a training program severely compromised the potential strength gains (Dudley et al. 1991).

## **Eccentric stress as a superior stimulus for muscle growth**

The last above-mentioned study (Higbie et al. 1996) found that eccentric-only training led to an average muscle size gain of 6.6% over 10 weeks while a concentric-only program led to gains of 5%. While the difference may not seem to be huge, any bodybuilder who knows his stuff understands that 2% more muscle over a 10 week period can be visually important, especially in the long run.

These results are backed by another recent study (Farthing and Chilibeck 2003), which concluded that “eccentric training resulted in greater hypertrophy than concentric training.”

One recent study (LaStayo et al. 2003) even found accentuated eccentric training to cause 19% more muscle growth than traditional strength training over 11 weeks!

Another study concluded that “*eccentric muscle actions are a necessary stimulus for muscle hypertrophy*” (Cote et al. 1988).

### **Why is eccentric training effective?**

Eccentric training allows one to stimulate greater strength and size gains than pure concentric training. Why is that? There are five major reasons why:

1. There is a greater neural adaptation to eccentric training than to concentric training (Hortobagyi et al. 1996).
2. There is a more important force output produced during a maximal eccentric action (greater overload) because you can use a higher external load (Colliander and Tesch 1990).
3. There is a higher level of stress per motor unit during eccentric work. Less motor units are recruited during the eccentric portion of a movement, thus each of the recruited motor units receives much more stimulation (Grabiner and Owings 2002; Linnamo et al. 2002). Furthermore, since the nervous systems seems to recruit less motor units during a maximal eccentric action, the potential for improvement could be greater than with maximal concentric action.
4. There is some evidence that maximal eccentric actions will preferably recruit fast-twitch muscle fibers, which are more responsive to muscle growth and strengthening (Nardone et al. 1989, Howell et al. 1995, Hortobagyi et al. 1996). In fact, eccentric training may stimulate an evolution towards a faster contractile profile (Martin et al. 1995).

5. Most of the micro-trauma to the muscle cells incurred during training is a result of the eccentric action (Brown et al. 1997, Gibala et al. 2000). It has been established that this micro-trauma acts as the signal to start the muscle adaptation process (Clarke and Feedback, 1996).

### **Further benefits of eccentric training**

For most of us, strength and size gains are the name of the game. However the positive effects of negative training don't stop there. We could also note the following "fringe" benefits:

1. Greater cross-education (Hortobagyi and Lambert 1997). Cross-education refers to transfer of strength gains from one limb-side to the other. In practical terms it means that if you were to work only your right arm using eccentric actions, some of the strength gains would transfer to the left arm. This can be very beneficial to prevent excessive strength loss if one limb is immobilized.

2. Eccentric training is also a superior method to treat tendinosis when compared with concentric exercise (Mafi et al. 2001). So it could be argued that this form of training is adequate for use by injured athletes and that it is relatively safer than concentric training even if the loads used are greater.

3. A last point of interest is that strength gains from eccentric training are maintained longer during a period of detraining than the gains from concentric-only training (Collinder and Tesch 1992, Housh et al. 1996), which may be very important for athletes who cannot train as much during the season as they can in the off-season.

### **In layman's terms please**

The last few paragraphs were very dense in scientific information, but practically, what does it all mean?

1. If you de-emphasize the yielding portion of your strength exercises (lowering the bar very fast, not contracting your muscles during the eccentric portion, etc.) you might as well not be training at all (at least if maximum strength and size are important to you). Be careful though, it doesn't mean that you should accentuate/emphasize the eccentric stress in all of your exercises, just that some exercises should target a very large eccentric overload.

2. Accentuating the eccentric stress during a session will lead to more strength gains. The reasons are related to structural as well as neural adaptations.

3. The eccentric portion of a movement is the main stimulus for muscle growth as it is the cause of most of the micro-trauma inflicted on the muscles, which acts as the signal to kick the muscle building process into overdrive.

4. One more benefit that I have found from experience is that overloading the eccentric portion of an exercise allows one to get used to holding big weights and controlling them. This can have a very important confidence-building effect when attempting to lift maximum weights.

## **Accentuated eccentric techniques**

### **The 2/1 technique**

This technique can be used quite effectively with exercises such as the seated row, cable rope curl, cable rope triceps extension, and most exercises that can be done using the triceps rope. It also works on most machines. The way it works is pretty simple: you lift the weight (overcoming/concentric portion) using two limbs (both arms if you are doing an upper body exercise, both legs if it's a lower body movement) and you return the weight (yielding/eccentric portion) with one limb.

So the load during the yielding portion of the exercise is twice as high as during the overcoming portion. The load to use should be light enough so that you can accelerate it during the overcoming portion but heavy enough to make the single-limb yielding portion hard to do. A load of around 70% of your “two-limb maximum” is a good place to start.

The overcoming portion should be done as fast as possible while the yielding portion is to be executed in 5 seconds. Sets of 3-5 reps per limb are performed (so 6-10 total reps per set).

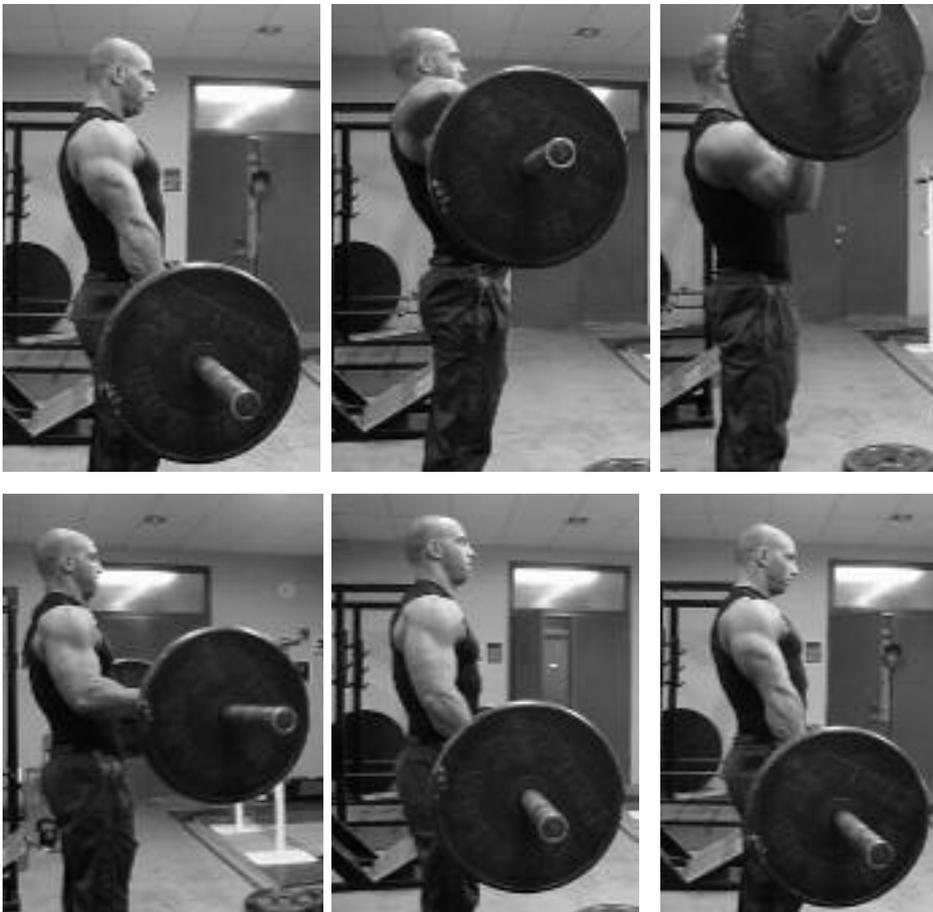


**Example of the 2/1 technique:** two arms are used to press down the weight while only one is used to return to the starting position

## The two-movements technique

This technique works by doing the overcoming portion of the lift using a compound movement and the yielding portion using an isolation movement. The two best examples are the power clean/reverse curl (lift the bar as a power clean and lower it as a reverse curl) and the close-grip bench press/nose-breaker (lift the bar as a close-grip bench press and lower it as a nose-breaker).

Using this technique will allow you once again to use a very heavy load in the yielding portion of the movement, thus placing a super-adaptive stimulation on your muscles and nervous system.



**Example of the two-movements technique:** power cleaning the weight up and lowering it in a controlled reverse curl

Here are a few more examples of possible movements to use this technique with.

Muscles to be overloaded	Overcoming portion	Yielding portion
Biceps, brachialis	Power clean from hang	Reverse curl
Triceps	Close-grip bench press	Nose-breaker
Pectoralis major	Dumbbell press	Dumbbell flies
Anterior and medial delts	Dumbbell clean and press	Lateral raises
Quadriceps, glutes	Two-leg squat with a DB	One-leg squat
Hamstrings, erector spinae	Weighted back extension	One-leg back extension
Rhomboids, posterior delts	Dumbbell bent over rowing	Dumbbell rear delt raises

I find that doing 3-5 reps works best with this type of training too.

### Superslow eccentrics

This technique is fairly simple. Using a moderate to important load (60-85% of your max) you execute a superslow yielding phase while lifting (overcoming) the bar explosively.

The following table gives you the parameters to use depending on the load you select.

Load	Time of the yielding portion	Number of reps per set
60%	14 seconds	3
65%	12 seconds	3
70%	10 seconds	2
75%	8 seconds	2
80%	6 seconds	1
85%	4 seconds	1

This type of accentuated eccentric training is fairly easy to do and can yield impressive muscle size and tendon strength improvements.

### Negative training

*Negatives* basically refer to performing only the yielding portion of a lift and having spotters lift the bar for you. You should use a load that is between 110 and 130% of your maximum on a certain lift when performing negatives. The time of the action (lowering) depends on the load:

**10** seconds if the load is **110-115%**

**8** seconds if the load is **115-120%**

**6** seconds if the load is **120-125%**

**4** seconds if the load is **125-130%**

When doing supramaximal negatives you should only do sets of one repetition. Anywhere from 3 to 10 singles should be done in a workout. This type of training places

a very important demand on the nervous system. For this reason you should take relatively long rest intervals when using this technique.

### **Concentric action training**

The concentric portion of a movement is also called miometric action or overcoming action. I much prefer the later (overcoming) as it explains what happens during this type of action; you exert a certain level of force to overcome, or lift, an external resistance.

This form of training is chiefly important since overcoming strength is the basis for many sporting actions and everyday occupations. It is of special importance for individuals involved in some form of competitive lifting (powerlifting, Olympic lifting), as their objective is to overcome the heaviest possible resistance.

### **Concentric stress as a necessary stimulus for strength improvements**

It has been established that it is the eccentric/yielding portion of an exercise that gives you the most bang for your buck. However, without using concentric/overcoming actions in a training regimen it is impossible to develop your limit strength maximally for the following reasons:

1. First of all, if eccentric training can bring the highest level of combined strength gains (eccentric strength gains + isometric strength gains + concentric strength gains), it also leads to less concentric strength gains. Research has found that training with only yielding actions leads to gains in overcoming strength which are 2-3 times lower than when overcoming training is used. The results are as follows:

<b>Study</b>	<b>Type of training</b>	<b>Overcoming strength gains</b>	<b>Yielding strength gains</b>
Higby et al. 1996	Eccentric action	6.8%	36.2%
	Concentric action	18.4%	12.8%
Hortobagyi et al. 1996	Eccentric action	13%	42%
	Concentric action	36%	13%

2. There is some evidence that the neural mechanisms used during concentric and eccentric actions are different (Lionnomo et al. 2002; Grabiner and Owings 2002; Fang et al. 2001). To quote Grabiner and Owings (2002): “*There is a dearth of direct evidence that concentric and eccentric contractions are controlled differently by the CNS*”. And this is not only evidenced during the action, but also during the preparatory period, hinting that the motor planning processes are different for both types of actions.

So this means that even if eccentric training can lead to great gains as far as the muscle structures are concerned, one still needs to practice overcoming actions to make the gains in strength functional.

It is also evident that the specificity of training adaptations applies to the type of muscle action, with eccentric training leading to more eccentric strength and concentric training leading to more concentric strength. So, since most sports (and lifting events) involve an important amount of overcoming work, concentric actions become all the more important in training.

### **Concentric stress as a necessary stimulus for muscle growth**

While it's fairly well established that accentuating the eccentric or yielding portion of an exercise is probably the best way to stimulate muscle growth, mostly because it is the part responsible for the most muscle micro-trauma, the concentric portion of the movement also plays a role in stimulating size gains.

The following table presents results from two research groups studying the impact of concentric and eccentric training on muscle cross-sectional area (size):

<b>Study</b>	<b>Type of training</b>	<b>Cross-sectional area gains</b>
Seger et al. 1998 (10 weeks)	Eccentric action	5.7%
	Concentric action	3.4%
Higbie et al. 1996 (10 weeks)	Eccentric action	6.6%
	Concentric action	5%
Higbie et al. 1994 (8 weeks)	Eccentric action	6.9%
	Concentric action	5%

So it should be clear that the concentric portion of an exercise still plays a very important role in stimulating hypertrophy. And that if you want to stimulate maximum gains, you should include training methods emphasizing both eccentric and concentric muscle actions.

Furthermore, according to the findings of Seger et al. (1998) eccentric and concentric training also seem to have a location-specific hypertrophic response; eccentric training leading to more hypertrophy in the distal portions of the muscle and concentric training leading to more hypertrophy in the mid-point of the muscle. This is one more reason to include both types of training if you want to maximize muscle size gains.

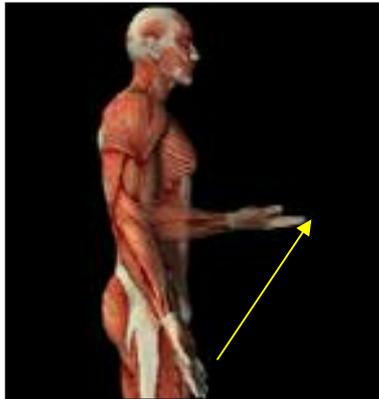
### **How to emphasize concentric muscle action**

To make the concentric portion of an exercise as effective as possible one should increase the level of intramuscular tension during the overcoming action. To maximize this tension one must produce a very high level of force. The more force you have to produce, the more tension will result.

Remember that  $F=ma$  (Force equals mass times acceleration). Once this is understood it becomes clear that there are three ways of maximizing force output and thus intramuscular tension:

1. Lift very heavy loads relatively slowly (high “mass” factor)
2. Lift light loads with a lot of acceleration (high “acceleration” factor)
3. Lift moderate loads with good acceleration (both factors are moderate)

### **For the concentric portion**



Intramuscular tension is increased if the ***resistance is greater*** and ***acceleration is preserved***.

Intramuscular tension is increased if the ***acceleration is greater*** and the ***resistance preserved***.

Intramuscular tension is increased if ***both acceleration and load are increased***

The key to remember is that regardless of the load used, you should try to lift the bar with as much speed as possible during the concentric portion of the exercise.

### **Isometric action training**

An isometric muscle action refers to exerting muscle strength/muscle tension without producing an actual movement or a change in muscle length. Isometric muscle action can also be called *static training*.

Examples of isometric action training can include:

1. Holding a weight at a certain position in the range of motion
2. Pushing/pulling against an immovable external resistance

Historically it's been believed that we can produce more strength in a maximum isometric action than in a concentric contraction. While some studies do find a slight difference, Soviet literature concludes that: “*it is necessary to point out that there is not a statistically significant difference between the maximum strength, as measured in a static regime, and the maximum weight that can be lifted in the same movement*” (A.S. Medvedyev 1986).

While probably not as effective as yielding or overcoming training, isometric training can still be of significant benefit to most athletes.

## **Isometric action training as an important muscle activation potentiator**

One of the most important benefits of isometric action training is that it's the contraction regimen that leads to the greatest activation level. Activation refers to the recruitment use of the motor-units of a muscle. A recent study comparing the level of muscle activation during isometric, concentric, and eccentric muscle actions found that one can recruit over 5% more motor-units/muscle fibers during a maximal isometric muscle action than during either a maximal eccentric or maximal concentric action; 95.2% for isometric compared to 88.3% for the eccentric and 89.7% for the concentric (Babault et al. 2001).

These findings are in accordance with the body of literature which finds that one can recruit almost all motor-units during a maximal isometric action (Allen et al. 1995, Allen et al. 1998, Belanger and McComas 1981, De Serres and Enoka 1998, Gandevia et al. 1998, Gandevia and McKenzie 1988, Merton 1954, Newham et al. 1991, Yue et al. 2000).

So what this tells us is that isometric action training can improve our capacity to recruit motor-units during a maximal contraction. So including this type of training in our regimen could improve our capacity to activate motor-units, even in dynamic actions. In the long run, this improved neural drive could greatly increase one's strength production potential.

In the past, isometric exercises have been described as a technique that should only be used by advanced lifters. I beg to differ. One of the biggest shortcomings of low-class lifters is the incapacity to produce maximum intramuscular tension during a concentric contraction. Isometric exercise can thus be used to learn how to produce this high level of tension, as it requires less motor skills than the corresponding dynamic action. For this reason I see isometric exercises as very beneficial for all classes of athletes.

## **Isometric action training as a stimulus for strength gains**

It has long been known that isometric action training (IAT) can lead to significant strength gains. In a recent experimentation, strength gains of 14-40% were found over a 10-week period using isometric action training (Kanchisa et al. 2002).

However, it is important to understand that the strength gains from an isometric regimen occur chiefly at the joint angles being worked (Roman 1986, Kurz 2001), although there is a positive transfer of 20 to 50% of the strength gained in a 20-degree range (working angle +/- 20 degrees).

Some people might see this limitation as a negative aspect of isometric action training. However, some authors prefer to see this as a benefit as it allows you to exert a greater level of strength at a certain point in the motion, allowing the athlete to stimulate more strength gains at a point where he needs it the most (sticking point).

These three benefits of isometric training can be noted:

1. Maximum intramuscular tension is attained for only a brief period in dynamic exercises (mostly due to the fact that the resistance has velocity and acceleration components), while in isometric exercises you can sustain that maximal tension for a longer period of time. For example, instead of maintaining maximum intramuscular tension for 0.25 to 0.5 second in the concentric portion of a dynamic movement, you may sustain it for around 3-6 seconds during an isometric exercise. Strength is greatly influenced by the total time under *maximal* tension. If you can add 10-20 seconds of maximal intramuscular tension per session, then you increase your potential for strength gains.

2. Isometric exercises can help you improve strength at a precise point in the range of motion of an exercise. This can prove to be very valuable to get past plateaus due to a chronic sticking point.

3. Isometric exercise is not “energy expensive,” meaning that you do not expend much energy by doing isometric training. So you can get the benefits of IAT without interfering with the rest of your planned workout.

### **Isometric action training as a stimulus for muscle growth**

While initial reports on isometric action training hypothesized that this type of training would not lead to significant muscle gains due to the absence of work, recent findings indeed conclude that an isometric training regimen can lead to gains in muscle size. A study by Kanchisa et al. (2002) found an average muscle cross-sectional area (size) improvement of 12.4% for maximal isometric contraction training and of 5.3% for isometric training at 60% of maximum contraction after a training period of 10 weeks. The authors attributed the gain in muscle size to metabolic demands and endocrine activities rather than mechanical stress and neuromuscular control.

### **Conclusions in regard to isometric action training**

It is important to note that isometric action training still has limited applications for an athlete or bodybuilder. Yes, it can help increase strength and size. But without a concurrent dynamic (yielding and overcoming) program the gains will be slow. In fact, some coaches noted that gains from isometric exercises stop after 6-8 weeks of use (Medvedyev 1986). So while isometric action training can be very helpful to work on a weak point or improve an athlete's capacity to activate motor-units, it should only be used for short periods of time when progress has slowed down or when a rapid strength improvement is needed.

Isometric action training can also be useful during periods of lowered training volumes, i.e. when one has to decrease his training load either due to fatigue symptoms or time constraints, isometric work can help prevent muscle and strength losses.

## **Applications of isometric action training**

Here are a few recommendations based on the work of Y.I. Ivanov of the former Soviet Union, John Ziegler of the U.S., and my own personal experience:

1. You must contract your muscles as hard as you can; to be effective you must reach and maintain a level of maximum intramuscular tension.
2. The duration of an action (or "set") should be 1-10 seconds, 3-6 being best in most cases.
3. Use at least 3 positions per movement, but as many as 6 positions can be used for maximum results (if time and equipment permit). Choose key positions of the equivalent dynamic exercise if you want a positive transfer of the strength gains.
4. Take sufficient rest between actions (sets) to allow for maximum tension to be produced each time. I personally find that you need 10 times more rest than you spend contracting. For example, if you use 3-second actions, you rest 30 seconds. If you use 6-second actions you rest 60 seconds, etc.
5. Isometric exercises should be used concurrently (in the same workout) with a similar dynamic exercise, preferably of a high-speed nature.
6. For optimal results, isometric training should be around 10% of the total strength training volume (calculated as the number of seconds under tension).
7. Many coaches agree that isometric exercises should be used at the end of a workout (Brunner and Tabachnik 1990, Vorobiev 1988). However, Siff and Verkhoshansky (1999) state that isometric action training can be used first in a workout to potentiate/facilitate subsequent strength and speed-strength exercises. I tend to agree with the latter.

## **A variation: Functional isometrics**

Former Olympic team member Bill March experimented with a type of training called "functional isometrics" and it improved his lifting performance at an astounding rate. Of course, data also suggests that March was one of Dr. John Ziegler's first guinea pigs for Dianabol use. Because of this fact, functional isometric training was dismissed on the grounds that March's gains were due to the drugs and not the training methods. That was a big mistake in my opinion!

First of all, March took only 5-10mg of Dianabol per day. That's an extremely low dose, especially considering that using ten to twenty times that amount in conjunction with other drugs is considered a "normal" cycle by most bodybuilders! So, although the 5-10mg of D-bol per day probably did make a difference, it can't explain the absolutely phenomenal gains made by March.

I recently tried the old March routine myself. I started the routine in March (how appropriate!) as part of my "comeback" to Olympic lifting training. Within two weeks, despite losing over 30 pounds of bodyweight, despite much lowered leg strength (we're talking about a 75 pound decrease in my max back squat), and despite not having practiced the lifts for over four months, I actually cleaned more than my all time best! And the lift was easy! Oddly, my snatch didn't improve nearly as fast (my snatch always improves faster than my clean). I reasoned that since I didn't use functional isometrics for the snatch but did so for the clean, there was something going on!

But let's back up a little. What are functional isometrics? Well, isometric training refers to exerting strength without movement. The most classic form of isometric training is pushing or pulling an immovable load. Since you recruit more motor-units during an isometric action than during a concentric action it's arguable that isometric exercises can lead to greater strength stimulation. However, as I mentioned, there are some problems with pure isometric training:

1. It's impossible to quantify progress. Since you're not moving a load, you don't know if you're improving or if you're exerting maximal effort or not. This can surely decrease progression and motivation.
2. Isometric training is angle specific, meaning that you'll gain strength only at the joint angles being worked. (There's only a 15-20 degree carryover of strength gains.)

Functional isometrics are a bit different. You still exert force without movement, but you're actually lifting a load. Let me explain.

You start the bar at a specific height and lift it two to three inches. Then you hold the position for six to ten seconds. You keep on adding weight until you can't lift and hold it for at least six seconds while maintaining a good lifting posture. This way you're actually lifting weights and can quantify your progress. But the problem of joint angle specificity still applies. That's why we want to use three positions working the whole range of motion of a selected movement. The three positions are:

1. A few inches after the start position
2. Sticking point
3. A few inches from the final position

This type of exercise can be used for several weight lifting exercises. I find it to be particularly effective to improve the bench press, deadlift/clean, and overhead press.

## **A second variation: The mixed regime exercise**

An exercise doesn't have to be a pure isometric for you to reap the benefits. A good variation is to use a static action as part of a dynamic movement. Olympic lifting coach Robert Roman recommends this form of isometric action training for Olympic lifters. Lifters will include exercises in which a pause is used at certain positions during the execution of a movement. For example, the athlete will squat halfway down, pause for 3-15 seconds when the knees are bent at 90 degrees, then finish the descent and lift the barbell.

I feel that this is a very good way to work, especially if one executes the pause at the weakest portion of a lift (sticking point). This way, not only do you strengthen the weakest link in the chain, but you also develop the capacity to fight inertia and accelerate the external load from that weak position.

Once again this method can be used for all exercises, but it is most useful for exercises having a significant sticking point and a large range of motion.

## **Examples of mixed regime training: The isomiometric and iso-ballistic methods**

This type of training refers to preceding an overcoming action (concentric/miometric contraction) with an isometric action. The isometric action should take place at the weakest point of an exercise and should be held for anywhere from 2 to 15 seconds depending on the nature of the drill.

The difference between isomiometric and iso-ballistic lies in the nature of the overcoming action. In an isomiometric exercise the load is lifted as fast as possible, but the load is relatively heavy so it doesn't always move very fast. In an iso-ballistic exercise you must project the source of resistance into the air (so the resistance should be light).

The benefits of this type of exercise are:

1. Strengthening the weakest point in an exercise (much like with isometric exercises) while integrating this improvement into a dynamic movement.
2. Strengthening of the starting portion of a lift.
3. Improvement in the capacity to produce maximum strength from zero velocity.

The following table will help you select the proper training parameters when using these two methods:

Load	Type of method	Duration of isometric portion	Number of reps per set
75-85%	Isomiometric	2 seconds	2-3
65-75%	Isomiometric	4 seconds	3-4
55-65%	Isomiometric	6 seconds	4-5
45-55%	Isomiometric	8 seconds	5-6
35-45%	Iso-ballistic	10 seconds	2-5
25-35%	Iso-ballistic	12 seconds	2-5
15-25%	Iso-ballistic	14 seconds	2-5

## Kinetic energy accumulation training

We will now discuss a special form of strength training that I call “*kinetic energy accumulation training*” (KEAT). It involves training methods in which there is an important kinetic energy build-up during the yielding phase of a movement and the consequent use of this energy to potentiate the overcoming portion of the exercise. This type of training has been known under various names: *shock training* (in Russian literature), *plyometrics* (by Western coaches), and *powermetrics* (a more recent term by Dr. Mel Siff).

I’d rather use the term “kinetic energy accumulation training” as it explains the nature and the reason for effectiveness of this type of exercise. Namely, by increasing the amount of kinetic energy produced during the yielding phase, and transferred into the execution of the overcoming phase, you increase power and force production as well as improving the neural, reflex, and muscular factors involved in force production.

Most coaches limit this type of exercise to the classic plyometric drills (depth jumps of various kinds) and regular jump training. However, many more methods are included in this type of training. Before I present them and explain the reason for their efficacy you must understand that KEAT is basically a form of accentuated eccentric training. However, instead of accentuating the eccentric stress by maximizing eccentric tension (lowering very heavy loads or lowering moderate loads slowly) we are going to use a very fast yielding action. The objective is not to increase eccentric stress, but rather to build-up as much kinetic and elastic energy as we can. To do so, the yielding action must be very fast and the coupling time (time between the yielding and overcoming phase of a movement) must be very short.

The types of exercise that we will include in this category are:

1. Depth jumps
2. Altitude landings
3. Overspeed eccentrics

## Depth jumps

Depth jumping, also known as shock training, was developed by Yuri Verkhoshansky in 1977. The objective of this method is to increase concentric power and force output by stimulating the muscles and reflexes via a “shock stretching” action preceding the overcoming portion of the movement. This is accomplished by dropping from a certain height (typically 0.4m to 0.7m, although heights of up to 1.1m have been used by very advanced athletes) to elicit a powerful stretch activation, then jumping up as high as possible immediately upon landing.



It has been well established in both Eastern and Western studies that depth jumping, or shock training, can significantly increase power production vertical jump height. This is mostly due to the following factors:

1. An increase in reactive strength. Reactive strength refers to the capacity to rapidly switch from an eccentric/yielding action to a concentric/overcoming action. Lack of reactive strength will lead to a longer coupling time and, consequently, lower force and power production during the overcoming portion of the movement (Kurz 2001).
2. Neural adaptations. Viitasalo et al. (1998) found a different neural response between athletes doing a lot of jumping and regular individuals when doing a depth jump. Jumpers were able to activate more motor units during the movement (greater EMG) and plan the motor command faster (higher and more rapid pre-action EMG). Kyröläinen et al. (1991) also found that 16 weeks of depth jump training led to better jumping efficiency. Schmidbleicher (1987 and 1982) found that trained subjects were able to use the kinetic energy produced during the eccentric portion of a depth jump, while in untrained subjects this eccentric period was actually inhibiting instead of potentiating! Finally, Walshe et al. (1998) concluded that the superiority of depth jump training over regular jump training was due to “*the attainment of a higher active muscle state,*” meaning that the fast eccentric portion of the movement increased muscle activation.
3. Structural adaptations. Depth jumps have been reported to cause some muscle soreness and muscle damage (Horita et al. 1999). This is understandable since the eccentric force

produced is very high, albeit rapid. This may indicate that depth jumps are a powerful stimulus to stimulate structural adaptations. However, depth jumps do not lead to significant hypertrophy. So the nature of the structural adaptations following depth jumping is not quantitative in nature, but qualitative: an improvement of the strength and contractile capacity of each muscle fiber.

Soviet literature gives the following guidelines when practicing depth jumps:

1. The joint position upon landing should be as close as possible to that of an important sport action (Laputin and Oleshko 1982).

2. The amortization phase should be short enough to avoid losing the elastic energy produced, but long enough to allow for the shock stretching to occur (Laputin and Oleshko 1982). Research indicates that the elastic energy from landing is stored for up to 2 seconds. So in theory you have a window of 2 seconds between the landing and take-off phase. However, to maximize the training effect you should not spend more than 1 second on the floor.

3. The height of the drop should be regulated by the preparedness of the athlete. The heels should not touch the ground during the landing phase. If they do, then the height of the drop is too high (Laputin and Oleshko 1982). A height varying from 0.5m to 0.7m appears to be ideal for most strength and power athletes (Roman 1986).

4. Depth jumps have a very powerful training effect, so the volume of work should be low, i.e. no more than 4 sets of 10 repetitions (or 40 total jumps spread over more sets), 2-3 times per week for advanced athletes and 3 sets of 5-8 repetitions (or 15-24 total jumps spread over more sets), 1-2 times per week for lower classes of athletes (Laputin and Oleshko 1982). The problem with many coaches and athletes is that they don't feel that depth jumping is hard; it's not very tiring compared to other means of training. Because of this, they do too high a volume of depth jumps.

5. Because of the very powerful training effect of depth jumping it is idiotic to perform this type of training systematically throughout the year. The shock method should be used in blocks of 3-4 weeks with at least 4 weeks between blocks (Roman 1986). In fact, some coaches recommend no more than 2-3 such blocks per year (Medvedyev 1996), and only when a rapid rise in power and reactive strength is needed to further performance gains. Remember that every training method, regardless of how effective it is, will lose its effectiveness over time. Shock training is no different. If you use it year-round there comes a point where you will get no added benefits from it. However, by using short "shock" blocks you can give a quick boost to your performance. Since you only use depth jumps for a short period you will get the same performance boost every time you use such a shock block.

## Altitude landings

A recent paper by David Kerin (2002) concluded that it is the eccentric portion of the depth jump that actually has the greatest training effect as far as increasing vertical jump and lower body power. It makes sense when you think about it. It is during the landing portion that the eccentric stress is at its highest, as all the kinetic energy accumulated during the fall is transformed into muscle loading. This can greatly increase your capacity to break your fall and absorb this kinetic energy. If you are weak in the eccentric portion of the depth jump what will happen? The coupling time (time it takes you to switch from yielding to overcoming) will be very high and the resulting jumping capacity will be low. The shorter the coupling time, the higher the subsequent jump will be. To reduce coupling time you must increase eccentric strength and the capacity to absorb the kinetic energy.

Depth jumps obviously do this, but doing only the eccentric portion (landing) and practicing “sticking the landing” (i.e. immediately breaking the downward movement as soon as you hit the ground) can actually be more useful in this regard. And this way you can use higher drop heights (up to 0.75-1.25m). Once again, the key point is to land in a position specific to your sport. For example, football linemen and linebackers should stick the landing with the knee bent at approximately 90-110 degrees.



Just like depth jumps, altitude landings have a very powerful training effect and should only be used for short periods of time and at a very low volume of work. While they can sometimes be used in the same training block as depth jumps, I don't recommend it. Rather, I like the following progression:

### **Block 1 (4 weeks)**

Altitude landings

### **Block 2 (4 weeks)**

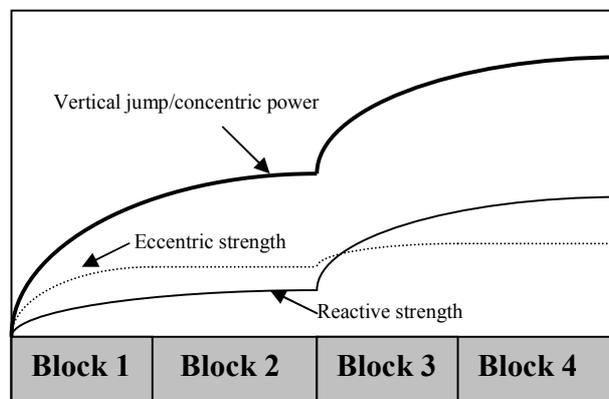
Low intensity jump training

### **Block 3 (4 weeks)**

Depth jumps

### **Block 4 (4 weeks)**

Low intensity jump training



This progression will ensure constant and rapid progress in vertical jumping capacity. You can repeat this 16-week cycle three times during the year for fantastic improvements.

## **Overspeed eccentrics**

This type of exercise could almost be called “shock training with weights.” It’s the brainchild of powerlifting coach Louie Simmons and is described in his training videos “*The Reactive Method*” and “*Special Strengths*”.

Simmons explains that to take advantage of eccentric training for maximum strength gains in lifting exercises you should use it (the eccentric/yielding portion) to accumulate kinetic energy that you will transform into elastic energy, reflex energy, and ultimately greater force production in the overcoming portion of the lift.

To do so two things must be present:

1. A fast yielding phase: By lowering the bar or your body faster you produce more kinetic energy. There is actually some research to back up this technique (not that the results from the Westside powerlifting crew don’t already speak volumes for its efficacy!). For example, a study by Farthing and Chilibeck (2003) found that “*eccentric fast training is the most effective for muscle hypertrophy and strength gain*.” This is in accordance with the findings of Paddon-Jones et al. (2001), who found that following a fast eccentric training program led to a decrease in type I fibers (from 53.8% to 39.1%) while type IIb fiber percentage increased (from 5.8% to 12.9%). In contrast, the slow eccentric group did not experience significant changes in muscle fibre type or muscle torque.

2. A rapid switch between the yielding and overcoming phases. The best example of this break in the yielding/overcoming chain is the use of the box squat. When you land on the box you immediately halt the yielding portion of the movement, converting the kinetic energy into elastic energy and reflex action.

One doesn’t have to use the box squat though. You can simply lower the bar as fast as you can and stop it quickly before lifting it explosively.

Using *Jumpstretch* elastic bands attached to the bar also has a very positive effect because the bands will actually try to “blast” the bar down, bringing it down faster than if only gravity was acting on it. This is one benefit that you don’t get from using chains since they are only acting as additional weight, while the elastic bands increase kinetic energy.

## **Contrast methods**

A very effective training method consists of varying the external load either during a workout, during an exercise, or even during a repetition. This has several benefits, including a more complete development of the motor capacities and strength qualities. It can have a very high training effect on the nervous system as well as on the muscle structures.

Let us examine the various types of contrast training. There are three principal contrast methods, which are:

1. Variation of lifting speed/load during a workout. Each exercise works the same group of muscles, but focuses on a specific strength-type (e.g. one limit strength exercise, one strength-speed exercise, one speed-strength exercise, one reactive-strength exercise). This is known as *complex training* in the Eastern Bloc literature.
2. Variation of lifting speed/load during a set. Each repetition in a set focuses on a varying specific strength-type (e.g. rep 1 with 90%/maximal effort; rep 2 with 50%/dynamic effort; rep 3 with 90%, rep 4 with 50%, etc.). This is called the *insider contrast method*, or IC.
3. Variation of lifting speed/load during a rep. This requires the use of bands, chains, or weight releasers added to the bar. One of these devices is attached to the bar so that the loading is greater in either the upper portion or the eccentric portion of the lift, but the bar becomes de-loaded in either the lower portion or the eccentric portion. This is called the *accommodating resistance method*.

## **Complex training**

There are three main forms of complex training:

1. Russian complex training
2. Bulgarian complex training
3. Canadian Ascending-Descending training

While each method is a bit different, they are all based on the same principle of alternating exercises of changing loads and execution speed in the same workout.

### **Russian complex training**

A Russian complex involves a continuous alternation between exercises of heavy and light loads in the same session; or more specifically, alternating between a slow-speed strength exercise and a high-speed strength exercise. In most cases a complex is made up of two exercises. For example:

## **Lower body Russian complex**

### Exercise 1. Back squat

3-5 repetitions with a load of 85-95% of 1RM

Rest 3-4 minutes

### Exercise 2. Jump squat

10 repetitions with a load of 15-20% of the back squat 1RM

Rest 3-4 minutes

This complex would be repeated anywhere from 2 to 5 times in a workout.

A variant of this form of training would be a Russian supersetted complex. Ironically, it was not used in the former Soviet Union, but rather it's an adaptation of the Russian complex by Western sport-scientists. The basic technique is the same, except that there is no rest between the exercises in a complex. For example:

### **1. Lower body Russian supersetted complex (strength-speed emphasis)**

#### Exercise 1. Back squat

3-5 repetitions with a load of 85-95% of 1RM

No rest

#### Exercise 2. Jump squat

10 repetitions with a load of 15-20% of the back squat 1RM

Rest 3-4 minutes

This complex would be repeated anywhere from 2 to 5 times in a workout.

### **2. Lower body Russian supersetted complex (speed-strength emphasis)**

#### Exercise 1. Jump squat

10 repetitions with a load of 15-20% of the back squat 1RM

No rest

#### Exercise 2. Back squat

3-5 repetitions with a load of 85-95% of 1RM

Rest 3-4 minutes

This complex would be repeated anywhere from 2 to 5 times in a workout.

I am not a big fan of the supersetted version as it prevents one from producing a high quality effort on both exercises. I think that it became popular mostly because it's a good way to save time and since it's more tiring, athletes believe that they are working harder.

## **Bulgarian complex training**

The Bulgarian complex is basically an extended version of the Russian complex. Instead of doing a complex of 2 exercises, you use a complex of 4-5 exercises, going from the heaviest one to the lightest one. For example:

### **Lower body Bulgarian complex**

#### Exercise 1. Back squat

3-5 repetitions with a load of 85-95% of 1RM

Rest 3-4 minutes

#### Exercise 2. Power snatch or power clean

2-3 repetitions with a load of 85-95% of 1RM

Rest 3-4 minutes

#### Exercise 3. Jump squats

10 repetitions with a load of 15-20% of the back squat 1RM

Rest 3-4 minutes

#### Exercise 4. Depth jumps

10 repetitions from 0.5m

Rest 3-4 minutes

#### Exercise 5. Vertical jumps

As many jumps as possible in 15 seconds

Rest 3-4 minutes

Because of the high number of exercises only 1-3 complexes would be completed in one workout.

## **Canadian Ascending-Descending training**

This is basically a spin-off from the Bulgarian complex. It also includes 4-5 exercises of various loading. The difference with the Bulgarian complex is that you have two workouts for each group of muscles/movements (either a lower body/upper body split or push/pull/lower body split). The first workout is an ascending workout (starting with the quickest but lightest exercise) and the second workout is a descending workout (starting with the slowest but heaviest exercise). Basically, the first workout is a reverse Bulgarian complex while the second workout is a regular Bulgarian complex.

There is one other slight deviation from the Bulgarian complex. In the Bulgarian complex you perform one set of each exercise of the complex then start a new complex (vertical loading). However, in the Canadian Ascending-Descending method you perform all the sets of an exercise before moving on to the next exercise in the complex (horizontal loading).

I find this system to be the best of all complex training methods as it allows one to give an equal focus to each type of strength in the strength spectrum, while in the Bulgarian complex you always perform speed-strength and reactive strength exercises in a fatigued state. Here's what the basic exercise organization looks like:

Ascending workout	
First exercise	Shock/reactive strength exercise
Second exercise	Ballistic exercise
Third exercise	Strength-speed exercise
Fourth exercise	Slow-speed strength exercise

Descending workout	
First exercise	Slow-speed strength exercise
Second exercise	Strength-speed exercise
Third exercise	Ballistic exercise
Fourth exercise	Shock/reactive strength exercise

### **Insider contrast method**

This method comes from the work of Gilles Cometti, a French sport-scientist. Now before you start screaming about how there are no strong Frenchmen and stop listening to me, I must say that this method has been proven effective in several athletes. And if you can get past the Frenchman barrier, it will be very effective for you too!

This method is an adaptation of what's known as contrast training, which refers to alternating between a slow set and a high speed set. This new method is called "Insider Contrast" training simply because you do not alternate between slow and fast sets, but between slow and fast reps. Read on, it's not as crazy as you think!

### **Some logic**

We know that slow and fast training can have drastically different training effects. We also know that light and heavy loads promote different adaptations. Fast training has a more important neuromotor component than slow training, and heavy training increases strength more so than light training. With the old school method an athlete/bodybuilder would alternate periods of various types of training to develop his power, size, and strength. Well, by combining explosive reps with heavy slow reps and light slow reps you can get it all at once!

Furthermore, we also know that fast and slow exercises can lead to the recruitment of different muscles. Dr. Tim Ziegenfuss demonstrated that a fast curl increases biceps activation twice as much as brachialis activation, while a slow rep will have the opposite activation pattern.

### **The Big Kahuna of insider contrast training**

This is my favorite variation of the IC method because it can develop power, strength, and size all at the same time. You do 2 reps with 85-90% of your max, 3 explosive reps at 60%, and slow reps to failure with the same 60%.

An example could be:

#### Bench press (max 400lbs)

Rep 1: 360lbs, maximum effort rep

Rep 2: 360lbs, maximum effort rep

*Quickly unload the bar to 240lbs (or have a partner do it)*

Rep 3: 240lbs, dynamic effort rep

Rep 4: 240lbs, dynamic effort rep

Rep 5: 240lbs, dynamic effort rep

Reps 6 to failure: 240lbs, slow tempo (313) reps

This method is very effective for individuals wanting to add size, strength, and power at the same time. With this method 3-5 sets per exercise should be used.

### **The painful extended variation**

This variation of the IC method is truly an example of masochism! It is a great shock method to stimulate your body out of a plateau, but it should only be used infrequently because it's so hard on the body.

The progression is: 2 reps at 85-90%, 3 explosive reps at 60%, slow reps to failure at 60%, 3 explosive reps at 30%, slow reps to failure at 30%, static hold (sticking point) with 30%.

A set could look like this:

#### Bench press (max 400lbs)

Rep 1: 360lbs, maximum effort rep

Rep 2: 360lbs, maximum effort rep

*Quickly unload the bar to 240lbs (or have a partner do it)*

Rep 3: 240lbs, dynamic effort rep

Rep 4: 240lbs, dynamic effort rep

Rep 5: 240lbs, dynamic effort rep

Reps 6-12: 240lbs, slow tempo (313) reps to failure

*Quickly unload the bar to 120lbs (or have a partner do it)*

Rep 13: 120lbs, dynamic effort rep

Rep 14: 120lbs, dynamic effort rep

Rep 15: 120lbs, dynamic effort rep

Reps 16-20: 120lbs, slow tempo (313) reps to failure

Rep 21: 120lbs, static hold at your sticking point

(Obviously the number of reps may change depending on where you reach failure).

This is a very intense method, one that should be used with care. Only 1-2 such sets are performed per exercise. The advantage of this method compared to the Big Kahuna variation is that it will develop a little more muscle mass, strength-endurance, and power-endurance.

### **The lazy man's insider contrast training**

This variation is less painful but can still provide a very powerful growth stimulus. I recommend this method as an introduction to insider contrast training as it's easier to handle at first. You will still be able to develop good strength, size, and power with this method.

A typical set looks like this: 2 reps at 80%, 2 explosive reps at 50%, 2 reps at 80%, and 2 explosive reps at 50%.

A set could look like this:

#### Bench press (max 400lbs)

Rep 1: 320lbs, moderate tempo (301)

Rep 2: 320lbs, moderate tempo (301)

*Quickly unload the bar to 200lbs (or have a partner do it)*

Rep 3: 200lbs, dynamic effort rep

Rep 4: 200lbs, dynamic effort rep

*Quickly load the bar to 320lbs (or have a partner do it)*

Rep 5: 320lbs, moderate tempo (301)

Rep 6: 320lbs, moderate tempo (301)

*Quickly unload the bar to 200lbs (or have a partner do it)*

Rep 7: 200lbs, dynamic effort rep

Rep 8: 200lbs, dynamic effort rep

This form of IC training can easily be used for 3-5 sets. It is a great introduction to IC training and can provide for a very pleasing workout. For people simply interested in gaining a bit more strength, size, and power this is certainly the best choice.

### **Can I periodize this approach?**

Yes! A very good training cycle would look like this:

**Week 1:** The lazy man's insider contrast training (moderate difficulty) for 4 sets of 4 exercises per session.

**Week 2:** The Big Kahuna of insider contrast training (high difficulty) for 3 sets of 4 exercises per session.

**Week 3:** The painful extended variation (very high difficulty) for 2 sets of 3 exercises per session.

**Week 4:** Regular training/no insider contrast (low difficulty) for 2 sets of 10 reps for 4 exercises per session.

This is a typical progressive loading/unloading approach that has stood the test of time. It also provides great training variety and lots of pain!

### **Accommodating resistance method**

It is well established in literature that the amount of force one can produce is very position-specific. This means that at certain points in the range of motion you are stronger than in others. In most exercises you are stronger near the completion of the movement. For example, you are stronger in a quarter squat than in a half squat; you are stronger in a half squat than you are in a full squat.

Herein lays two problems:

1. If you use full-range of movement exercises (as you should most of the time) you are basically limited in the amount of weight you will use by the weakest position in the lift. Because of this, the strongest portion of a range of motion is not fully stimulated. For example, if you are doing a full squat you can only use so much weight compared to a quarter squat. Let's say that you can quarter squat 600lbs but can only full squat 350lbs. If you are doing a set of full squats with 325lbs you are underloading the strongest

portion of the lift by at least 250-275lbs! Your strength gains are therefore limited in the strongest portion of the lift.

2. One solution is to try to accelerate the load as much as possible. Force equals mass times acceleration, so in the last portion of the movement (in which you are stronger) you will be able to accelerate more (since the relative mass is lower), thus producing as much force as you would with a heavier load. The problem this causes is that you will need to decelerate the bar to avoid injuring the joints. In practice this leads to a deceleration phase lasting as much as 1/3 of the movement! So, while in theory lifting with as much speed as possible will allow you to overload the whole range of motion, in reality you spend about as much time decelerating (thus underloading) as you do accelerating (overloading)!

To overload the entire range of motion we need a solution that will vary the resistance so that the load to overcome is heavier at the end of the movement, while providing a natural way of decelerating, without lowering force production.

It's with these concerns in mind that accommodating resistance was born. It was first introduced to the strength training community by powerlifting coach/genius Louie Simmons. The first method of accommodating resistance that he used was chains. He would attach 5' chains to the bar so that as the lifter was lowering (yielding) the bar, the chains would lie on the ground gradually, unloading (reducing the load of) the bar. As the lifter would start lifting (overcoming) the bar, the chains would gradually be lifted off the ground, reloading the bar. In this way one could increase the load at the end of the movement (where you are stronger) and reduce it in the weakest portion.

This method was a giant step forward. We finally had an effective way of overloading the whole movement.

However, the problem of deceleration remained. You see, even if the chains gradually overload the whole range of motion they are still just "dead" weight. Because of this you still had to voluntarily decelerate at the end of the movement and stop the bar. Granted, since the chains place a significant overload during the whole movement this is not such a big problem. But still, it's not perfect.

Enter the bands! *Jumpstretch* bands to be exact. These big rubber bands (providing up to 150lbs of tension per band) are attached to the bar and to an object/rack on the floor. They act much like the chains, in that they are fully stretched in the finish position, increasing the load. As the lifter goes down the bands become a bit looser, reducing the tension they provide. Now, the added benefit of the bands over the chains is that they are actually trying to throw you or the bar down. This is called *hypergravity* training, meaning that the deceleration provided by the elastic is more important than that provided by gravity alone. This means that the elastic will actually decelerate the load at the end of the movement. Because of this, you can still exert maximum force and try to lift the bar as fast as you can without fearing any joint shock.

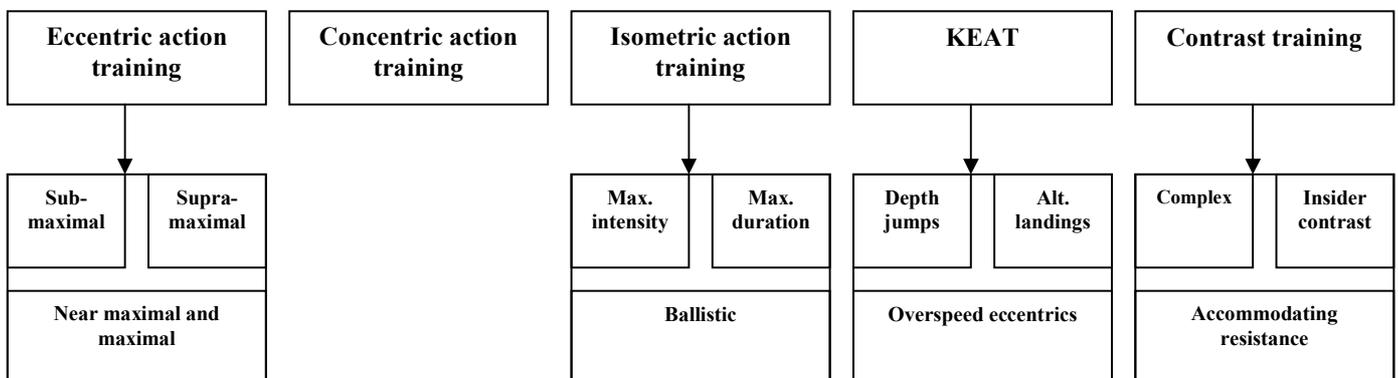
For athletes these bands have three *very significant* benefits:

1. They allow you to overload the last portion of the range of motion. It is this portion of the movement that is most often needed in sports. So you are emphasizing the joint angles needed for optimum sport performance while still getting the benefits of using a full range of motion in your exercises.
2. They allow you to maximize acceleration by reducing the deceleration phase. In the long run this can have an important effect on your motor pattern, allowing you to be faster and more powerful in your sport movements.
3. They greatly reduce the risk of joint injuries. This is done first by reducing joint shock as the bands decelerate the load, and second because the bands place a lot of eccentric stress (because of the hypergravity factor) on the body's structures, which has proven effective for treating tendinitis.

The accommodating resistance method is thus known as a contrast method because the load varies during the execution of the movement.

## Variations of the methods presented

Based on the preceding info we can now propose a list of various training methods:



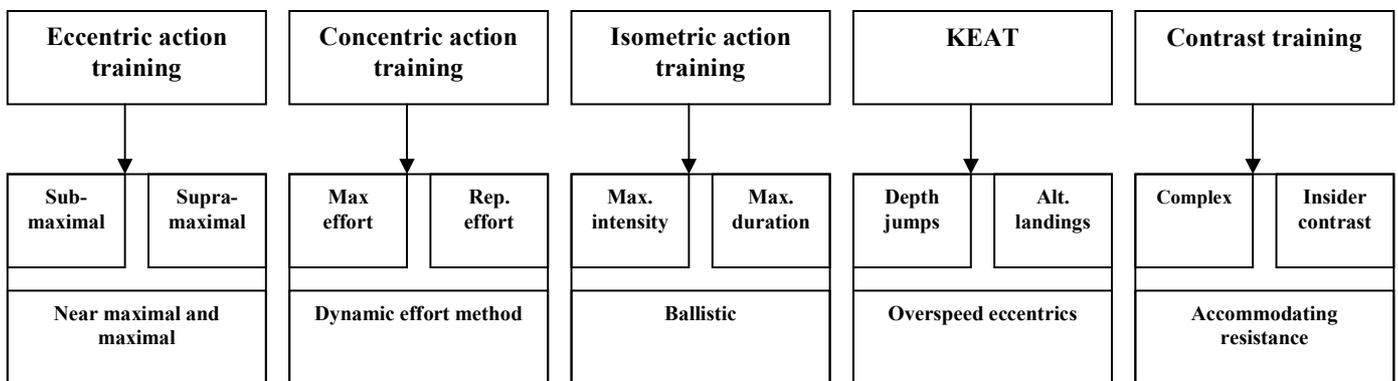
When it comes to concentric action training the load and speed of contraction can alter the training method used. For simplification's sake, and because it's the most widely accepted model of strength training, we will use the basic three concentric strength training methods as established by Zatsiorsky. These are the three training methods ensuring the greatest amount of stimulated motor-units:

1. Maximal effort method: This refers to the lifting of maximal or near maximal loads (90-100%+) for a limited number of repetitions (1-5).
2. Dynamic effort method: This refers to lifting a submaximal load with as much speed as possible. The set should be terminated when bar speed cannot be maintained. Generally

loads of 10-30% (jumps squats, ballistic bench press), 40-60% (bench press, squat, and other basic strength movements), or 70-85% (Olympic lift variations) should be used for a low number of repetitions (1-5) and a high number of sets (5-12).

3. The repetition method: This refers to lifting a submaximal load under control until one is no longer able to lift the weight in good form (failure). Moderate loads (40-80%) are to be used for a relatively high number of reps (10-30+) and a low number of sets (2-4).

So now our figure of training methods becomes:



And then you always have the possibility of mixing two or more training methods into a single exercise. So the possibilities are quite numerous, to say the least!

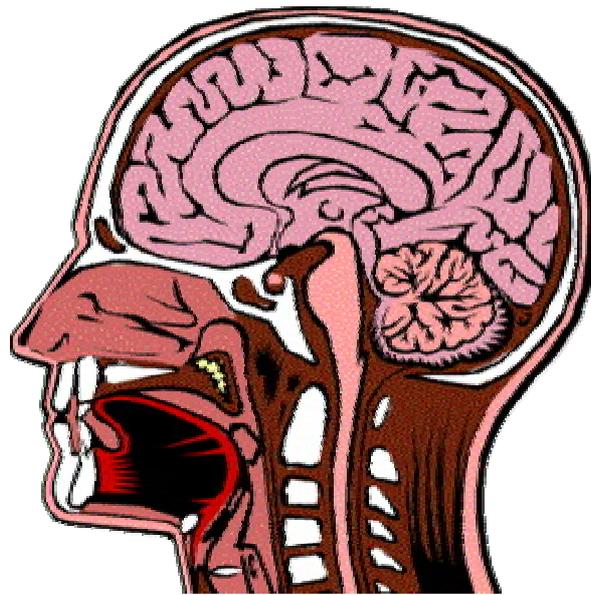
### Conclusion

This part of the book is the most complex by far. It constitutes the scientific and theoretical foundation on which the training process is based. The take home message is that there are a lot of different ways to execute the same exercise. Always remember that how you perform an exercise is more important than the exercise itself.

Now, the trick is to understand how to apply these techniques to basic training movements and how to design a complete training plan. The following portions of the book will delve into that, but be sure that the information that you just read has sunk in properly. It's important that you understand it correctly before jumping into the next section.

# Part 2

## Neural aspects of strength and power training

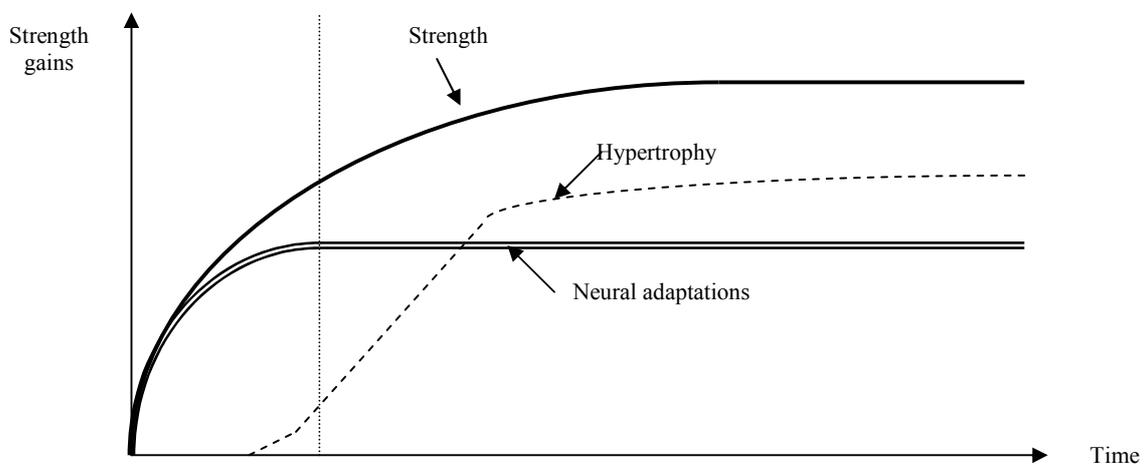


*How to command the commander for maximum performance*

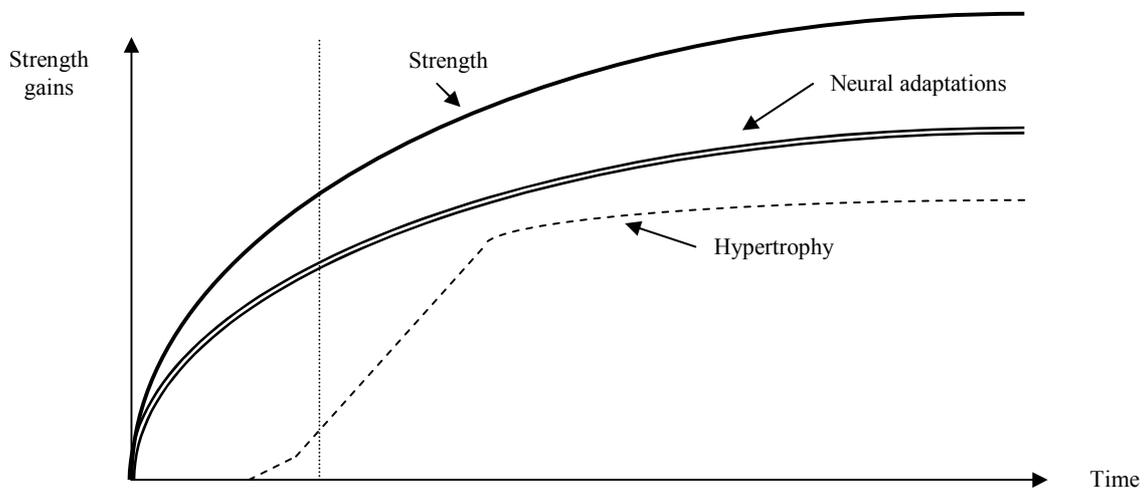
## The nervous system: Commander of all muscle actions

Most athletes focus their training on the muscles. Similarly, most research focusing on adaptations to strength training generally disregard testing the nervous system for improvements. To be fair, most specialists agree that initial gains from a strength training program are due to neural factors, especially motor learning. However few, if any, have tackled one important issue: how does one improve nervous system performance once past that initial adaptation stage?

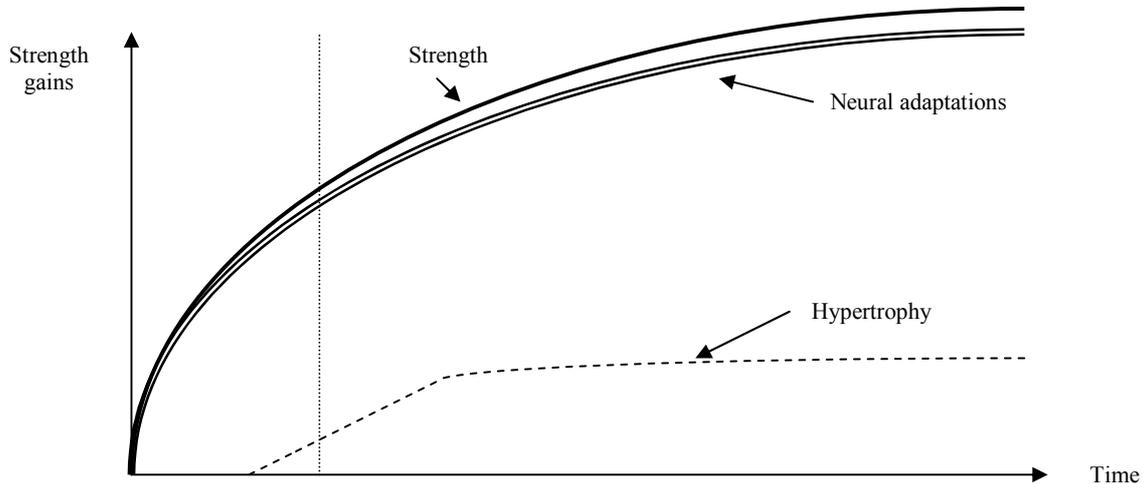
The following figure illustrates the muscle adaptation pattern following strength training according to the work of DG Sale (1988).



As you can see, as neural improvements cease, the rate of strength gain greatly decreases too. This is because structural adaptations (in this case hypertrophy) take much more time than neural adaptations to develop. I feel that the situation presented in the graphic above is unacceptable for elite athletes. For them, continuous performance improvement is crucial. And since strength gains via hypertrophy take a long time to occur, and in some cases are detrimental to sport performance, we have no choice but to find ways to stimulate neural improvements on a steady basis. The ideal performance graph would then be something like this.



For some athletes an adaptive process involving even less hypertrophy is warranted (athletes in weight classes or athletes who have their body weight as a source of resistance in their sports, e.g. *gymnastics*, *figure skating*). For them, neural improvements become even more crucial since it's for all practical purposes, the only acceptable way to increase strength. For these athletes the following adaptive response is thus desired:



In the case of such athletes, strength improvement basically parallels neural adaptations. But regardless of their sports and the possibility for functional hypertrophy, it should seem obvious that athletes should strive for strength and power improvements mainly by increasing the efficiency and efficacy of the nervous system.

While some authors have gave us some clues as to how to train the nervous system, the quantity and diversity of these solutions is limited at best. For most coaches neural enhancement methods are limited to:

1. Near-maximal and near maximal lifting (90%+)
2. Explosive lifting
3. Plyometric drills

These are the methods being widely accepted as effective at improving strength and power without a significant gain in muscle mass. So it's concluded (rightly so) that they are thus neural training methods. However this is a rather limited way to maximize neural adaptations. And because of the lack of diversity, results will soon stagnate. In this chapter we will present the best methods to train the nervous system. But first, we must understand the nature of the neural drive during force production.

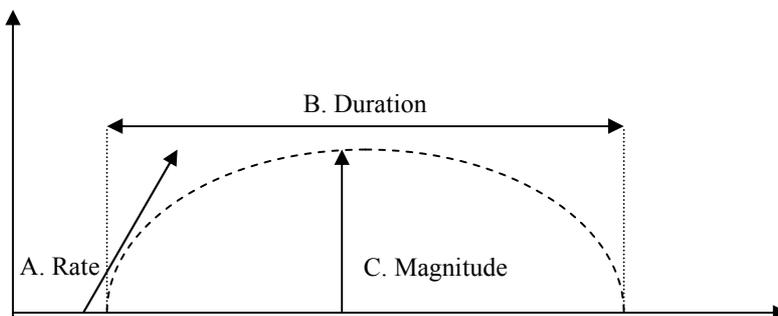
## The nature of the neural drive

To keep it simple, all motor actions first start by a neural action. Either a voluntary motor command or a reflexive one. This action, or command, is sent to the appropriate motor units. Upon reception of the impulse (potential of action) the motor unit is activated and produces force. This is obviously a gross oversimplification of the neuromuscular processes. But for the scope of this book, it's sufficient and will allow us to better understand how to manipulate the neural action/command processes.

The neural drive has **three distinct characteristics** which will vary in relative importance depending on the *type* of action needed. These three characteristics are:

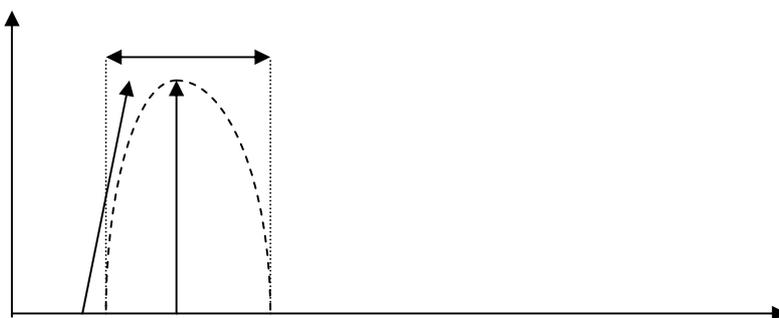
- A. **Rate:** How fast can the neural drive activate or deactivate motor units.
- B. **Duration:** For how long the neural drive keeps the motor units activated.
- C. **Magnitude:** The importance of the neural impulse. The larger is an impulse, the more motor units it will activate.

Here's what it looks like :



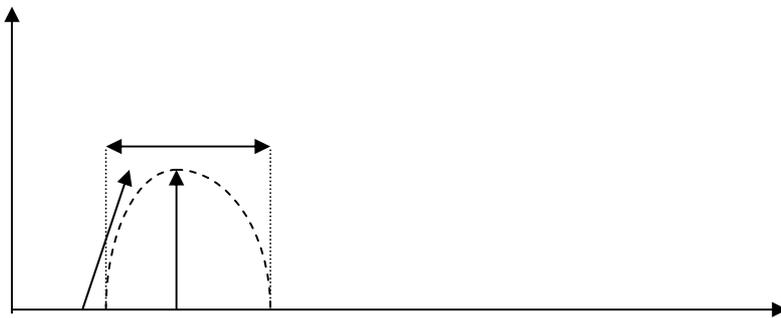
Now, with any given muscle action there will be a different type of neural drive. A neural drive can be rate-dominant or duration-dominant. An important magnitude can occur with both types of dominance as we will illustrate.

### Rate-dominant drive of a high magnitude



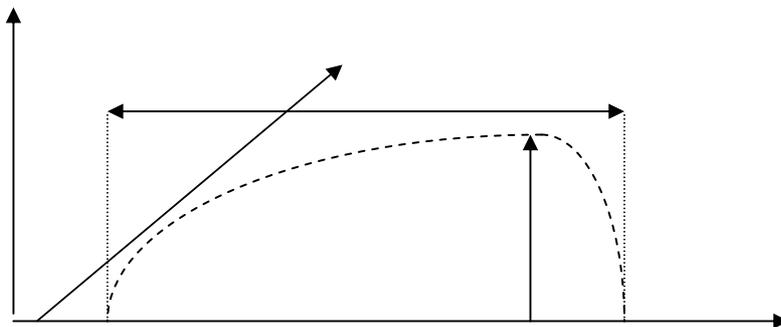
In this first type of drive, we can see that the neural rate is very important. That is, it doesn't take long for the neural drive to reach its peak. On the other hand, the duration of the drive is short. In real life what happens then is a very rapid force production lasting for only a brief period of time. The relatively high magnitude indicates a high level of force production. This type of drive is characteristic of shock training methods such as plyometrics, depth landings, explosive lifting movements and reactive strength exercises (catching a load and quickly reversing its motion).

### Rate-dominant drive of a low magnitude



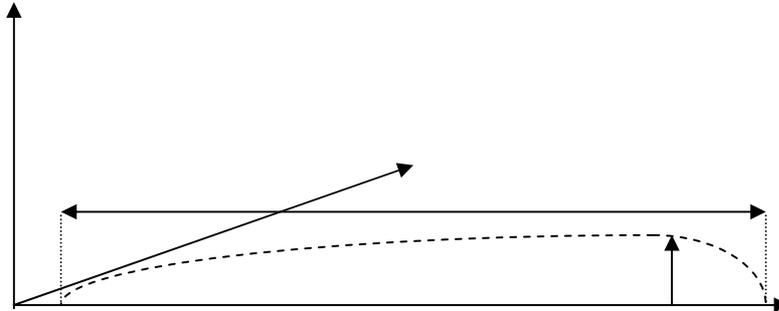
In this second example we still have an important rate and a short duration of action. But this time the magnitude is lower. Meaning that we are still seeing a rapid and brief neural drive, but the actual force production is not that high. Rapid unloaded limb movements and regular jumps and bounds are good examples.

### Duration-dominant drive of a high magnitude



This type of neural drive occurs when we need to produce a high level of force for a relatively long period of time. Generally speaking we are talking anywhere between 4 to 12 seconds when force production is concerned. This type of drive is characteristic of actions requiring a high level of force production that must be sustained. A good example is heavy lifting: lifting a near-maximal or maximal weight might take you 4-12 seconds. This requires that the nervous system sends a sustain drive for the whole duration of the effort.

### Duration-dominant drive of a low magnitude



This type of drive is found in movements in which you must produce a moderate amount of force for a longer period, when talking about strength training 20-70 seconds is a good approximation. In that case we can sustain the effort for longer than during a duration-dominant drive of a high magnitude, but the output is lower. This means that the neural drive is active for longer, but it is of lesser importance. A good example of such a drive would be found in sub-maximal lifting at a controlled tempo (sets of 8-20 reps).

### **Importance of the type of neural drive**

Knowing the type of neural drive present in a given muscle action is crucial for several reasons. Among the most important we can name:

- a. Reducing the risk of CNS overtraining
- b. Higher rate of progress by avoiding opposite types of drive within a single session
- c. Selecting training methods and means adapted to the needs of the individual
- d. Selection training methods and means adapted to the needs of the sport

### **Reducing the risk of CNS overtraining**

Neural drive magnitude, rate and duration all have an impact on CNS stress. A high magnitude is extremely demanding on the CNS by itself. In fact, the more important the magnitude of the neural drive is, the greater is the ensuing CNS fatigue. The duration of the drive can also have an impact in that cumulative CNS output can place a significant burden on the neuromuscular apparatus. A long duration by itself is not really stressful: if you maintain an extremely low magnitude for a long duration the actual CNS stress is virtually nil. However when a high magnitude occurs at the same time, the cumulative CNS fatigue effect is very important. A high rate of neural drive is also demanding on the CNS, especially when of a high magnitude. However since it's almost impossible to have both a long duration and a high rate, the cumulative CNS fatigue effect from rate work is harder to accomplish. It's still possible to do so, by using too many total repetitions.

The most CNS-demanding neural drive is thus **duration-dominant and high magnitude**. The second most demanding being a **rate-dominant high magnitude** drive.

The third most demanding is a **rate-dominant low magnitude** drive while duration-dominant low magnitude work is the least demanding on the CNS, which is why it's often used as a restorative method following a period of CNS demanding work.

### **Higher rate of progress by avoiding opposite types of drive within a single session**

For maximum results you should not mix rate-dominant and duration-dominant exercises within the same training session. This would lead to sub-optimal neural adaptations, which would impair both short and long-term progress. I have myself been guilty of using a mixed approach; the *Canadian Ascending-Descending* program is such an example. It did produce good results, better than traditional strength training, so at first I did not question the validity of the approach. However as I improved my understanding of the neural processes involved in training I came to the conclusion that separating rate and duration work would bring the fastest results. And it did. It takes a big man to recognize his mistakes, and I fancy myself of being relatively big! So although a mixed approach will produce good results, separating rate and duration work into different sessions will lead to an even faster rate of improvement.

I find the following combination to work very well:

#### **Two methods in one session**

1. maximum effort concentric – repetitive effort concentric
2. maximum effort eccentric – maximum intensity isometric
3. submaximal eccentric – maximum duration isometric
4. high intensity absorption – dynamic effort concentric

#### **Three methods in one session**

1. maximum effort concentric – repetitive effort concentric – maximum duration isometric
2. maximum effort eccentric – maximum intensity isometric – submaximal eccentric
3. high intensity absorption – ballistic isometric – dynamic effort concentric

#### **Four methods in one session**

1. max effort concentric – repetitive effort concentric – max duration isometric – max intensity isometric
2. max effort eccentric – submaximal eccentric – max duration isometric – max intensity isometric
3. overspeed eccentric – high intensity absorption – ballistic isometric – dynamic effort concentric

### **Selecting training methods and means adapted to the needs of the individual**

Each individual will have motor unit activation properties in which he's more efficient. For example, you might be very efficient at producing a duration-dominant neural drive. This means that you can keep on producing the required level of force for a relatively long period. This is what I call "grinders": when lifting a maximal load the speed will be extremely slow, almost static really, but it continues to move. Grinders can produce and sustain maximum force in 5-10 seconds, however they often have problems with explosive or reactive exercises requiring a rate-dominant neural drive.

On the opposite side of the coin you have rate-dominant individuals. I call them "hit or miss" because with them they either complete a lift with seemingly room to spare, or

miss it at the first sign of slowing down. For example such an individual could bench press 315lbs in 2 seconds (rather easily), but miss 320lbs! These peoples can produce a very large amount of force in a brief period of time, but they cannot sustain it for long, hence the hit or miss phenomenon.

Then you have mixed individuals who are neither rate nor duration dominant. They are pretty much equal in both types of actions.

You can get a good idea of the dominance of an individual by timing the concentric portion of a maximum strength lift (bench press or squat for example). A duration-dominant individual will complete his maximal lift in 5-10 seconds; a rate-dominant individual will complete it in 1-3 seconds and a mixed individual in 4-5 seconds.

When you know somebody's strength (dominance) you also know his weakness: if someone is obviously duration-dominant, more rate work should be included in the program and vice versa. Sometimes an individual might participate in a sport where one type of action is not needed. Still, you should work on individual needs (individual-specificity) first and sports related needs (sport-specificity) second.

### **Selection training methods and means adapted to the needs of the sport**

Certain sports are rate-dominant (jumps, football, sprints, throws, etc.) others are duration-dominant (powerlifting, strongmen events, etc.) and many are mixed demands. Once that individual needs are filled out, you can start to maximize those capacities involved in the sport of choice of your athlete.

But remember, individual-specificity first, sport-specificity second!

### **Elastic versus Contractile force production**

During any given movement/muscle action force is being produced via a combination of muscle contraction and elastic action. The muscle contraction aspect is also called voluntary muscle activation while the elastic action can be called reflexive action.

Generally speaking, the importance of the reflexive action increases when there is a rapid switch from stretching to contraction (or from eccentric to concentric). The faster the transition is, the more important will be the reflexive component. On the opposite, during single regimen actions (concentric-only, eccentric-only, isometric only) and during slow transition movements, it's the voluntary muscle activation that plays the biggest role.

Some individuals have very good reflexive properties while have weak voluntary properties or vice versa. For maximum performance it is important to establish if an athlete is less efficient in one of these types of actions. In most cases, rate-dominant athletes have better reflexive properties than duration-dominant athletes while the later have stronger contractile properties.

## **Conclusion**

As you can see, the nervous system really is the true commander of all motor actions. While it may seem somewhat complex, it really is simple to understand. When you establish the neural dominance and the contractile dominance of an athlete it becomes quite easy to select the training methods best suited to his needs and the needs of his sport.

# Part 3

## Specific

# Applications of the

# Methods



*How to apply the various training methods to basic strength exercises*

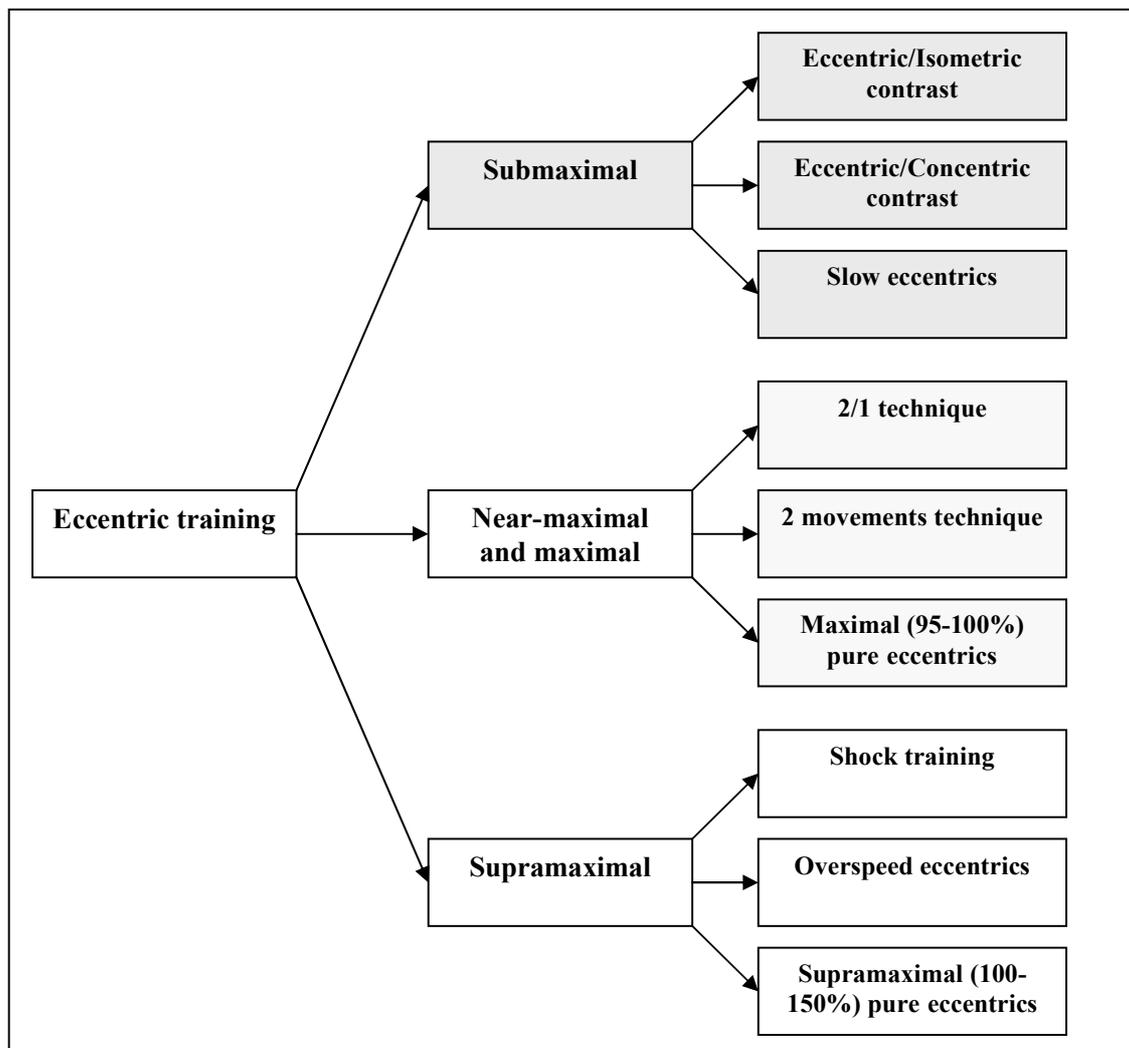
## Eccentric training methods

There are several different eccentric training methods. But first understand that by eccentric training methods I mean those in which the eccentric portion of the exercise is emphasized, not necessarily exercises in which there is only an eccentric action taking place.

There are three main types of eccentric training, each with its own subtypes and applications. These three types of training are:

1. Submaximal eccentric training
2. Near-maximal and maximal eccentric training
3. Supramaximal eccentric training

The following graph can help you understand the various types of eccentric action methods:



## **Submaximal eccentric training**

With submaximal eccentric training you find yourself using a load that is lower than your maximum concentric (or isometric) strength. Since your maximum eccentric strength is significantly higher, the intensity of work will thus be submaximal. So to create a significant training effect we must use certain training techniques that will create an important stimulus, despite the relatively low intensity. I will present three of these techniques (although there are many more possibilities): **eccentric/isometric contrast**, **eccentric/concentric contrast**, and **slow eccentrics**.

### Eccentric/isometric contrast

#### *- Version 1*

In this type of exercise you find yourself slowly lowering a load equivalent to 60-80% of your maximum concentric strength in a movement, adding several isometric (static) pauses during the yielding (lowering) portion; the longer the range of motion of an exercise, the more pauses you'll take. Each of these pauses should last 3 to 6 seconds. Once the bar has been fully lowered (eccentric portion of the movement is completed) you lift the bar or have a partner lift it for you.

For big ROM compound movements (squats, deadlifts, etc.) you should use 3-4 pauses, for medium ROM compound movements (bench press, barbell rowing, military press, etc.) you should use 2-3 pauses, and for short ROM exercises you should use 2 pauses.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Very high*

**Effect on structural elements (hypertrophy):** *Very high*

**Effect on functional elements (strength, power):** *Low*

**Load:** *60-80% of maximum concentric effort*

**Number of reps per set:** *3-6*

**Number of sets per exercise:** *3-6*

**Number of exercises per muscle group:** *1-3*

**Rest between sets:** *90-120 seconds*

#### *- Version 2*

In this second version you will use a load equivalent to 70-90% of your concentric maximum on an exercise. You lower the bar slightly (usually to the strongest point in the range of motion) and you hold it there for as long as you can (maximum duration isometric effort). When you can no longer hold the weight statically you lower it as slowly as you can until you reach the end of the full range of motion. You then have a partner assist you in lifting the bar.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Very high*

**Effect on structural elements (hypertrophy):** *Very high*

**Effect on functional elements (strength, power):** *Moderate*

**Load:** *70-90% of maximum concentric effort*

**Number of reps per set:** *1*

**Number of sets per exercise:** *5-7*

**Number of exercises per muscle group:** *1-3*

**Rest between sets:** *90-120 seconds*

#### Eccentric/concentric contrast

This method is fairly basic and in many ways similar to the slow eccentric method. It consists of dissociating the eccentric and concentric portions of a lift. In this way it becomes both a pure concentric and pure eccentric method (thus it can be included in both categories). You lower the bar slowly, under control. Once you reach the end of the yielding portion of the movement you pause for 3-5 seconds. This is **not** an isometric pause; you must relax your muscles! Then you execute the concentric portion as fast as you can. You use a relatively light load for this exercise (50-70% of your concentric maximum) and lower the load in 5-10 seconds while lifting it explosively.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Moderate*

**Effect on structural elements (hypertrophy):** *Moderate*

**Effect on functional elements (strength, power):** *Low (strength) to moderate (power)*

**Load:** *50-70% of maximum concentric effort*

**Number of reps per set:** *5-10*

**Number of sets per exercise:** *3-6*

**Number of exercises per muscle group:** *1-3*

**Rest between sets:** *60-90 seconds*

#### (Super) Slow eccentrics

This method has already been presented earlier. Using a moderate to important load (60-85% of your max) you execute a superslow yielding phase while lifting (overcoming) the bar explosively.

The following table gives you the parameters to use depending on the load you select.

Load	Time of the yielding portion	Number of reps per set
60%	14 seconds	3
65%	12 seconds	3
70%	10 seconds	2
75%	8 seconds	2
80%	6 seconds	1
85%	4 seconds	1

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Moderate*

**Effect on structural elements (hypertrophy):** *High*

**Effect on functional elements (strength, power):** *Low*

**Load:** *60-85% of maximum concentric effort*

**Number of reps per set:** *1-3*

**Number of sets per exercise:** *3-6*

**Number of exercises per muscle group:** *1-3*

**Rest between sets:** *60-90 seconds*

As you can see, as a whole, submaximal eccentric methods have an effect mostly on the structural elements of the muscular system (muscle hypertrophy, tendon strengthening), but not so much on its functional (strength) capacities. This is important to remember, as it will become capital once you reach the chapter on how to plan the organization of the methods and integrate each method in a complex system.

### **Near-maximal and maximal eccentric training**

This method basically refers to lowering, under control, a load nearing (or at) the point of maximum eccentric strength. Since it's hard (and somewhat risky) to evaluate the exact maximum eccentric strength level, I suggest using a load that is between 100-150% of the maximum concentric strength in a given movement.

I have included three basic techniques in the NM/M eccentric class of methodics:

1. **The 2/1 technique:** Using a load that is 100-150% of the concentric strength of a single-limb exercise, do the eccentric/yielding portion with just that one limb (e.g. with only the right arm) and the concentric/overcoming portion with both limbs.
2. **The 2 movements technique:** Using a load that is 100-150% of the concentric strength of any isolation exercise, execute the concentric portion as a compound movement (as it was explained earlier in this text).
3. **Maximal pure eccentrics:** In this variation, commonly known as “negatives,” you only perform the eccentric portion of an exercise and have a spotter lift the bar back to the starting position for you. Weight releasers can also be used for this purpose (to lighten the load to be lifted during the concentric phase to an insignificant level).

In all three cases the purpose is always to lower a load close to your maximum capacity. The methods only vary in the way that you bring the weight back up to the starting position for another rep (or to conclude the set).

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Moderate*

**Effect on structural elements (hypertrophy):** *High*

**Effect on functional elements (strength, power):** *Very high/strength, low/ power*

**Load:** *100-150% of maximum concentric effort*

**Number of reps per set:** *1-6*

**Number of sets per exercise:** *4-8*

**Number of exercises per muscle group:** *1-2*

**Rest between sets:** *120-180 seconds*

These methods can have a profound effect on both strength and muscle size. However, for the technique to have an important impact on muscle size the total volume must be relatively high. If hypertrophy is your main objective, then you should use 6-8 sets of 4-6 reps using 100-110% of your concentric maximum. If relative strength (strength relative to your bodyweight) is your goal, then a lower volume of work is best; 4-6 sets of 1-3 reps at 120-150% of your concentric maximum.

### **Supramaximal eccentric training**

The objective of this form of training is to place a very important mechanical and neural stress on the organism to increase its force production and to stimulate qualitative (as opposed to quantitative for hypertrophy methods) structural changes.

Understand that by *supramaximal* I am referring to a mechanical stress at, or higher than, the maximum eccentric strength in a movement. There are two ways of doing this:

1. By using kinetic energy accumulation training (KEAT) methods in which the fall of the body or an object leads to an important accumulation of kinetic energy. This accumulation of kinetic energy leads to a reflexive and voluntary (mixed action) muscular contraction during which the amount of force produced is higher than the maximum possible voluntary force output. Force production of up to 200% of the isometric maximum (thus 200-210% of the concentric and 120-150% of the eccentric maximum) has been reported during high intensity depth jumping. Shock training and overspeed eccentrics are included in this category.

2. By using loads that are over one's voluntary eccentric maximum (we are thus talking about loads of around 150-200% of one's concentric maximum). Since the load cannot be lowered under control (as it's over one's maximum eccentric strength) I **strongly** advise against this type of training; the risk potential is too high, even for extremely well trained athletes.

So the only two supramaximal eccentric methods that should be considered are **shock training** and **overspeed eccentrics**.

Shock training refers mostly to depth jumps, but it can also include any exercise in which you are catching an external load and doing an explosive concentric action immediately afterward.

Another form of shock training, which could be termed “**reactive eccentrics/isometrics**,” includes depth landings from various heights and different positions. Depth landing basically refer to dropping from a certain height into a catch position while “sticking” the landing (shortest possible absorption) and then holding this position for a few seconds. In most cases the landing position should mimic an important posture used in the athlete’s sport of choice.

The main advantage of these shock exercises is to develop the capacity to absorb an external force, which is an often-overlooked quality in sports. Before being able to move an external force (e.g. an opponent, your own body as it hits the ground, etc.) you must be able to absorb its force, stop its movement, and then overcome it. The better you are at absorbing force, the more effective you can be at overcoming a source of resistance.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Low (although the actual impact is very high)*

**Effect on structural elements (hypertrophy):** *Low to moderate*

**Effect on functional elements (strength, power):** *Very high*

**Load:** *Above the eccentric maximum from an accumulation of kinetic energy*

**Number of reps per set:** *3-10*

**Number of sets per exercise:** *3-5 (do not exceed 40 total ground contacts)*

**Number of exercises per muscle group:** *1-2*

**Rest between sets:** *120-180 seconds*

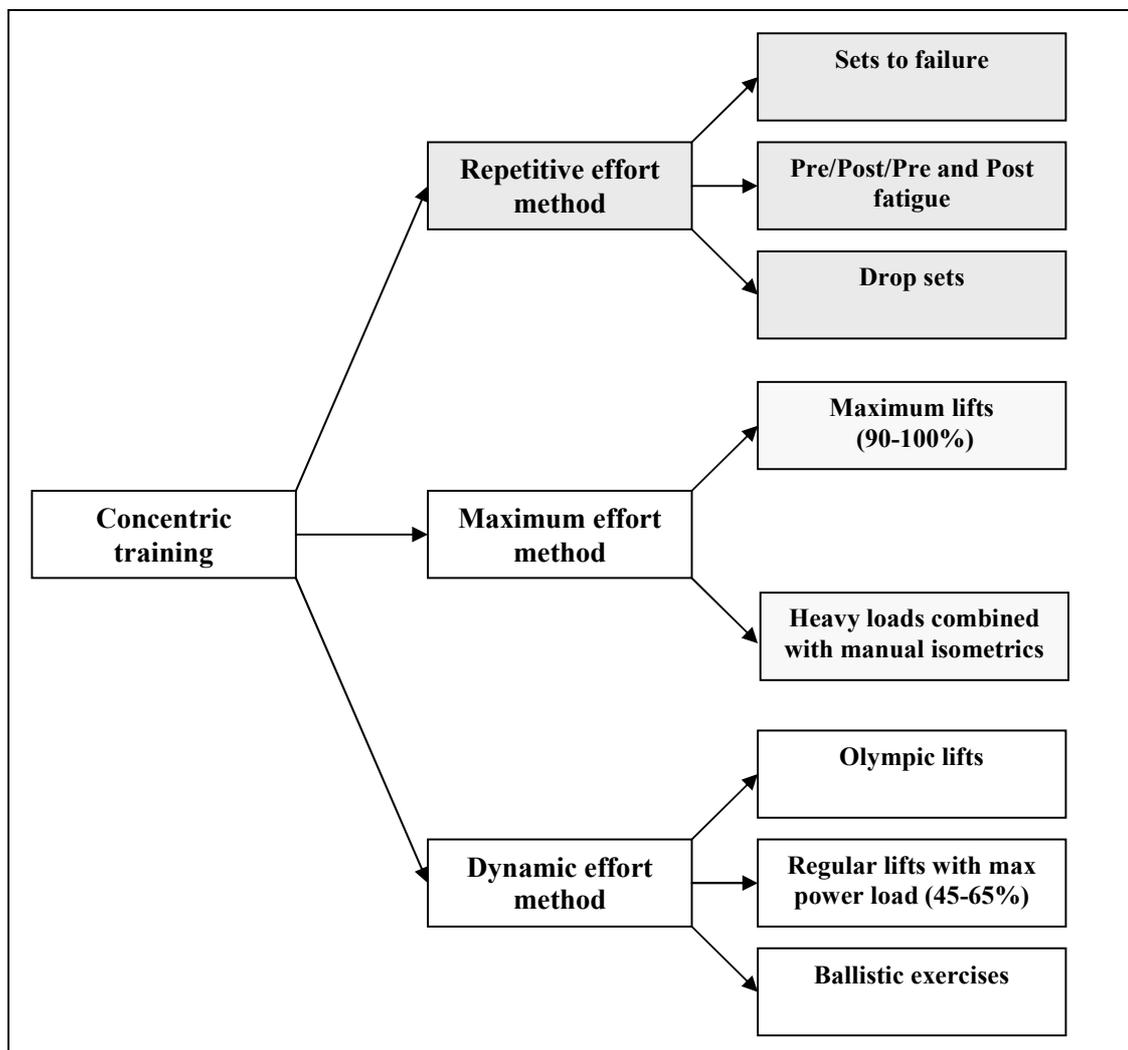
## **Concentric training methods**

Concentric methods refer to training techniques in which the concentric/overcoming portion of the movement is emphasized; this does not mean that there is no eccentric or isometric action involved. Note that to be effective, a concentric method must maximize motor unit recruitment.

When we talk about concentric training methods we can use Zatsiorsky’s classification:

1. The repetitive effort method
2. The maximum effort method
3. The dynamic effort method

These methods can be further divided into various techniques. The following figure shows some possible applications of these three basic methods.



### **Repetitive effort method**

Here we are basically talking about bodybuilding methods, which involve doing a lot of work in a series with a moderate load. The objective is to recruit as many motor units as possible within a muscle by what's known as cumulative fatigue. As some motor units/muscle fibers become too tired to handle the load, more and more are recruited. When using a high volume of work more motor units are recruited due to the large amount of muscle fatigue.

These methods are thus very effective at increasing the quantitative aspect of the training adaptations. However, because the level of intramuscular tension (proportional to the force output) produced during the set is relatively low, these methods don't lead to maximum improvement in the muscle's functions.

However, to increase muscle size these methods are optimal.

### Sets to failure

This is your basic bodybuilding scheme. You select a load that is 60-80% of your maximum in a lift and you perform reps until failure (the point where completing another rep is impossible).

Ideally:

- a) Novice lifters will want to use a load permitting **12-15 repetitions** and perform **2-4 sets** per exercise.
- b) Intermediate lifters will want to use a load permitting **8-12 repetitions** and perform **3-5 sets** per exercise.
- c) Advanced lifters will want to use a load permitting **6-8 repetitions** and perform **4-6 sets** per exercise.

The most effective way of performing this type of training is to yield (eccentric portion) slowly (3-5 seconds) and to overcome (concentric portion) as fast as you can. This will maximize muscle tension. The rest intervals should be very short to prevent full muscle recovery, thus forcing the body to recruit more and more motor units for each set.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *High*

**Effect on structural elements (hypertrophy):** *High to very high*

**Effect on functional elements (strength, power):** *Low to moderate*

**Load:** *60-80% of the concentric maximum*

**Number of reps per set:** *6-15*

**Number of sets per exercise:** *2-6*

**Number of exercises per muscle group:** *2-4*

**Rest between sets:** *45-90 seconds*

### Post-fatigue, pre-fatigue, post- and pre-fatigue

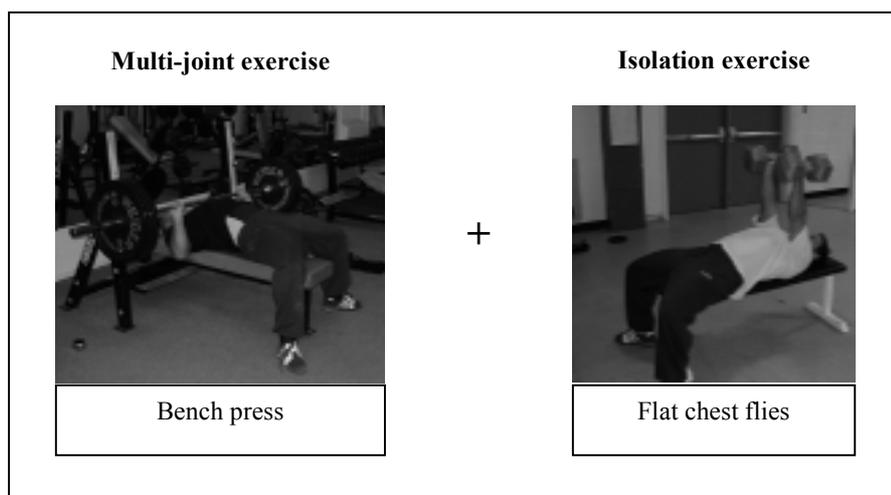
The objective of all three of these techniques is to further fatigue a certain muscle group by using an isolation exercise (for the target muscle) either before (pre), after (post), or before and after (pre and post) a multi-joint exercise. The logic is that in a compound exercise the load is distributed over several muscles at the same time, so each muscle is not necessarily being fully stimulated. By using an isolation exercise in conjunction with the multi-joint exercise you are making sure to fully fatigue (thus to recruit and stimulate as many motor units as possible) the target muscle group.

### *Post-fatigue*

In short, the post-fatigue method consists of adding a less complex movement after your main movement to fully stimulate and fatigue the target muscle group. These two exercises are done with no pause in between them.

The logic behind this method is that in complex (multi-joint) movements the weaker muscle groups will always fail first, leaving the prime movers under-stimulated. For example, in the bench press the triceps or deltoids are likely to fail before the stronger pectorals, thus leaving the pectorals under-stimulated.

By adding an isolation exercise for the pectorals (e.g. flies) right after your set of bench presses you will be able to fully fatigue and stimulate your pectorals. The more stimulation you put on your muscles, the more protein degradation occurs, the higher the anabolic response.



**Example of the post-fatigue method for the pectorals**

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Very high*

**Effect on structural elements (hypertrophy):** *Very high*

**Effect on functional elements (strength, power):** *Moderate*

**Load:** *60-80% of the concentric maximum (multi-joint exercise)*

**Number of reps per set:** *6-15 (MJ exercise) and 10-20 (ISO exercise)*

**Number of sets per exercise:** *2-6*

**Number of exercises per muscle group:** *1-3*

**Rest between sets:** *No rest between exercises, 60-120 seconds between sets*

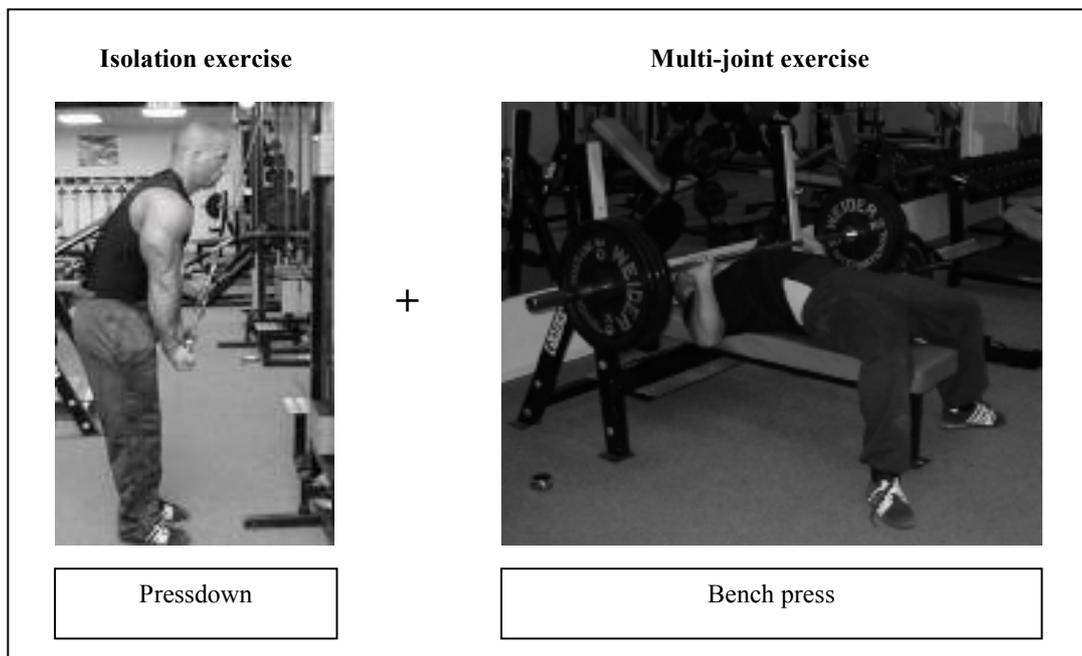
### *Pre-fatigue*

The objective of this method is somewhat similar to the post-fatigue method in that the goal is to fatigue a specific muscle group that might not get fully stimulated from a complex exercise.

As I have mentioned, the strongest muscle involved in a movement will rarely be fully stimulated from this movement because the weaker muscles will fail first. However, if you fatigue this muscle before you perform the main exercise, then you will be able to fully stimulate it when you do the main exercise.

This technique is very effective at stimulating hypertrophy in a specific body part (the body part for which you do the isolation exercise). However, it is not as good for developing overall hypertrophy as the post-fatigue method because it is possible that you will not be able to use as much weight on the main exercise due to the pre-fatigue set.

Because of this characteristic, the main use of this method is to *improve a weak body part*. If you have an underdeveloped chest compared to your shoulders and arms, use a pre-fatigue set for the chest. If your back is lacking behind your arms and shoulders, use a pre-fatigue set for the back. And it isn't even obligatory to do a pre-fatigue set for the strongest muscle group in the main exercise. For example, if you feel like your triceps are proportionally weaker compared to your chest, then you can pre-fatigue them before doing the bench press.



**Example of the pre-fatigue method for the triceps**

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Very high*

**Effect on structural elements (hypertrophy):** *Very high*

**Effect on functional elements (strength, power):** *Low*

**Load:** *60-80% of the concentric maximum (multi-joint exercise)*

**Number of reps per set:** *6-15 (MJ exercise) and 10-20 (ISO exercise)*

**Number of sets per exercise:** *2-6*

**Number of exercises per muscle group:** *1-3*

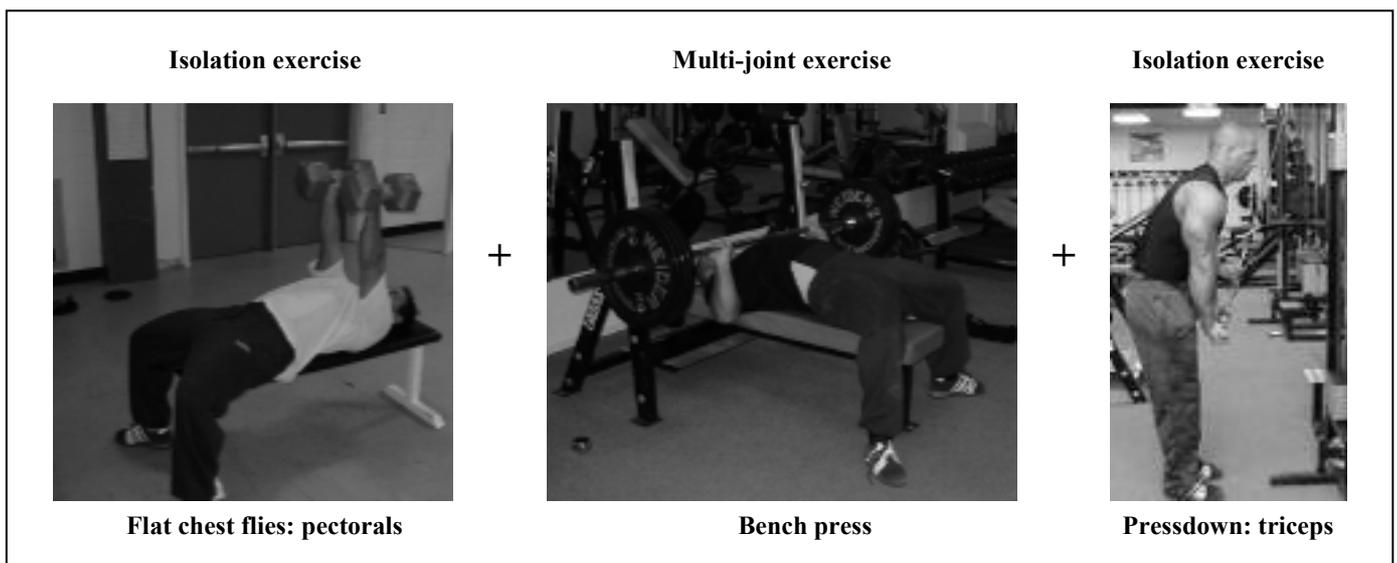
**Rest between sets:** *No rest between exercises, 60-120 seconds between sets*

### *Pre- and post-fatigue*

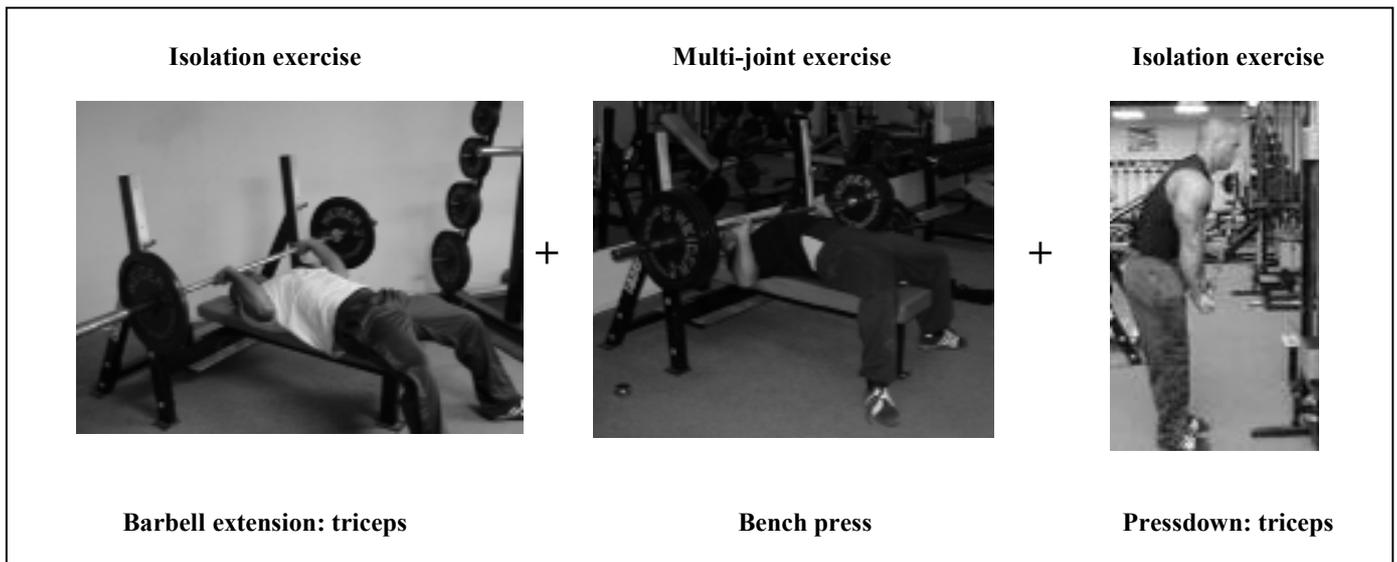
This is certainly the most difficult hypertrophy method of all, and probably the most effective as well. It simply is a mix of the pre-fatigue method and post-fatigue method. It leads to the greatest possible hypertrophy response of all the methods that you can use in the gym. Because this method is so intense, it should not be used for more than 2-3 weeks straight.

You can do two types of pre-/post-fatigue training:

1. Targeting the same muscle group during the pre-fatigue exercise and the post-fatigue exercise; this will place a large hypertrophy stimulus on the targeted muscle group.
2. Targeting one muscle group during the pre-fatigue exercise and another one during the post-fatigue exercise. This allows you to correct two different weaknesses at the same time.



Example of the pre- and post-fatigue method for the triceps and chest



**Example of the pre- and post-fatigue method for the triceps**

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Extremely high*

**Effect on structural elements (hypertrophy):** *Extremely high*

**Effect on functional elements (strength, power):** *Low*

**Load:** *60-80% of the concentric maximum (multi-joint exercise)*

**Number of reps per set:** *6-15 (MJ exercise) and 10-20 (ISO exercises)*

**Number of sets per exercise:** *2-3*

**Number of exercises per muscle group:** *1-2*

**Rest between sets:** *No rest between the three exercises, 60-120 seconds between sets*

### Drop sets

The drop set method, if pushed to the extreme, can be even harder than the pre- and post-fatigue method. The drop set method is an extension of the post-fatigue method where you use the same exercise with a lighter load after your main set. Only, in the drop set method, you add 2-6 additional post-fatigue sets of the same exercise with gradually decreasing loads. This method is probably the best to fully stimulate a muscle group, but it can be truly excruciating and hard. Like the pre- and post-fatigue method it should never be used for more than 2-3 weeks straight.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Extremely high*

**Effect on structural elements (hypertrophy):** *Extremely high*

**Effect on functional elements (strength, power):** *Low*

**Load:** *Variable during the set, start at around 70-90% of your maximum*

**Number of reps per set:** *Highly variable, depends on the number of drops*

**Number of sets per exercise:** *2-3*

**Number of exercises per muscle group:** *1-2*

**Rest between sets:** *No rest between drops, 60-120 seconds between sets*

### **Maximum effort method**

Maximum effort refers to overcoming an external resistance close to, or at, your maximum capacity for a certain exercise. It is characterized by a very large amount of intramuscular tension producing a maximal amount of force.

In layman's terms, maximum effort refers to straining hard to lift a certain load. I will present two such methods (the two most effective ones), *maximal lifting* and *heavy lifting coupled with manual isometrics*.

#### *Maximal lifting*

This is the most straightforward maximum effort method. It consists of lifting a barbell weighing 90-100% of your maximum on a certain lift. Because of the maximal level of intensity, the number of reps per set is kept low (1-3 reps per set).

This type of lifting doesn't have a significant impact on muscle mass, unless a very large number of sets are used. However, it is very effective at increasing strength, mostly through neural processes (especially intramuscular coordination) and qualitative changes to the muscle structures.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *High*

**Effect on structural elements (hypertrophy):** *Low to moderate*

**Effect on functional elements (strength, power):** *Very high*

**Load:** *90-100% of the concentric maximum*

**Number of reps per set:** *1-3*

**Number of sets per exercise:** *4-8*

**Number of exercises per muscle group:** *1-2*

**Rest between sets:** *150-180 seconds between sets*

*Heavy loads combined with manual isometrics*

This method is a favorite of mine. It consists of doing reps with a relatively heavy load (70-80%) while during certain repetitions (or during all repetitions) a partner applies a manual overload to the bar (he pushes against the bar), preventing you from continuing the concentric portion of the lift (the combined barbell load and manual load is thus above the concentric maximum, but not above the isometric maximum). The manual overload is placed for 2-3 seconds and then released, allowing the lifter to complete the repetition. This type of training can also be classified as *functional isometrics*. One of the biggest benefits of this method is to integrate the benefits of maximal isometric work into a dynamic perspective. It also allows you to place an emphasis on the weakest part of a lift.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Very high*

**Effect on structural elements (hypertrophy):** *Moderate to high*

**Effect on functional elements (strength, power):** *High*

**Load:** *70-80% of the concentric maximum plus a manual overload*

**Number of reps per set:** *2-6 (with 1-3 manual overloads per set)*

**Number of sets per exercise:** *3-5*

**Number of exercises per muscle group:** *1-2*

**Rest between sets:** *150--180 seconds between sets*

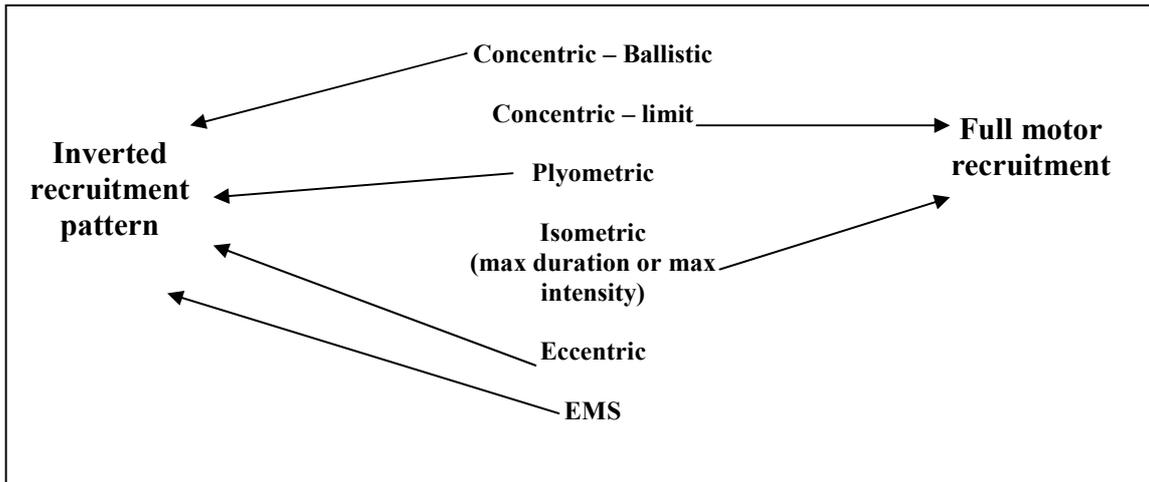
### **Dynamic effort method**

This method relies on lifting sub-maximal loads with a high degree of acceleration.

The dynamic effort method allows for maximal motor unit recruitment through an increase in intramuscular coordination and increased motor unit activation via a potentiation of the central nervous system. There is also some evidence that explosive (high acceleration) exercise increases the rate of fast-twitch fiber innervation, leading to an inverted motor recruitment pattern.

Normal motor recruitment pattern: The slow-twitch fibers are recruited first and as the intensity of the movement and the demand on the muscle increases, the fast twitch fibers enter into the action. This is known as the “size principle.” According to the size principle, the smallest, most oxidative (ST) fibers are recruited first and the most powerful fibers (FT) are recruited last.

Inverted recruitment pattern: During explosive exercises (especially those of a ballistic nature) the activation threshold of all the motor units is brought to the same level. This means that the signal to activate the motor units occurs at the same time for all types of fibers. However, since the nerve impulse takes less time to innervate the fast-twitch fibers than the slow-twitch fibers (60ms vs. 140ms), these FT fibers enter into action first, hence the reverse order of activation/recruitment. This form of recruitment is also found in maximal/supra-maximal eccentric training and EMS training.



Dynamic effort methods offer a lot to most athletes who need explosive strength and speed.

We will discuss three different applications of the dynamic effort method:

- I. Olympic lift variations
- II. Regular lifts with a maximum power load (45-65%)
- III. Ballistic lifts (10-25%)

### *Olympic lift variations*

The Olympic lifts include the competitive lifts (snatch, clean & jerk) as well as their derivatives. When talking about Olympic lifts we should use a three-word term:

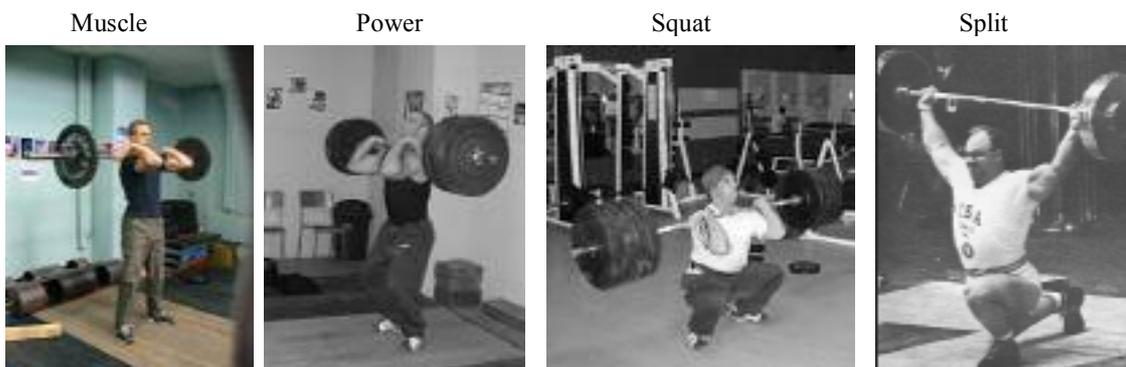
**First word:** position of the catch/reception of the barbell (muscle; power; squat; split)

*Muscle* = catch with no bending of the knees

*Power* = catch with a slight bending of the knees (less than 90 degrees)

*Squat* = catch with an important bending of the knees

*Split* = catch with one leg forward and one leg backwards



**Second word:** general type of lift (snatch; clean; jerk)

*Snatch* = lifting the bar from the starting position straight to overhead

*Clean* = lifting the bar from the starting position to the shoulders/clavicles

*Jerk* = lifting the bar from the shoulders to overhead

Snatch



Clean



Jerk



**Third word:** starting position (floor; hang; blocks)

*Floor* = the bar starts on the floor

*Hang* = the bar starts above or below the knees, with the lifter holding it there

*Blocks* = the bar starts on blocks leaving it above or below the knees

Floor



Hang



Blocks



These classifications give us the following lifts:

Type of exercise	Variations
Snatch	Muscle snatch from the floor Muscle snatch from the hang Muscle snatch from the blocks  Power snatch from the floor Power snatch from the hang Power snatch from the blocks  Squat snatch from the floor Squat snatch from the hang Squat snatch from the blocks  Split snatch from the floor Split snatch from the hang Split snatch from the blocks

Type of exercise	Variations
Clean	Muscle clean from the floor Muscle clean from the hang Muscle clean from the blocks  Power clean from the floor Power clean from the hang Power clean from the blocks  Squat clean from the floor Squat clean from the hang Squat clean from the blocks  Split clean from the floor Split clean from the hang Split clean from the blocks

Type of exercise	Variations
Jerk	Muscle jerk from the clavicles Muscle jerk from behind the neck  Power jerk from the clavicles Power jerk from behind the neck  Squat jerk from the clavicles Squat jerk from behind the neck  Split jerk from the clavicles Split jerk from behind the neck

Note: An athlete who doesn't plan on competing in Olympic lifting should stick with the easier variations of these lifts:

- Muscle snatch from the hang*
- Muscle snatch from the blocks*
- Power snatch from the hang*
- Power snatch from the blocks*
- Muscle clean from the hang*
- Muscle clean from the blocks*
- Power clean from the hang*
- Power clean from the blocks*
- Muscle jerk from the clavicles*
- Power jerk from the clavicles*
- Split jerk from the clavicles*

The Olympic lifts are explosive by nature. This means that to complete the lift you must produce a lot of acceleration. Because of this, it is possible to use a relatively heavy load and still produce a high level of power. The Olympic lifts are a rather unique animal. For one thing, few training exercises have such a mystique surrounding them as the Olympic lifts. But these lifts are nothing mysterious and their method of action is not a secret. We know that the Olympic lifts work and we know *why* they work.

1. The Olympic lifts have a very large power output. The body improves what it is trained to do, train to produce a lot of power and you'll get better at producing power! The following table by Dr. Mike Stone illustrates the superiority of the Olympic lifts when compared to "regular" strength exercises in terms of peak power production:

EXERCISE	ABSOLUTE POWER (W)	
	100KG MAN	75KG WOMEN
BENCH PRESS	300	
SQUAT	1100	
DEADLIFT	1100	
SNATCH (A)	3000	1750
SN SECOND PULL (B)	5600	2900
CLEAN (A)	2950	1750
CL SECOND PULL (B)	5500	2650
JERK	5400	2600

(A) LIFT OFF TO MAXIMUM VERTICAL VELOCITY  
 (B) TRANSITION UNTIL MAXIMUM VERTICAL VELOCITY

2. The Olympic lifts require that you synchronize several muscle actions to produce one fluid, powerful motion. While the specific technique of the Olympic lifts cannot improve your skills in sport movements, these lifts can develop your **general capacity to solve complex motor tasks**. This means that becoming efficient in the Olympic lifts will improve the efficacy of the nervous system to create well-timed motor patterns, and this general capacity can be transferred to sports.

3. The Olympic lifts develop strength and power in muscles that are key in most sports: quadriceps, hamstrings, calves, glutes, lower back, traps, and arms.

4. The Olympic lifts teach an athlete to receive an outside force and how to absorb it. This is critical for optimum sport performance and can also help reduce the risk of on-field injuries due to external forces.

5. The Olympic lifts are fun to do! Once learned properly they are among the most enjoyable and fulfilling strength exercises you can do. There is something special about hoisting a heavy weight from the floor to over your head in one powerful motion!

6. The Olympic lifts are a great way to develop CNS efficacy and to train the CNS to recruit high threshold muscle fibers, which are normally hard to stimulate. When an Olympic lifting program is combined with “regular” strength training or bodybuilding training, the CNS stimulating effect of the Olympic lifts magnifies the gains brought on by the other two types of training.

7. Of special interest to women, the Olympic lifts are not exercises in which you feel a localized pump. As a result, women will not have the impression of bulking up. Obviously this is just a subjective and psychological benefit, but if it keeps them interested in training, it’s all good!

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Moderate*

**Effect on structural elements (hypertrophy):** *Low*

**Effect on functional elements (strength, power):** *Very high*

**Load:** *70-90% of the concentric maximum*

**Number of reps per set:** *1-6*

**Number of sets per exercise:** *4-10*

**Number of exercises:** *1-3 Olympic lift variations per workout*

**Rest between sets:** *90-120 seconds between sets*

*Regular lifts with a maximum power load (40 -65%)*

The Olympic lifts are not the only exercises that can produce a lot of power. By using an optimal load and maximal acceleration with regular exercises such as the bench press and squat, you can get the same power enhancement benefits as with the Olympic lifts.

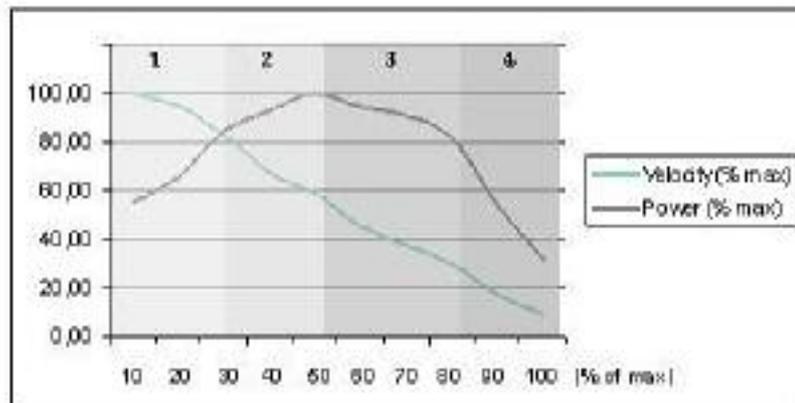
Over the past few years there has been a significant effort from the scientific crowd to establish just where that optimal percentage is situated. The varying types of study designs and different fitness level of the test subjects led to somewhat conflicting results.

For example Siegel et al. (2002) found that the greatest power output was between 50 and 70% of 1RM for the squat and between 40 and 60% for the bench press.

Baker et al. (2001) found that power output was maximized with loads of 55-59% in the squat (a bit lower than the Siegel study), but power output was still very high in the 47-63% range. They also found that the load maximizing power output in the bench press was 46 to 62% with an average peak occurring at 55%.

These two recent studies offer a somewhat conflicting conclusion compared to the earlier investigations in regard to peak power, which supposedly occurred at around 30% of 1RM.

It is because of this discrepancy, as well as the success of the Westside Barbell lifters (who are using 40-60% to develop power), that I decided to conduct a little study on peak power. Using the **Fitrodyn** unit by Tendo Sport, I decided to establish the “power curve” and “velocity curve” for strength lifts. In doing so I tested several athletes (hockey players, football players, powerlifters, a sprinter, and an Olympic lifter) on the bench press using loads ranging from 10% up to 100% of their maximum. Velocity as well as power output was recorded at each percentage.



### General findings

1. Peak power occurs at 45-55% on average.
2. Submaximal power (90-100% of max power) is produced with loads ranging from 40 to 65% of maximum.
3. Maximum velocity is reached with the lightest tested load (10%); it is quite possible that it could be even higher with lighter loads.
4. Submaximal velocity (90-100% of max velocity) is produced with loads ranging from 10 to 25% of maximum.
5. There is an inverse proportional relationship between velocity and load; the higher the load, the slower the bar speed.
6. The power curve is parabolic; at the highest velocities, the load is too low and at the heaviest loads the velocity is too low to lead to a large power output.

From this curve we can conclude that to train for maximum power when using regular strength lifts we should use a load ranging from 40 to 65% of one's concentric maximum, lifting the bar as fast as possible.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Moderate*

**Effect on structural elements (hypertrophy):** *Low*

**Effect on functional elements (strength, power):** *Very high*

**Load:** *40-65% of the concentric maximum*

**Number of reps per set:** *1-6*

**Number of sets per exercise:** *4-10*

**Number of exercises:** *1-3 power exercises per session*

**Rest between sets:** *90-120 seconds between sets*

*Ballistic lifts (10-25%)*

Ballistic refers to an actual projection of the source of resistance. The source of resistance itself can either be from an outside source (e.g. medicine ball) or from the athlete's bodyweight. The intensity of these exercises varies from very low (simple bounding drills) to very high (loaded absorption drills, high impact plyos). These exercises are the ones in which the acceleration factor is the greatest in relation to total force production. These exercises have a great impact on the nervous system because of the high accelerative demands. While low intensity ballistic exercises (bounding drills, basic jump training, light medicine ball throws, etc.) are not very stressful (and thus can be used quite often, mostly as a good specific warm-up tool), high intensity ballistic exercises (depth jumps, weighted jumps, heavy medicine ball throws, loaded absorption drills) should only be used infrequently (once or twice a week) for a limited period of time (4-6 weeks). The latter exercises (high intensity) do carry a great potential for power improvement, but they are very stressful on the nervous system and the tendons. It is also important to understand that the training effect of the high intensity ballistic exercises is delayed, meaning that the improvements in the capacity to produce power are best seen 2-3 weeks after the last stimulation.

In the power curve presented earlier, we see that speed is maximized with this method. This training method can be used to train speed of movement, but has little benefit for improving strength. When training in this zone (10-25%) it is preferable to project the load or body into the air, because with regular lifting the deceleration phase will be much longer, which will have a negative effect on speed. Exercises such as jump squats, bench throws, and medicine ball throws are best suited for this training zone.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Low to moderate*

**Effect on structural elements (hypertrophy):** *Very low*

**Effect on functional elements (strength, power):** *High*

**Load:** *10-25% of the concentric maximum*

**Number of reps per set:** *5-10*

**Number of sets per exercise:** *3-6*

**Number of exercises:** *1-3 speed exercises per session*

**Rest between sets:** *90-120 seconds between sets*

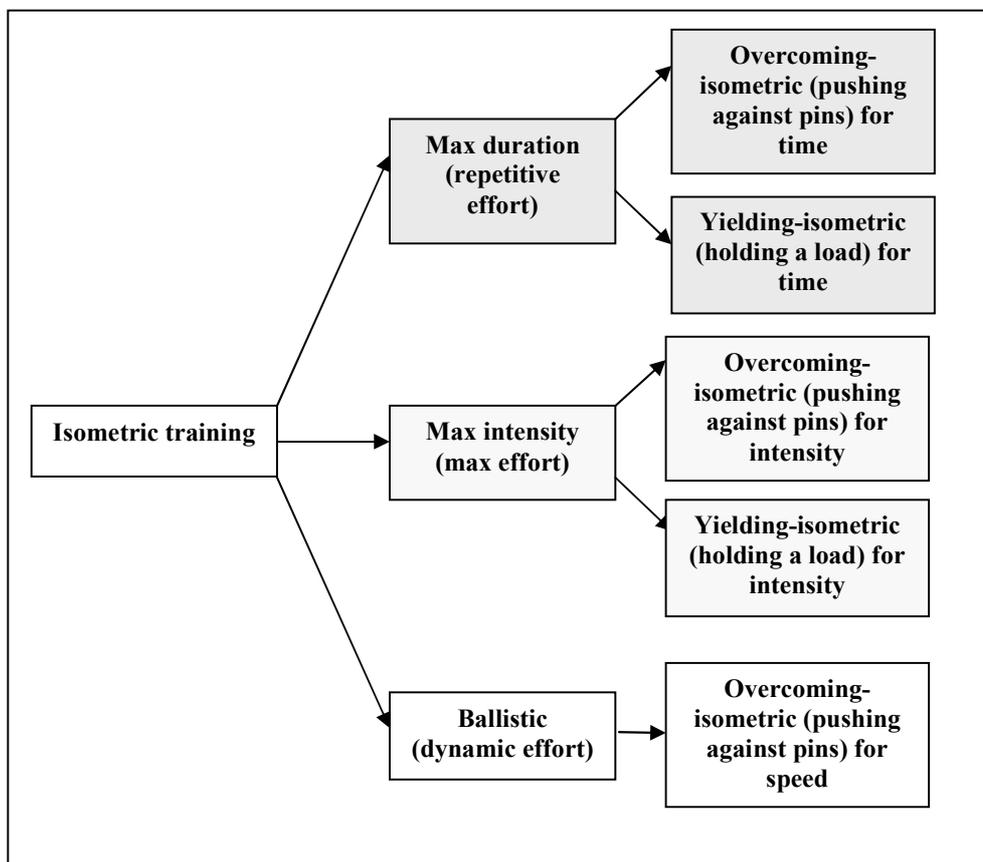
## Isometric training methods

Isometric methods refer to producing muscle tension without moving. With this method you are basically fighting a source of resistance without altering its position

We will discuss three applications of this method:

1. *Max duration isometrics (equivalent to the repetitive effort method)*
2. *Max intensity isometrics (equivalent to the max effort method)*
3. *Ballistic isometrics (equivalent to the dynamic effort method)*

There are also mixed regimen isometrics (also known as functional isometrics), but these applications have already been discussed.



You'll notice that I mention two types of isometric exercises: *overcoming-isometric* and *yielding-isometric*. Understand that this doesn't mean that you are combining a concentric (or eccentric) action along with the isometric action. The actual external outcome of the exercise is the same; there is no movement at all. However, the **intent** during the exercise changes.

Overcoming-isometric: You are pushing or pulling against an immovable resistance. There is no external movement, but your *intent* is to move the resistance (even though it's impossible).

Yielding-isometric: You are holding a weight and your objective is to prevent it from going down. So once again, there is no external movement. However, your intent is no longer to move the resistance, but to stop its movement.

It is important to understand that both techniques will not have the same effect. For one thing, the neural patterns used in both cases will be different. Overcoming-isometrics may have a bigger impact on concentric strength than yielding-isometrics.

### **Max duration isometric (repetitive effort)**

With max duration isometric exercises you are pushing/pulling or holding a sub-maximal load for as long as possible, going to muscle failure. For maximum effect we want to use sets ranging from 20 to 60 seconds in length. The effect of this type of training on muscle mass can be great as there is a very significant growth stimulus placed on all of the muscle fibers.

**\*Note:** A lot of studies don't report a lot of muscle growth from isometric training. This is only because the old German model of 6-second actions (or something similar) was used in the experiments. This duration of effort, albeit adequate for strength gains, is not sufficient to cause hypertrophic changes in the muscles. However, when using sets lasting 20-60 seconds, the growth stimulus is significant.

With this method you can use both overcoming-isometrics and yielding-isometrics (which were explained earlier). However, I find that yielding isometrics (holding a weight) are much superior when it comes to max duration isometric training. In this case, a load of 50 to 80% for a duration of 20 to 60 seconds is best.

As it was mentioned earlier in the text, with isometric training you will want to use at least three positions per exercise to get improvement throughout the entire range of motion.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Very high*

**Effect on structural elements (hypertrophy):** *High to very high*

**Effect on functional elements (strength, power):** *Low*

**Load:** *50-80% of the concentric maximum if using yielding-isometrics*

**Number of reps per set:** *20-60 seconds per set*

**Number of sets per exercise:** *2-4 per position / 3 positions per exercise*

**Number of exercises:** *1*

**Rest between sets:** *60-90 seconds between sets*

### **Max intensity isometric (maximum effort)**

The max intensity isometric method is related to the concentric maximum effort method. You will try to maintain a maximum isometric action for 3-6 seconds. You can, once again, use either overcoming-isometrics or yielding-isometrics, but in this case overcoming isometrics (pushing/pulling against pins or an immovable resistance) give the best results and are much safer.

This type of isometric training doesn't have a significant impact on muscle mass, however it can increase muscle density and myogenic tone (also called "tonus," or the firmness/hardness of your muscles). Its main effect is on maximum strength development, which occurs specifically at the joint angle being trained. So once again, you'll want to use multiple positions. There is also some evidence that maximum isometric training can improve the capacity to recruit and synchronize motor-units (intramuscular coordination) even in dynamic movements.

Even though overcoming-isometrics are best for this method, you can still use yielding-isometrics. In this case you would use a load of 100 to 110% of your maximum.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Moderate*

**Effect on structural elements (hypertrophy):** *Low*

**Effect on functional elements (strength, power):** *High*

**Load:** *100-110% of the concentric maximum if using yielding-isometrics*

**Number of reps per set:** *3-6 seconds per set*

**Number of sets per exercise:** *3-6 per position / 3+ positions per exercise*

**Number of exercises:** *1*

**Rest between sets:** *30-90 seconds between sets*

### **Ballistic isometric (dynamic effort method)**

Be careful not to mix up iso-ballistic (or stato-ballistic) training with the ballistic isometric method. Iso-ballistic is a mixed regime method in which an explosive dynamic action is preceded by an isometric pause.

The ballistic isometric method refers to pushing against an immovable resistance for a very brief period of time (1-2 seconds) while trying to reach peak force output as fast as possible (basically trying to go from 0% force to 100% force in 1 or 2 seconds).

You cannot use the yielding-isometric method here, as it doesn't suit the nature of the exercise. The nature being to produce maximum isometric tension in as little time as possible.

This type of exercise is especially good to develop starting-strength and is very useful for any athlete involved in a sport where explosive starts from a static position are involved.

Here are the characteristics and parameters of this method:

**Perceived effort/difficulty:** *Low*

**Effect on structural elements (hypertrophy):** *Very low*

**Effect on functional elements (strength, power):** *High*

**Load:** *N/A*

**Number of reps per set:** *1-2 seconds per set*

**Number of sets per exercise:** *5-10 per position / 3+ positions per exercise*

**Number of exercises:** *1*

**Rest between sets:** *10-30 seconds between sets*

### **KEAT training**

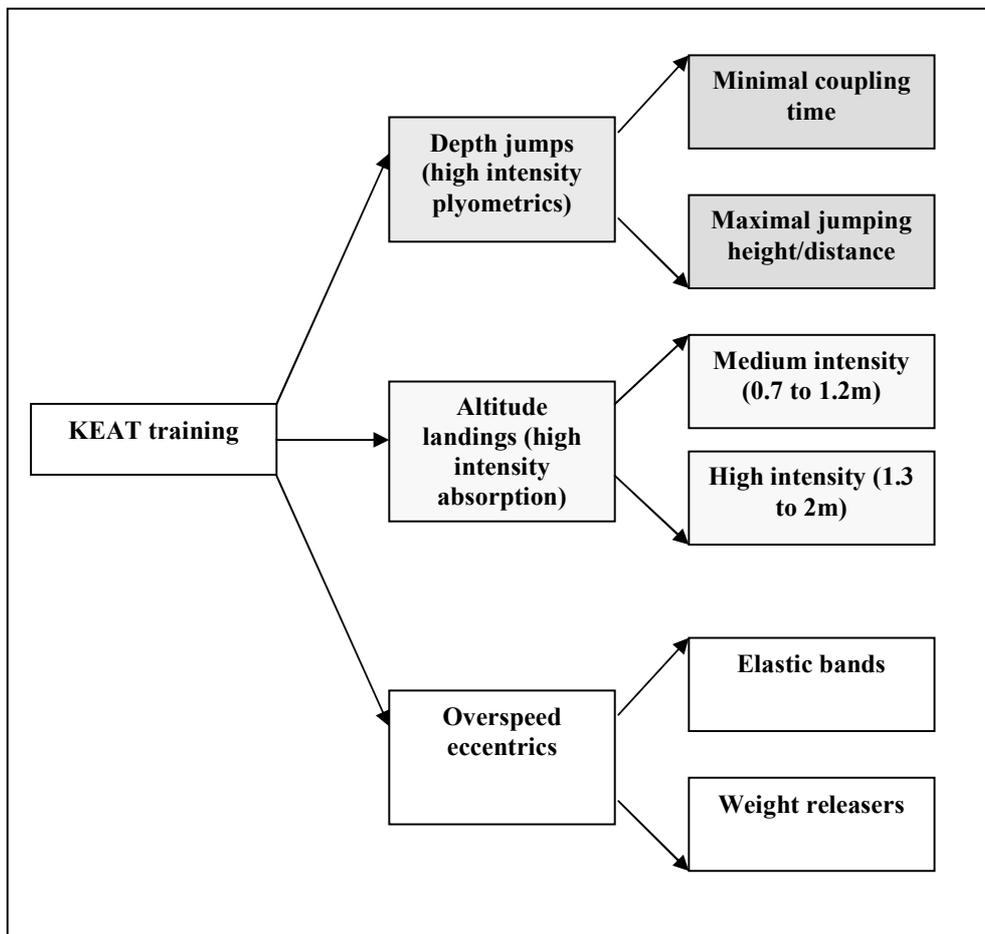
As was explained earlier in the text, KEAT (kinetic energy accumulation training) refers to creating a supra-maximal muscle tension by using a build-up of kinetic energy. This method can lead to a muscle action producing up to 150-200% of the maximal isometric strength of an athlete (Cometti, 1987). Not only is this a good method to develop force and power output, but it is also a fantastic way of improving the capacity of an athlete to absorb force. In fact, this is probably the most important benefit of the KEAT methods, yet one that is not normally talked about.

#### **A little bit on absorbing force**

In all sports an athlete must overcome an external resistance. Every time you run you must overcome the external resistance of your body landing on the ground. In some sports you must overcome a charging opponent (football, rugby, judo, etc.). And in other sports it is an object that you must overcome (shot put, soccer, discus, hammer throw, etc.). All of these actions require that you be able to fight against a source of resistance and move it.

Now, before you can overcome an external force you must absorb its force (coming towards you), and only then can you overcome it! The better and the more effective you are at absorbing an external force, the faster you can overcome it. That's why plyometric drills seem to increase vertical jumping and speed so much. They improve your capacity to quickly switch from an absorption action to an overcoming action. You might have all the concentric power in the world, but if you have problems absorbing an external force then there is no way that you can overcome it with great power and speed!

By using KEAT exercises you will increase your capacity to absorb force, which will allow you to be able to use all of your concentric strength and power in the field of play!



# Part 4

## Training tools: Weight Releasers



*Maximal eccentrics, overshoot training, contrast training*

Weight releasers are one of the most important tools that a coach can buy. Furthermore they're inexpensive, which make it a *most for the least* deal! I personally use this tool in the training of almost all of my athletes, and it constitute a significant part of their yearly program.

Releasers are quite simple to understand. Basically we're talking about hooks which are attached to the bar and loaded with weight. The hooks hang down lower than the bar, so as you lower the bar, the releasers will contact the ground, making them "unhook" the bar, thus *releasing* some weight from the bar.

They thus allow an athlete to lower more weight than he lifts. As it was mentioned in the first chapter of this book, the eccentric portion of a movement is responsible for a lot of strength and size gains. However since you are always stronger during the eccentric portion of the lift, the stimulation you can place on your body during that part of a lift will always be limited by your concentric (overcoming) strength. So basically it becomes very hard to increase the tension magnitude during the eccentric portion of regular exercises. All you can really do is increase the duration of the lowering phase. This indeed increase the stimulation placed on the muscles during the eccentric action, but it is somewhat limited for athletes wanting to increase their maximal strength level.

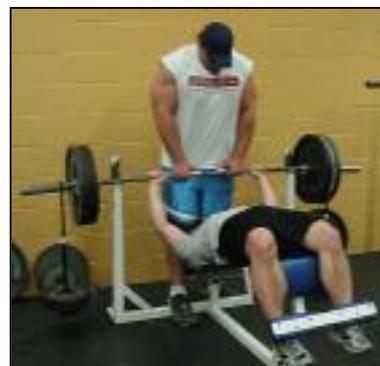
An alternative is to have a partner push down on the bar during the eccentric portion of the lift. I've used this technique myself and it does work. However it becomes very hard to quantify the training processes. How much resistance did you add during the eccentric portion? 45lbs, 35lbs, 100lbs? You really can't tell. So this method can be useful, but it's also limitative.

Releasers on the other hand allow you to add resistance during the eccentric portion of a lift and know exactly how much more you added. This makes training quantification possible.

For example, below the first athlete has 455lbs on the bar, plus 65lbs of releasers per side (total of 130lbs). The second athlete has 315lbs on the bar plus 65lbs of releasers per side. Both perform 5 singles with that load. So they would write down the following in their journal:



**5 x 1 @ 585/455**



**5 x 1 @ 445/315**

As you can see, you can know exactly what is going on with the athlete's training.

In this short chapter I will describe three types of training using the weight releasers. I will then give you a few tips and recommendations on how to use them safely and effectively.

The three training methods we will discuss are **maximal eccentrics**, **contrast training** and **overshoot training**.

### **Maximal eccentrics**

For this training technique an athlete should work up to the maximum weight he can lower under control. For safety purposes my athletes must lower the bar in 5 seconds during a maximal eccentric exercise. If they can't lower it in 5 seconds, it's too heavy. Some will argue that it's not a true maximum, I agree, but the overload is more than enough to stimulate positive gains in strength. And no athlete has ever gotten stronger in the hospital!

You start the exercise with 50-100lbs less than your maximum set on the bar (e.g. if your bench press maximum is 400lbs, the bar weight would be 300-350lbs). This won't change during the workout. I choose that load because I don't like to add too much weight to the releasers (it could damage them) but I don't want to use a bar weight that turns the exercise into a maximal concentric exercise. There is a place and time for a combination of maximal eccentric and maximal concentric but this method focuses only on the eccentric part. Since we are doing only single reps, the load during the concentric portion will be easy and not stressful at all on the body.

The starting weight for the combination of releasers + bar weight should be equal to your concentric maximum. For example, if your maximum is 400lbs and that the bar weight is 330lbs you should use 70lbs in releaser (35lbs per side). You add weight to the releasers with each set until you can no longer lower the load under control in 5 seconds. Most individuals will be able to use 110-130% of their concentric maximum. But if you do less than that don't feel bad, in fact feel happy! This means that this form of training will increase your limit strength at a faster rate than any other method (since it's a weak point). On the other hand, if you can lower 150% of your maximum, or more, this type of training won't be very effective because it's not a limiting factor in your performance level.

This training method has several positive impacts on performance. First it can increase eccentric, isometric and concentric strength to a large extent. This is mostly due to neural adaptations, but also to some structural changes. It also increases the athlete's capacity to control an important external force, which can be useful on the playing field. Psychologically it helps getting used to holding heavy weights, so when you attempt a concentric maximum, it will feel lighter by comparison, giving you a psychological boost. There is also some evidence that lowering big weights offer more than a

psychological benefit: it's possible to desensitize the Golgi Tendon Organs and Muscle Spindles by using such a technique. This will allow you to use a greater proportion of your strength potential due to a lowered neural inhibition. Lastly, since this is a form of accentuated eccentric training, it will lead to significant structural changes. Since the duration of a set is relatively low, it will take many sets to build up a cumulative stimulation sufficient to lead to muscle gains. But in the long run this method can have a very positive effect on functional hypertrophy. I never use this technique more than once per week with my athletes, and never for longer than 6 straight weeks, more often then not it's used in a 3-weeks block.

### **Contrast training**

Contrast training refers to using a load that is equally challenging during both the eccentric and concentric portion of a lift. Since we're stronger during the eccentric portion, the only way this method can be applied is to add resistance during the eccentric part of the exercise.

To properly select the training load it is important to know both your concentric and eccentric maximum on the lift you intend to use. For example, your bench press 1RM could be 400lbs and your maximal eccentric bench press (lowered in 5 seconds) could be 475lbs. Since we want to use the same relative load during both phases of the movement, both the bar weight and releaser weight must be carefully selected.

For example, if you want to train at 80% the loads should be:

- a. Bar weight (concentric portion) =  $400\text{lbs} \times 80\% = 320\text{lbs}$
- b. Releasers weight + bar weight (eccentric portion) =  $475\text{lbs} \times 80\% = 380\text{lbs}$
- c. Releasers weight =  $380\text{lbs} - 320\text{lbs} = 60\text{lbs}$  (30lbs each side)

So to recap our athlete choosing to train at 80% would use a bar weight of 320lbs and add 30lbs to each releaser. This way he lowers 80% of his eccentric maximum and lift 80% of his concentric maximum.

This training method should be performed for multi-reps sets. Since the releasers must be replaced on each repetition I suggest two approaches:

1. Cluster training: perform 5-8 single reps with around 5-10 seconds of rest between them. After each rep you rack the bar and replace the releasers (or have a partner replace them).

2. Paused training: you also perform 5-8 reps but after each rep you hold the bar at arms length while two partners simultaneously replace the releasers.

I prefer option no.1 myself. Option no.2 is a big riskier, for example the spotters could replace the releasers at with a slight delay between them, this could lead to an injury.

However option no.2 has the advantage of keeping the muscles under load for a longer period of time, which may be slightly better for hypertrophy purposes.

Since the fatigue factor might be more important (because of the added eccentric loading) you might be able to complete 1-2 less reps than during a concentric emphasis set for the same relative load. The following table indicates good reps target to shoot for at given loads.

Load	Minimum reps	Maximum reps	Average
95%	1	2	1
90%	1	4	2
85%	3	6	4
80%	5	8	6
75%	6	11	8
70%	8	13	10

This method is especially effective at stimulating maximum hypertrophy in a very short period of time because the stimulation is equivalent during both phases of the movement. Remember to always perform the eccentric portion in 5 seconds (since your eccentric maximum is based on a 5 seconds effort).

It's also a method that is effective at increasing eccentric and concentric strength at the same rate, at the same time. Which can be useful for some athletes who already have a proper eccentric strength/concentric strength ratio.

### **Overshoot training**

Overshoot refers to a sur-activation of fast-twitch motor units during the eccentric portion of the lift allowing the athlete to be more explosive during the concentric portion. In many regards this works the same was as depth jumps and other high impact plyometric drills.

We will accomplish this overshoot by lowering an heavy load during the eccentric portion and lifting a light load as fast as possible. The eccentric portion doesn't have to be as controlled as during the preceding two methods. Lowering the load in 2 seconds is adequate.

The bar weight should be around 50-60% of your concentric maximum and you add another 30-40% on the releasers. For example, an athlete who can bench press 400lbs would use the following:

- a. Bar weight =  $400\text{lbs} \times 50\% = 200\text{lbs}$
- b. Releasers weight =  $400\text{lbs} \times 40\% = 160\text{lbs}$  (80lbs per side)

We want to perform sets of 2-4 reps using this method. However the releasers are only used on the first rep. The overshoot phenomenon being maintained for the whole sets provided that acceleration is maintained at the maximum possible.

### **Tip and recommendations**

1. Before each utilization make sure that the releasers are in working order. If the steel rod becomes slightly bent, I suggest buying new ones as they may become hazardous.
2. Make sure that both releasers release in the same direction.
3. Find out the perfect rod length (which is adjustable) for you. Not all peoples are built the same way. We want the releasers to drop when the bar is 1-2'' from the chest (bench press) or at parallel (squat).
4. Make sure to lower the bar under control. A good way to see if you're doing this is if the releasers unhook at the same time.

### **Conclusions**

All three of the methods presented have been used by me and other coaches quite successfully. When used properly they can greatly enhance the training effect stimulated. And for some athletes this method is even a necessity (those with a low eccentric strength capacity).

However avoid being over-enthusiastic. Don't do too much too soon! I know that for us coaches and athletes, buying a new training tool is like receive our Christmas presents: we want to play with it all the time! However since these methods are all very stressful on both the nervous system and musculoskeletal system, you should start doing the minimum amount of work and very slowly building up as your capacities improve. If you have never training using accentuated eccentrics you won't need a lot of stimulation, doing too much work would be like using a hammer to kill a fly: it might work, but it's unnecessary and might cause some damage.

# Part 5

## Training tools:

### *Jumpstretch* bands

*Accommodating resistance training, max acceleration training,  
variable resistance training*

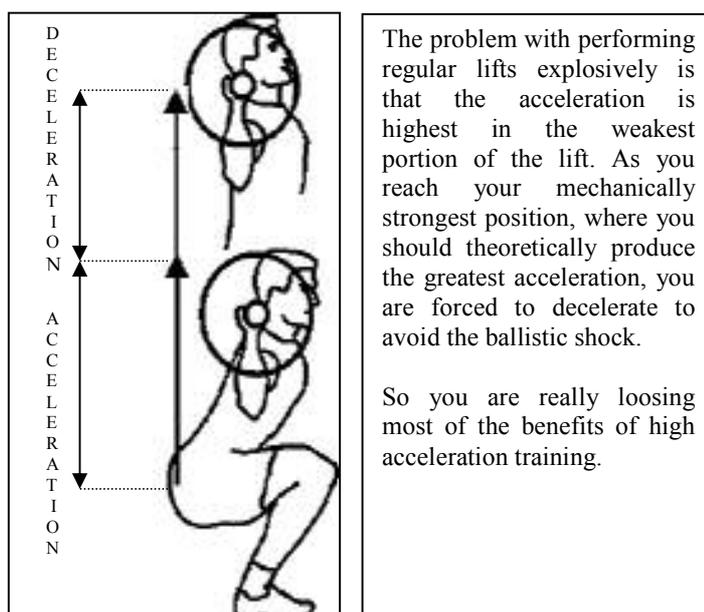
## Problems with regular lifting exercises

Before we start to talk about the problems inherent to regular lifting exercises, I must first say that it is not my intention to say that regular strength exercises are not effective and that they should be removed from a training program. On the contrary! Free-weight lifting is still one of the best way to increase limit strength, strength-endurance and muscle mass. For most peoples, this type of exercise will be more than sufficient. However for the elite athletes who need that extra edge, or those who are perfectionists and want to get the absolute best out of their training, additional methods should be used to compensate for the small shortcoming of regular free-weight lifting.

### Problem no.1: Time spent decelerating the bar

In most sports an athlete's success is directly dependent on his capacity to accelerate. Strength coaches have long realized this, which has led to explosive free-weight lifting. That is using moderate weights in classical strength exercises, performing the concentric portion as fast as possible (trying to accelerate as much as possible).

The problem that exist with explosive lifting using normal exercises is that the preventive deceleration phase can be as long, if not longer, than the voluntary acceleration phase. How can this happen if we're trying to lift the weight as fast as possible? Well the body wants to protect itself. So nearing the end of the concentric action, it will instinctively decelerate to avoid any ballistic shock in the joints and muscles. For the body, its more natural to slowly decrease speed until velocity is zero than to make a sudden stop from max velocity to zero velocity. Blame it on your dear protective mechanisms! Lets take the back squat for example. You accelerate when you first start to lift the bar, but acceleration quickly diminishes and deceleration starts as you stand above parallel. And the faster you attempt to lift the bar, the shorter will be the acceleration phase and the longer will be the deceleration phase.

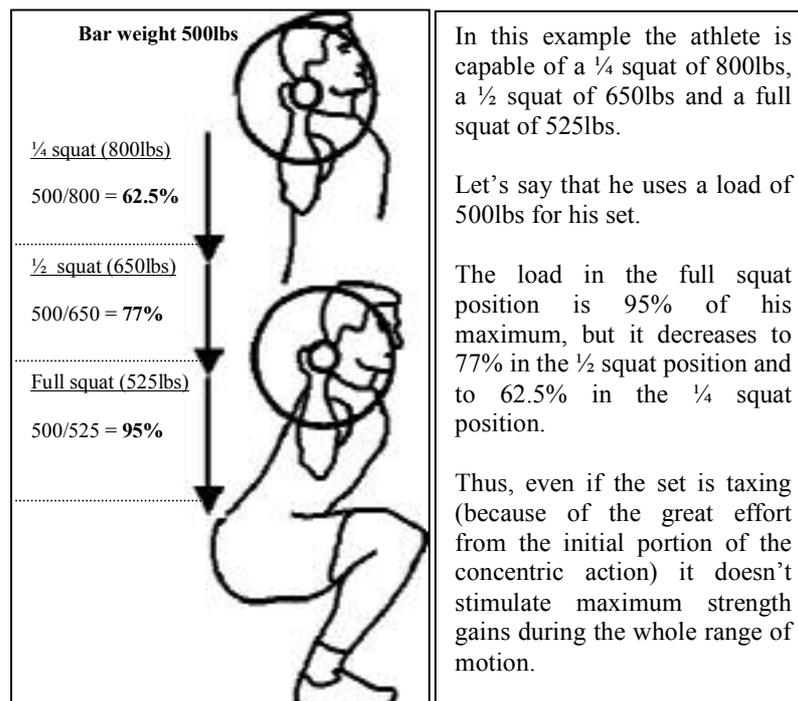


So by trying to go faster you actually are increasing deceleration! This can have a negative impact on your nervous system, which becomes better as decelerating than at accelerating. Furthermore, the deceleration period occurs in the sport-specific joint angles where acceleration is the most important! Sport-scientist D.G. Sale has demonstrated that it is the *intent* to accelerate the bar that is important rather than the actual speed of the bar that causes neural adaptations. Now, if you spend more time decelerating the bar than accelerating it, even if bar speed is fast, you learn bad motor habits.

This is where *jumpstretch* bands come in. These bands provide a lot of resistance. By attaching them to the bar when lifting you can significantly increase the load during the last portion of a lift. The benefit when acceleration is concerned is that the bands will actually decelerate the bar (because of the increase in resistance). So you will not have that preventive deceleration phase: the bar speed will slow down, but you will be able to try to accelerate it as much as possible because of the increased resistance. Basically even if bar speed becomes slower than during regular explosive lifting, the intent to accelerate is more important when using bands. This will lead to more sport-efficient motor patterns: basically learning to keep on accelerating rather than decelerating as you reach the strongest positions of the range of motion.

### Problem no.2: Loading not adapted to mechanical advantage

Another problem with regular lifting is that the load doesn't change during the movement. This is because you are lifting an object (in this case a free-weight) of a constant mass. The problem with this is that this constant load will not place a maximal stimulation throughout the whole range of motion. Let me explain: we all know that we're stronger in a quarter squat than in a half squat, and we're stronger in a half squat than in a full squat. This is nothing groundbreaking so far. But this means that the constant load will no provide the same impact during the whole range of motion.



The problem is this sort of lifting places the greatest overload in the initial portion of the lift because that's where the relative importance of the load compared to the strength at the specific joint angle is the greatest. However in a vast majority of sport actions the most important portion of the range of motion of a joint is that last ½ or last ¼ part. This part of the range of motion must be overloaded, but instead it is under loaded!

A possible solution would be to use partial movements in training, quarter squats, half squats, half bench, half deadlift, etc. However this also poses several problems, not the least being the development of strength imbalances.

Another solution is the use of bands, not only with explosive lifting but with heavy lifting as well. The *jumpstretch* bands can add anywhere from 25lbs to 200lbs of tension per band when fully stretched (depending on the type of band). This will allow you to place a significant overload where it counts, during that last portion of the exercise.

One problem remains with training quantification. How can we evaluate the load at various part of the movement? I feel that only two weights need to be noted: the weight in the bottom position and the weight at the top. But we still have to establish just how much resistance is added by the bands at those positions.

A simple way of estimating this is to set up the bands on the empty bar and use a scale. You unrack the bar as if you were going to squat. Then you stand on a scale in the top squat position and you note the weight (let's say 445lbs). Then you do the same thing in the bottom position of a squat (let's say 265lbs).

Now you have to remove the weight of the bar and your body from the values you noted. So if you weight 200lbs and the bar is 45lbs you remove 245lbs from the values noted.

- a. Band resistance at the top = 445lbs (total tension) – 245lbs (BW + bar) = **200lbs**
- b. Band resistance at the bottom = 265lbs (total tension) – 245lbs (BW + bar) = **25lbs**

So now you know that with the bands used there is an additional 200lbs at the top and 25lbs in the bottom position.

So if you are using a bar weight of 400lbs the resistance at the top would be 600lbs and at the bottom it would be 425lbs. Let's say that you perform 5 sets of 3 reps with that load, you write down the following in your journal:

**5 x 3 @ 600/425(400)**

Meaning that you did 5 sets of 3 reps with 600lbs at the top, 425lbs in the bottom from a bar weight of 400lbs.

Note that you should take the time to measure the resistance that the bands give you personally. A taller individual will have more resistance at the top than a shorter individual (the bands are stretched more). Similarly, depending on where you attach the

bands, the resistance may also vary. But remember that we always want to have at least some tension in the bottom position. It doesn't have to be much, but it should be more than bar weight.

### **Additional benefit of using the bands**

Another good thing that comes out from using the bands is the accentuated eccentric stress they provide. You see, the bands don't just add weight at various portions of the lift. They are actually trying to throw you down to the ground! Thus the bands try to increase eccentric acceleration. By controlling this yielding phase you are thus learning how to absorb and control an external force of an accelerative nature. Basically you become very efficient at breaking, controlling and reversing an external load. A fantastic asset for most athletes!

### **The three main methods of bands work**

We already explained much of what there is to know about the training methods used with bands. But just to make it clear, there are three main training methods to use:

1. **Accommodating resistance limit strength training** (max effort method)
2. **Max acceleration training** (dynamic effort method)
3. **Variable resistance training** (repetitive effort method)

The accommodating resistance method uses the property of the bands to overload the whole range of motion during a heavy lift: developing strength throughout the whole range of motion.

The max acceleration training method calls for moderate loads lifted with max acceleration. In that case the bands serve to limit deceleration.

Finally the variable resistance method allows you to perform many controlled repetitions with a moderate load while placing an important tension during the whole movement. This will stimulate hypertrophy much faster than regular weight lifting because the average loading during the whole movement is more important.

### **Conclusion**

Bands are a versatile tool that can be used to serve many different training purposes. However, just like with weight releasers, be careful not to overdo it at first. Bands place a very large amount of eccentric stress on the muscles and this can increase the time you need to recover from a workout.

# Part 6

# Training tools: Other effective training tools

*Boards, chains, kettlebells*

This chapter will discuss a few more training tools that you can use in the training of your athletes. I know that so far a lot of new info has been presented, and once you're done with this chapter there will still be more spinning in your head! Beware of the shotgun approach though. A lot of coaches wanting to design the best program in the world are quick to add a little bit of everything to their regimen, hoping that the sheer multiplicity of training means will equate big gains. This is not the case; in most instances you're much better limiting your program to a few limited methods and means at any one time, but rotating these methods frequently (but logically).

Hopefully you will not feel obligated to blindly include every single training method I described so far in this book. A much better approach is to understand the benefits and drawbacks of all the methods presented so that you can select those that will be of the most use to your athlete's needs.

That having been said we can go on with our discussion on various training tools. In this third chapter related to this subject I'll briefly introduce four training tools that you can use effectively. These methods should become the focal point of your training, but they can be a good addition as either supplementary or remedial training.

These four tools are:

1. **Kettlebells**
2. **Boards and boxes**
3. **Chains**

## **Kettlebells**

The following is from my good friend and world-renowned kettlebell training expert Mike Mahler. Mike has written an extensive training manual and produced a great DVD on kettlebell training including over 40 different exercises! I asked him to give me a quick rundown of the benefits of this very good training tool:



Mike Mahler is not only a great kettlebell instructor; he is a fantastic athlete who practices what he preaches.

As I always say myself, a coach should be able to do what he asks of his athletes: leaders lead from the front, not from the back.

1. **Kettlebells** have thick handles that turn every drill into a grip exercise and will make your grip and forearms much stronger.

2. The off centered weight with **kettlebells** works makes the weight harder to control and works more stabilizer muscles. Also, due to the off centered weight the tension is high through out each grind exercise. Try curling a **kettlebell** and it gets harder as you get to the top rather than easier.

3. There is a ballistic shock involved on exercises such as snatches and cleans in which you learn how to absorb the shock of the bell flipping over the hand. Great skill for athletes, especially combat athletes.

4. **Kettlebells** increase shoulder flexibility as the off centered weight pulls your arms back. Exercises such as windmills and Turkish get-ups work the shoulder from several angles and are great for rehab.



Patricia Smith performing a windmill



The Turkish get-up is one of the most challenging weight training exercise around!

5. You can do several exercises with **kettlebells** such as the bottom up clean, open palm clean and press, open palm snatch that are not possible with dumbbells. The bottom up clean is excellent for increasing grip strength.



Mike Mahler demonstrates a bottom up clean. This may seem like a simple drill, but it is very challenging and requires a lot of forearm and hand strength.

It's beside the scope of this book to go into details about kettlebell training. However, since I feel that they're a worthy training tool I felt obligated to include at least a brief explanation of the advantages of kettlebells. If you want to learn more, you can buy Mike's training manual and/or DVD. Both of which are available from his website ([www.mikemahler.com](http://www.mikemahler.com)).

### **Boards and boxes**

Boards and boxes serve one main purpose and that is to break the concentric/eccentric chain by rapidly halting the bar during the eccentric portion. This leading to a build-up in kinetic energy resulting in a greater strength potential. Another benefit of these tools (boards for the bench press and boxes for the squat) is that you can manipulate with great precision the range of motion of the exercise. For example, by using three boards stacked together (called a 3 boards press) you decrease the range of motion of the bench press by about 6". This allows you to overload the finishing portion of the movement.

Some peoples claim that simply performing partial lifts (e.g. half-squat, half-bench press) will do the same thing. Not true! You see, during a partial lift you have to decelerate the bar voluntarily before lifting it, this is good to develop deceleration strength and even isometric strength, however it is of limited use when trying to increase acceleration and power. To maximally increase those we need to develop our capacity to use kinetic energy to our advantage. The boards or boxes rapidly halt the eccentric portion without you significantly decelerating the bar, this results in a tremendous build up of kinetic energy which can be used during the subsequent concentric action. Basically board presses and box squats are very similar in effect to high intensity plyometric training.

For maximum effectiveness, you cannot stop on the board/box for more than 2 seconds, time after which the gained kinetic energy will be lost. Ideally the contact time would be shorter than one second, but you must still produce a lot of kinetic energy by avoiding simply "patting" the board/box; you must try not to decelerate too much: act as if the board/box didn't exist, lower the bar normally until the object suddenly stop the bar descent.

Obviously we don't want to exaggerate and "slam" into the board/box either. This will not bring any additional benefits and could actually increase the risk of injuries.

## Chains

An effective training method to use is the addition of chain links to a bar. The chains hang from the bar, and as the bar is lowered, the chains gradually pile up on the ground effectively unloading the bar of the additional weight. For example, if you use 50lbs of chains per side on the bench press and that half the chains are on the floor in the bottom position and none of it are on the floor at the top you have an overload of 50lbs at the top of the range of motion. This allows you to increase resistance at the strongest portion of a lift, making you work hard through all the range of motion to complete the lift.

Chains are often associated with *jumpstretch* bands because they are used to increase the load during the concentric portion of the movement, as you reach stronger joint angles.

However the chains and bands differ in one very important way: the bands are actually trying to throw down the bar toward you (bench press) or throw you down (squat). So basically the bands provide an eccentric acceleration component that must be countered via muscle action.

The bands on the other hand are only added weight. The more chains are resting on the floor, the less weight is added to the bar and vice versa. However, contrary to the bands, chains don't have that eccentric acceleration component. They simply allow you to increase the resistance during the movement.

This may not seem like much of a difference but in regard to the training effect we're talking about two entirely different methods. The following table will help you understand the difference:

Benefit	Bands	Chains
Increased loading at the strongest portions of the movement.	Yes	Yes
Helps prevent voluntary deceleration of the bar.	Yes	Yes, but less than bands
Increased eccentric stress.	Yes	No
Potentially increase kinetic energy.	Yes	No
Create an unstable environment requiring significant trunk stabilization (squat) or shoulders stabilization (bench)	Yes	No

### Increased loading at the strongest portion of the movement

We already established that chains and bands both increase the load as one progresses in the concentric portion of the exercise. Chains do this by being lifted off of the floor while bands do it by being stretched on the way up. Both methods are effective and should be experimented for best results.

### **Helps prevent voluntary deceleration of the bar**

This is one of the biggest benefits of the bands: their elastic properties effectively try to decelerate the bar during the concentric portion. This means that you can try to accelerate the load as much as you can during the whole range of motion without risking joint stress. Chains are less effective for that purpose because they lack the elastic component of the bands. The added load during the later parts of the concentric range of motion might help reduce the need to voluntarily decelerate the bar, but not to the same extent as bands.

### **Potentially increase kinetic energy**

The bands not only provide a variable load, but also a variable accelerative element. As we just saw, during the concentric portion of the lift, the bands will act to decelerate the bar. During the eccentric portion of the lift the opposite is true: the bands will accelerate the bar. This can have any one of two benefits: 1) increase eccentric stress if you try to lower the bar under control (which will help increase muscle mass) 2) increase kinetic energy accumulation if you let the bands accelerate your descent (which will have much of the same training effect as plyometric drills).

The chains don't do this because they are "dead weight" which doesn't have an accelerative component of its own.

### **Create an unstable environment requiring significant trunk stabilization (squat) or shoulders stabilization (bench)**

This is one of the lesser known benefits of bands: because of the elastic tension at the top position, it's hard to maintain balance. This can really help strengthen the trunk muscles (when squatting) and the shoulder girdle (when bench pressing). I believe that performing exercises this way can actually accomplish what other tools such as the Swiss ball and wobble boards only claim to do: help prevent injuries by improving stability.

Chains don't really do this, although when walking out with a squat bar the chains may move a round a bit, increasing the need to stabilize the trunk, but it's nothing compared to the effect of bands, which has to be experienced to be fully understood.

### **So...**

As you can see, bands carry a wider range of benefits than chains. This is why bands are discussed in a chapter of their own. However that doesn't mean that chains should not be used at all. You see, one of the characteristic of band training is the eccentric stress which is exponentially increased. This type of training requires a long time to recover from and is very hard structurally. So one should not use bands all the time or he risk overtaxing his body beyond its recovery capacities.

During periods where bands are phased off, chains can be used as a replacement method. They still bring you some of the same benefits as bands, but while placing less stress on the body.

I personally found that rotating every three weeks between 1) bands, 2) chains and 3) bar-only is the best approach to use in many cases.

### **Conclusion**

The most important factor in a training program is the proper application of the adequate training means and methods. The same tool might be perfect for one athlete, but useless for another. So one of the crucial jobs that a strength coach has is to pinpoint the exact needs of his athletes and select the proper training techniques accordingly. To do so the coach must understand exactly what each method consists of and what adaptations it can stimulate. Hopefully the preceding chapters helped you in that regard.

# Part 7

# The Integrated Training Plan



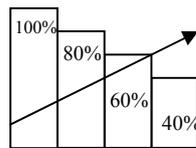
*How to design a training cycle using the modern methods of  
strength and power development*

## Using the block structure to facilitate program design

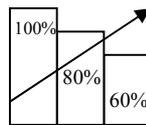
I personally like to design my training programs block by block. A block is a structural training unit lasting from 2 to 8 weeks in which the basic focus of the training process is the same. For example, in a maximal strength block you would put an emphasis on methods used to increase maximal strength. Contrary to the old periodization model, we still include all other types of work in the block to avoid losing any previously gained capacities.

Generally, I will use 4-weeks block or 3-week blocks. In the past I would stick to four weeks, but now find that three weeks is best, especially in advanced athletes. The way to structure block training is to go from structural methods to functional methods and then to specialization methods. I use the terms accumulation (structural), intensification (functional), and explosion (specialization) for my new blocks. Adding one block of each creates a training cycle.

I now use the following block structure (note that the column refers to volume while the arrow refers to intensity).



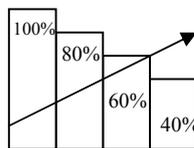
**4-weeks block**



**3-weeks block**

During the blocks volume is lowered in a step-like fashion (week 1 has the highest volume, 100%, and the volume of the other weeks is planned according to the first week). The last week of each block is generally a test week or at least a very high intensity week.

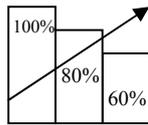
I recommend that an **accumulation block** last four weeks. Since we want to cause significant structural changes (increase in muscle mass and tendon integrity) we need at least that amount of time. An atrophied individual or a beginning athlete might require 2-3 such blocks in a row to start a training cycle. During a structural block we choose the training methods that have the highest impact on muscle mass.



### **Accumulation block**

- Post-fatigue method (concentric)
- Superslow eccentrics (eccentric)
- Yielding-iso for time (isometric)
- Medium intensity altitude landings (KEAT)

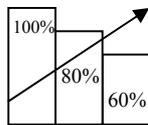
For an **intensification block** three weeks seems to be the best option. Most of the gains promoted by the methods used in this block are via neural adaptations, which occur very rapidly. Going on for more than three weeks with the same methods will not bring on continuous gains for most athletes. During this block we select training methods that have the highest impact on maximal strength improvement.



### **Intensification block**

Maximum lifts (90-100%) (concentric)  
Pure eccentrics (100-150%) (eccentric)  
Overcoming-iso for intensity (isometric)  
High intensity depth landings (KEAT)

For an **explosion block** three weeks is also optimal, once again because the gains are mostly due to neural adaptation. The methods we want to use in this block are those that improve power the most. Depending on the needs of the sport we may opt either for a speed-strength profile (lighter loads, more acceleration) or a strength-speed profile (relatively heavy load lifted as fast as possible).



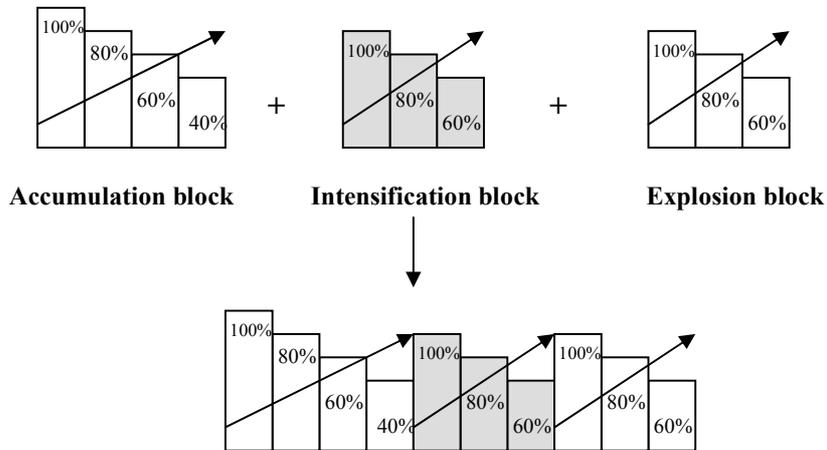
### **Explosion block**

Olympic lift variations (concentric)  
Overspeed eccentrics – bands (eccentric)  
Overcoming-iso for speed (isometric)  
Depth jumps for height (KEAT)

\*NOTE that during each block you still maintain the gained capacities. Meaning that during the accumulation block, intensification and explosion methods will still constitute 10-20% of the training volume and so on.

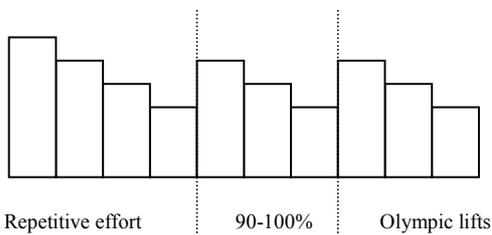
The last two weeks of a cycle can be a mini-peaking block, which has a week of super high intensity and moderate volume followed by a week of high intensity and minimal volume/frequency. A test or competition is done 2 days after the end of the block.

We can now understand the general design of our training cycle:

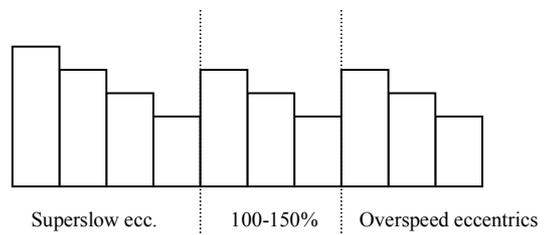


Note that this only gives you the basic plan of attack; you still need to plan the methods you want to use individually. I personally use 4 main methods per block (concentric, eccentric, KEAT, and isometric) and I plan the cycle for each of these individually (although I respect the same model for all methods).

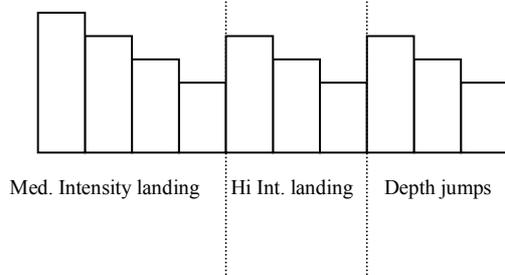
### 1) Concentric training



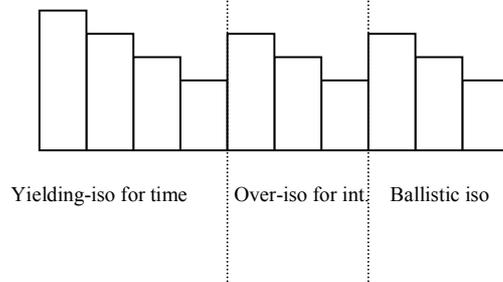
### 2) Eccentric training



### 3) Plyometric/KEAT



### 4) Isometric training



Obviously, this is just an example. You can use the methods that you want. The following table will help you make a good choice.

	Limit strength	Strength-speed	Speed-strength	Starting-strength	Reactive (absorption) strength	Hypertrophy	Strength-endurance
<b>ECCENTRIC ACTION</b>							
<i>Submax eccentrics</i>							
Ecc./Iso. contrast	X					XX	X
Ecc./Conc. contrast	X					XX	X
Superslow Ecc.						XX	X
<i>Near max/Max eccentrics</i>							
2/1 technique	XX	X	X		X	XX	
2 movements technique	XX	X	X		X	XX	
Pure eccentrics (95-100%)	XX				X	XX	
<i>Supramax eccentrics</i>							
Shock training			XX	XX	XX		
Overspeed eccentrics		XX	X	X	XX		
Pure eccentrics (100-150%)	XXX				X	X	
<b>CONCENTRIC ACTION</b>							
<i>Repetitive effort</i>							
Exercise to muscle failure	X					XX	XX
Post/Pre/Pre and post fatigue	X					XXX	XXX
Drop sets	X					XXX	XXX
<i>Maximum effort</i>							
Maximum lifts (90-100%)	XXX	X				X	
Heavy + manual overload	XXX	X		X	XX	X	
<i>Dynamic effort</i>							
Olympic lifts variations	X	XXX	X	X	XX		
Power load exercise (45-65%)	X	XX	XX	X			
Ballistic exercises		X	XXX	XX	X		
<b>ISOMETRIC ACTION</b>							
<i>Maximum duration</i>							
Overcoming-iso for time	X					XX	XX
Yielding-iso for time	X					XXX	XX
<i>Maximum intensity</i>							
Overcoming-iso for intensity	XX			X	X		
Yielding-iso for intensity	XX			X	X		
<i>Ballistic</i>							
Overcoming-iso for speed			X	XX	X		
<b>KEAT</b>							
<i>Depth jumps</i>							
Minimal coupling time			X	XX	XX		
Maximal jumping			XXX	X	X		
<i>Altitude landings</i>							
Medium intensity				X	XXX		
High intensity				X	XXX		
<i>Overspeed eccentrics</i>							
Bands		XX	X	X	XX	X	
Weight releasers		XX	X	XX	X		
<b>CONTRAST</b>							
Russian complex	XX	X	X	X	X	X	
Bulgarian complex	XX	XX	XX	XX	XX	X	
Ascending-Descending	XX	XX	XX	XX	XX	X	

We thus have our **general plan** for each type of training method. We now need to design a more specific plan in which intensity, volume, and exercise selection are included. Here is an example of how this can be done.

### Accumulation block

Day	Exercise	Week 1			Week 2			Week 3			Week 4		
Mon		Set	Reps	Load	Set	Reps	Load	Set	Reps	Load	Set	Reps	Load
	Bench press	4	10	75%	4	8	80%	5	6	85%	5	5	88%
	Back squat	4	10	75%	4	8	80%	5	6	85%	5	5	88%
	Rom. Dead.	4	10	75%	4	8	80%	5	6	85%	5	5	88%
	Military press	4	10	75%	4	8	80%	5	6	85%	5	5	88%
	Barbell row	4	10	75%	4	8	80%	5	6	85%	5	5	88%
Wed		Set	Reps	Load	Set	Reps	Load	Set	Reps	Load	Set	Reps	Load
	Close-grip bench <u>slow eccentric</u> (9s.)	4	5	70%	4	4	75%	5	3	80%	5	2	85%
	Leg press 2/1 technique	4	5/leg	70%	4	4/leg	75%	5	3/leg	80%	5	2	85%
	Leg curl 2/1 technique	4	5/leg	70%	4	4/leg	75%	5	3/leg	80%	5	2	85%
	Seated rowing <u>slow eccentric</u> (9s.)	4	5	70%	4	4	75%	5	3	80%	5	2	85%
Fri		Set	Reps	Load	Set	Reps	Load	Set	Reps	Load	Set	Reps	Load
	Bench press hold (sticking point)	4	40s.	60%	4	35s.	65%	3	30s.	70%	3	25s.	75%
	Back squat hold (parallel)	4	40s.	60%	4	35s.	65%	3	30s.	70%	3	25s.	75%
	Rom. Dead. Hold (below knees)	4	40s.	60%	4	35s.	65%	3	30s.	70%	3	25s.	75%
	Seated row hold (at sternum)	4	40s.	60%	4	35s.	65%	3	30s.	70%	3	25s.	75%

### Intensification block

Day	Exercise	Week 1			Week 2			Week 3		
Mon		Set	Reps	Load	Set	Reps	Load	Set	Reps	Load
	2 Boards press	6	3	90%	7	2	95%	Work up to maximum		
	Back squat	6	3	90%	7	2	95%	Work up to maximum		
	Deadlift	6	3	90%	7	2	95%			
	Push press	6	3	90%	7	2	95%			
	Barbell row	6	3	90%	7	2	95%			
Wed		Set	Reps	Load	Set	Reps	Load	Set	Reps	Load
	Bench press + weight releasers	7	1	80% 25%	6	1	80% 30%	5	1	85% 30%
	Back squat + weight releasers	7	1	80% 25%	6	1	80% 30%	5	1	85% 30%
	Eccentric-only deadlift	7	1	105%	6	1	110%	5	1	115%
Fri		Set	Reps	Load	Set	Reps	Load	Set	Reps	Load
	Ballistic bench press	6	5	20%	5	5	25%	4	5	30%
	Jump squat	6	5	20%	5	5	25%	4	5	30%
	Bench max intensity iso against pins (3 positions)	2 per pos.	6s.	N/A	2 per pos.	6s.	2 per pos.	2 per pos.	6s.	N/A
	Squat max intensity iso against pins (3 positions)	2 per pos.	6s.	N/A	2 per pos.	6s.	2 per pos.	2 per pos.	6s.	N/A

## Explosion block

Day	Exercise	Week 1			Week 2			Week 3		
		Set	Reps	Load	Set	Reps	Load	Set	Reps	Load
Mon										
	Push jerk	6	3	80%	7	2	85%	5	1	90%
	Power snatch from blocks	6	3	80%	7	2	85%	5	1	90%
	Speed bench press	6	3	50%	7	3	55%	5	3	60%
	Speed squat	6	3	50%	7	3	55%	5	3	60%
Wed		Set	Reps	Load	Set	Reps	Load	Set	Reps	Load
	Bench press overshoot	10	3	60% 30%	8	3	60% 35%	6	3	60% 40%
	Back squat overshoot	10	3	60% 30%	8	3	60% 35%	6	3	60% 40%
Fri		Set	Reps	Load	Set	Reps	Load	Set	Reps	Load
	Ballistic bench press	6	5	20%	5	5	25%	4	5	30%
	Jump squat	6	5	20%	5	5	25%	4	5	30%
	Depth jumps	4	10	N/A	3	10	N/A	2	10	N/A
	Depth push ups	4	10	N/A	3	10	N/A	2	10	N/A

# Part 8

## Special Topic: EMS for Sports



*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 little, if any, fatiguing effect on the CNS (Weineck, 1996;

Duchateau, 1993). This allows for a greater total workload and more adaptation without an increased risk of overtraining.

### Conclusion

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.

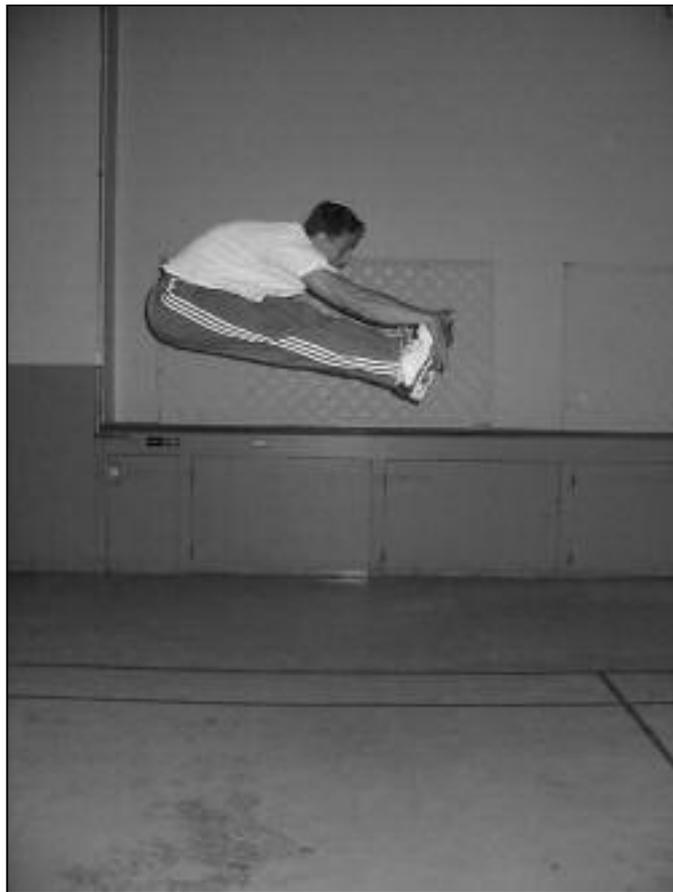
## **Conclusion on EMS**

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.

# Part 9

## Special Topic:

# Explosive Strength Exercises



*Exercise examples to spice up your power workouts*

In this section I will present a few good exercises that you can use to build-up your capacity to absorb force and display explosive strength. Obviously, I will not cover every possible exercise; if you understand the principles of KEAT training you can design several effective drills yourself. Those that I will present are very effective and will make a better athlete out of you!

### **1. Depth push-ups**



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. At the start your hands are placed on blocks and the feet are on the floor; your body is “in-line.”</li> <li>2. Quickly remove your hands from the blocks and let yourself fall to the floor.</li> <li>3. As soon as your hands touch the floor propel yourself into the air with a powerful push of the arms.</li> <li>4. Land back on the blocks.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep your body tight, do not let your hips sink down.</li> <li>2. As you land on the floor you must stick the landing, not sink down toward the floor.</li> <li>3. Imagine that the floor is burning; immediately push up as you touch it.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Reactive (absorption) strength</li> <li>2. Speed-strength</li> <li>3. Starting-strength</li> </ol>
<b>Target region</b>	Upper body pushing muscles

## 2. Depth push-ups with elevated feet (advanced version)



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. At the start your hands are placed on blocks and the feet are on another block; your body is “in-line”.</li> <li>2. Quickly remove your hands from the blocks and let yourself fall to the floor.</li> <li>3. As soon as your hands touch the floor propel yourself into the air with a powerful push of the arms.</li> <li>4. Land back on the blocks.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep your body tight, do not let your hips sink down.</li> <li>2. As you land on the floor you must stick the landing, not sink down toward the floor.</li> <li>3. Imagine that the floor is burning; immediately push up as you touch it.</li> <li>4. Your feet stay on the block at all times.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Reactive (absorption) strength</li> <li>2. Speed-strength</li> <li>3. Starting-strength</li> </ol>
<b>Target region</b>	Upper body pushing muscles

### 3. Ballistic bench press



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Lie down on the bench (using the Smith machine) and hold the bar at arms length with a shoulder width grip.</li> <li>2. Very quickly lower the bar to the chest.</li> <li>3. As soon as you reach the lowest portion of the movement you throw the bar up into the air.</li> <li>4. Catch the bar with stiff arms.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep your body stable; we only want to use the arms in this movement.</li> <li>2. Think minimum coupling time. <u>Immediately</u> after you reach the chest you must throw the bar quickly up into the air, don't wait!</li> <li>3. Use a load that is 10-25% of your maximum bench press</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Speed-strength</li> <li>2. Starting strength</li> <li>3. Reactive strength (reversal of the eccentric to concentric)</li> </ol>
<b>Target region</b>	Upper body pushing muscles

#### 4. Depth jumps front-to-back



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Stand up on a box/bench (0.5-1.0m). Your knees are bent at the angle you want to work (high catch: quads; mid catch: hamstrings; low catch: glutes).</li> <li>2. Let yourself fall off the box (do not jump) keeping the same knee angle.</li> <li>3. Land on the floor with the same knee angle as in the starting position.</li> <li>4. As soon as your feet touch the floor jump back onto the box.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep the knee angle stable.</li> <li>2. Do not let the heels touch the floor.</li> <li>3. The floor is burning! Jump up as fast as you can.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Reactive strength</li> <li>2. Starting strength</li> <li>3. Speed-strength</li> </ol>
<b>Target region</b>	Lower body muscles



**High catch**



**Mid catch**



**Low catch**

Landing positions for the depth jump.  
 Note that you land directly in these positions. You do not land and then squat down to reach the correct position.

## 5. Depth jumps back-to-front



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Stand up on a box/bench (0.5-1.0m). Your knees are bent at the angle you want to work (high catch: quads; mid catch: hamstrings; low catch: glutes).</li> <li>2. Let yourself fall off the box (do not jump) keeping the same knee angle.</li> <li>3. Land on the floor with the same knee angle as in the starting position.</li> <li>4. As soon as your feet touch the floor jump back onto the box.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep the knee angle stable.</li> <li>2. Do not let the heels touch the floor.</li> <li>3. The floor is burning! Jump up as fast as you can.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Reactive strength</li> <li>2. Starting strength</li> <li>3. Speed-strength</li> </ol>
<b>Target region</b>	Lower body muscles



**High catch**



**Mid catch**



**Low catch**

Landing positions for the depth jump.  
 Note that you land directly in these positions. You do not land and then squat down to reach the correct position.

## 6. Jump squat



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Stand up with a bar on your shoulders (as if you were going to squat).</li> <li>2. Lower yourself quickly into a quarter squat.</li> <li>3. As soon as you reach the quarter squat position jump up straight into the air.</li> <li>4. Land solidly and take time to reset properly before starting the next rep.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep the trunk upright. We want the legs to do the work, not the lower back!</li> <li>2. Minimal coupling time.</li> <li>3. Jump straight up.</li> <li>4. Use a load that is 15-35% of your max squat.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Speed-strength</li> <li>2. Starting strength</li> </ol>
<b>Target region</b>	Lower body muscles

## 7. Jump squat series



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Stand up with a bar on your shoulders (as if you were going to squat).</li> <li>2. Lower yourself quickly into a quarter squat.</li> <li>3. As soon as you reach the quarter squat position jump up straight into the air.</li> <li>4. Land in the quarter squat position and immediately jump back up.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep the trunk upright. We want the legs to do the work, not the lower back!</li> <li>2. Minimal ground contact time.</li> <li>3. Jump straight up.</li> <li>4. Use a load that is 15-35% of your max squat.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Speed-strength</li> <li>2. Starting strength</li> <li>3. Reactive strength</li> </ol>
<b>Target region</b>	Lower body muscles

## 8. Iso-ballistic jump squat



Pause 3-10 seconds

Pause 3-10 seconds

<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Stand up with a bar on your shoulders (as if you were going to squat).</li> <li>2. Lower yourself quickly into a quarter squat.</li> <li>3. Take a 3-10 second pause in the quarter squat position then jump up.</li> <li>4. You land straight in the quarter squat position and pause for 3-10 seconds.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep the trunk upright. We want the legs to do the work, not the lower back!</li> <li>2. Keep a solid position during the isometric pause.</li> <li>3. Jump straight up.</li> <li>4. Use a load that is 10-25% of your max squat.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Starting-strength</li> <li>2. Speed-strength</li> </ol>
<b>Target region</b>	Lower body muscles

## 9. Box jump squat (very advanced)



<p><b>Execution</b></p>	<ol style="list-style-type: none"> <li>1. Stand up with a bar on your shoulders (as if you were going to squat). A box/block is approximately one foot ahead of you.</li> <li>2. Lower yourself quickly into a quarter squat.</li> <li>3. As soon as you reach the quarter squat position jump up and forward onto the box.</li> <li>4. Land solidly on the box, and <u>step down</u> (do not jump off or let yourself fall off the box).</li> </ol>
<p><b>Key points</b></p>	<ol style="list-style-type: none"> <li>1. Keep the trunk upright. We want the legs to do the work, not the lower back!</li> <li>2. Minimal coupling time.</li> <li>3. Use a load that is 10-25% of your max squat.</li> </ol>
<p><b>Target capacities</b></p>	<ol style="list-style-type: none"> <li>1. Starting-strength</li> <li>2. Speed-strength</li> <li>3. Reactive strength</li> </ol>
<p><b>Target region</b></p>	<p>Lower body muscles</p>

## 10. Scissor split



<b>Execution</b>	<ol style="list-style-type: none"><li>1. Stand up in a shallow lunge position. One foot forward, one foot back. Your arms should be opposite your legs (running position).</li><li>2. Jump up into the air as high as you can.</li><li>3. In mid-air you switch the position of your legs.</li><li>3. Land solidly in a shallow lunge position.</li></ol>
<b>Key points</b>	<ol style="list-style-type: none"><li>1. Keep the trunk upright. We want the legs to do the work, not the lower back!</li><li>2. Switch the position of your legs as fast as you can.</li><li>3. Jump straight up and as high as you can.</li></ol>
<b>Target capacities</b>	<ol style="list-style-type: none"><li>1. Starting-strength</li><li>2. Speed-strength</li><li>3. Reactive strength</li></ol>
<b>Target region</b>	Lower body muscles

## 11. Jump lunges



<b>Execution</b>	<ol style="list-style-type: none"><li>1. Stand up in a shallow lunge position. One foot forward, one foot back. A barbell is on your shoulders.</li><li>2. Jump up into the air as high as you can.</li><li>3. In mid-air you switch the position of your legs.</li><li>3. Land solidly in a shallow lunge position.</li></ol>
<b>Key points</b>	<ol style="list-style-type: none"><li>1. Keep the trunk upright. We want the legs to do the work, not the lower back!</li><li>2. Switch the position of your legs as fast as you can.</li><li>3. Jump straight up and as high as you can.</li><li>4. Use 10-25% of your max squat or 30-40% of your max lunge.</li></ol>
<b>Target capacities</b>	<ol style="list-style-type: none"><li>1. Starting-strength</li><li>2. Speed-strength</li><li>3. Reactive strength</li><li>4. Strength-speed</li></ol>
<b>Target region</b>	Lower body muscles

## 12. Single-leg Bulgarian squat jump



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Stand with the front foot on the floor (knee at 45-90 degrees) and the back foot on a box.</li> <li>2. Using only the leg on the floor you jump up as high as possible.</li> <li>3. In the air, try to bring up your leg by activating the hip flexors.</li> <li>4. When you land back on the floor, immediately jump back up.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep the trunk upright. We want the leg to do the work, not the lower back!</li> <li>2. Really focus on bringing working leg up high, without bringing the torso down.</li> <li>3. Jump straight up and as high as you can.</li> <li>4. As soon as you hit the floor you must jump back up; minimal coupling time.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Starting-strength</li> <li>2. Reactive strength</li> <li>3. Speed-strength</li> </ol>
<b>Target region</b>	Lower body muscles

### 13. Step-up jumps



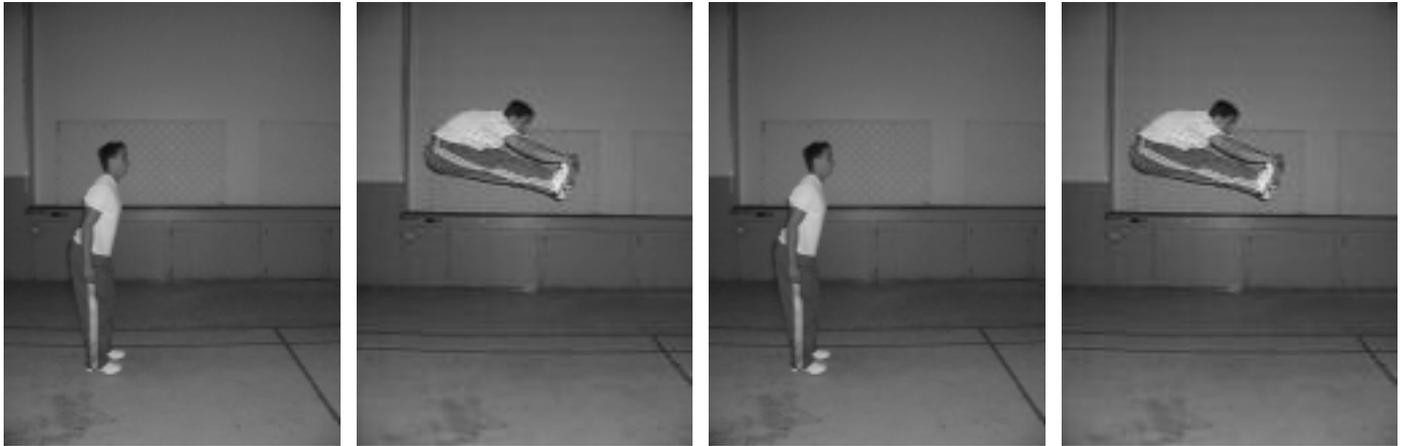
<p><b>Execution</b></p>	<ol style="list-style-type: none"> <li>1. Stand with the front foot on a box, the back foot on the floor. Your arms should be opposite your legs (running position).</li> <li>2. Jump up into the air as high as you can.</li> <li>3. In mid-air you switch the position of your legs.</li> <li>4. Land solidly with one leg (opposite as in starting position) on the box and one leg on the floor.</li> <li>5. As soon as you land you jump back up.</li> </ol>
<p><b>Key points</b></p>	<ol style="list-style-type: none"> <li>1. Keep the trunk upright. We want the legs to do the work, not the lower back!</li> <li>2. Switch the position of your legs as fast as you can.</li> <li>3. Jump straight up and as high as you can.</li> </ol>
<p><b>Target capacities</b></p>	<ol style="list-style-type: none"> <li>1. Starting-strength</li> <li>2. Reactive strength</li> <li>3. Speed-strength</li> </ol>
<p><b>Target region</b></p>	<p>Lower body muscles</p>

## 14. Sit jumps



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Sit down on a box. The height is such that the knees are approximately 90-degrees in the starting position.</li> <li>2. Using only your legs (as little center of gravity shift forward as possible) you jump up and back toward the box.</li> <li>3. Land solidly on the box and sit back down.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep the trunk upright. We want the legs to do the work, not the lower back!</li> <li>2. Use only your legs to jump up; minimize arm action and center of gravity shift.</li> <li>3. Jump as high as you can</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Starting-strength</li> <li>2. Speed-strength</li> </ol>
<b>Target region</b>	Lower body muscles

## 15. Hip flexor jump



<p><b>Execution</b></p>	<ol style="list-style-type: none"> <li>1. Stand up in an upright position.</li> <li>2. Dip into a quarter squat and jump up as high as possible.</li> <li>3. In mid-air, contract your hip flexors and trunk flexors hard to bring your legs up and your torso towards your legs; try to touch your feet. (<u>Note: a beginner's version can be done with the legs bent instead of kept straight</u>)</li> <li>4. Uncoil and land on your feet and then immediately jump back up.</li> </ol>
<p><b>Key points</b></p>	<ol style="list-style-type: none"> <li>1. Jump up as high as you can.</li> <li>2. Contract your hip flexors and trunk flexors as <u>hard</u> and as <u>FAST</u> as you can!</li> </ol>
<p><b>Target capacities</b></p>	<ol style="list-style-type: none"> <li>1. Starting-strength</li> <li>2. Speed-strength</li> <li>3. Reactive strength</li> </ol>
<p><b>Target region</b></p>	<p>Lower body muscles (great for hip flexor power and for improving stride frequency)</p> <p>Trunk muscles</p>

## 16. Single-leg altitude landing (low box)



<b>Execution</b>	<ol style="list-style-type: none"><li>1. Stand up on one leg on a low box (6-12”).</li><li>2. Let yourself fall off the box (a slight push-off with the ankle is ok).</li><li>3. Land on the floor solidly. As you land you must stick the landing, meaning that your body should not “drop off” after your feet contact the ground.</li><li>4. Hold the position in balance for 5-30 seconds.</li></ol>
<b>Key points</b>	<ol style="list-style-type: none"><li>1. Stick the landing!!!</li><li>2. Keep perfect balance at all times.</li></ol>
<b>Target capacities</b>	<ol style="list-style-type: none"><li>1. Reactive strength</li><li>2. Starting strength</li></ol> <p><u>* Great for developing the capacity to absorb force</u></p>
<b>Target region</b>	Lower body muscles

## 17. Single-leg altitude landing (high box/advanced)



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Stand up on one leg on a high box (18-24").</li> <li>2. Let yourself fall off the box (a slight push-off with the ankle is ok).</li> <li>3. Land on the floor solidly. As you land you must stick the landing, meaning that your body should not “drop off” after your feet contact the ground.</li> <li>4. Hold the position in balance for 5-30 seconds.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Stick the landing!!!</li> <li>2. Keep perfect balance at all times.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Reactive strength</li> <li>2. Starting strength</li> </ol> <p><u>* Great for developing the capacity to absorb force</u></p>
<b>Target region</b>	Lower body muscles

### 18. Single-leg altitude landing sprint stance (low box)



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Stand up on one leg on a high box (18-24").</li> <li>2. Let yourself fall off the box (a slight push-off with the ankle is ok). As you fall, you switch the legs and arms around.</li> <li>3. Land on the floor solidly. As you land you must stick the landing, meaning that your body should not “drop off” after your feet contact the ground.</li> <li>4. Hold the position in balance for 5-30 seconds.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Stick the landing!!!</li> <li>2. Keep perfect balance at all times.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Reactive strength</li> <li>2. Starting strength</li> </ol> <p><u>* Great for developing the capacity to absorb force</u></p>
<b>Target region</b>	Lower body muscles

### 19. High altitude drops (very advanced drill!!!)



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Stand up on an elevated surface (1.2-1.7m).</li> <li>2. Let yourself fall off (a slight push-off with the ankle is ok).</li> <li>3. Land on the floor solidly. As you land you must stick the landing, meaning that your body should not “drop off” after your feet contact the ground.</li> <li>4. Hold the position in balance for 5-30 seconds.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Stick the landing!!!</li> <li>2. Keep perfect balance at all times.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Reactive strength</li> <li>2. Starting strength</li> </ol> <p><u>* Great for developing the capacity to absorb force</u></p>
<b>Target region</b>	Lower body muscles

## 20. Whole body rebound push-ups



<p><b>Execution</b></p>	<ol style="list-style-type: none"> <li>1. At the start your hands are placed on blocks and the feet are on the floor; your body is “in-line.” Your arms are bent to maximally stretch the pectorals.</li> <li>2. Using both your arms and legs you project yourself up into the air. The arms must be kept slightly bent. The body must be “in-line” and parallel to the floor at its highest point.</li> <li>3. You land with the hands on the blocks and feet on the floor. Your hands and feet must land at the same time and you must land with bent arms (starting position).</li> <li>4. Immediately rebound upward as you land.</li> </ol>
<p><b>Key points</b></p>	<ol style="list-style-type: none"> <li>1. Keep your body tight and in-line at all times; do not let your hips sink down.</li> <li>2. As you land you must rebound up immediately.</li> </ol>
<p><b>Target capacities</b></p>	<ol style="list-style-type: none"> <li>1. Reactive (absorption) strength</li> <li>2. Starting-strength</li> </ol>
<p><b>Target region</b></p>	<p>Upper body pushing muscles</p>

## 21. Whole body rebound push-up + catch



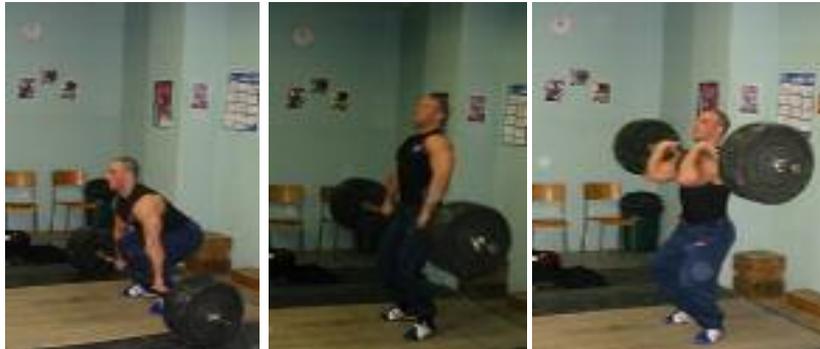
<p><b>Execution</b></p>	<ol style="list-style-type: none"> <li>1. At the start your hands are placed on blocks and the feet are on the floor; your body is “in-line.” Your arms are bent to maximally stretch the pectorals.</li> <li>2. Using both your arms and legs you project yourself up into the air. The arms must be kept slightly bent. The body must be “in-line” and parallel to the floor at its highest point.</li> <li>3. You land with the hands on the blocks and feet on the floor. Your hands and feet must land at the same time and you must land with bent arms (starting position).</li> <li>4. Immediately rebound upward as you land.</li> <li>5. On the last rep of the set you push yourself back and up and stick the landing with the elbows bent 90-degrees. Hold for 10-30 seconds.</li> </ol>
<p><b>Key points</b></p>	<ol style="list-style-type: none"> <li>1. Keep your body tight and in-line at all times; do not let your hips sink down.</li> <li>2. As you land you must rebound up immediately.</li> <li>3. Stick the landing on the last rep and hold the position without the hips sinking down.</li> </ol>
<p><b>Target capacities</b></p>	<ol style="list-style-type: none"> <li>1. Reactive (absorption) strength</li> <li>2. Starting-strength</li> </ol>
<p><b>Target region</b></p>	<p>Upper body pushing muscles</p>

## 22. Isoballistic push-up



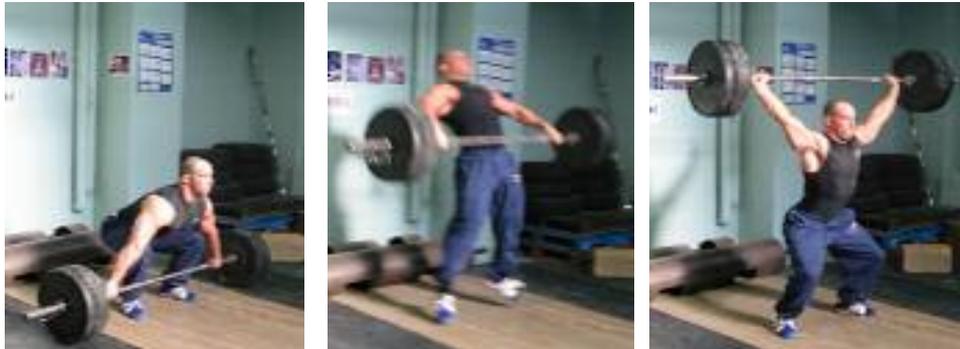
<b>Execution</b>	<ol style="list-style-type: none"> <li>1. At the start your hands and feet are on the floor in a regular push-up position.</li> <li>2. Lower yourself quickly down into a half push up.</li> <li>3. As your elbows reach 90-degrees immediately propel your upper body into the air using only your arms.</li> <li>4. Land with the elbows at 90-degrees and hold the position for 3-5 seconds before starting another rep.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep your body tight; do not let your hips sink down.</li> <li>2. As you land on the floor you must stick the landing, not sink down toward the floor.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Reactive (absorption) strength</li> <li>2. Speed-strength</li> <li>3. Starting-strength</li> </ol>
<b>Target region</b>	Upper body pushing muscles

### 23. Power clean from floor



<p><b>Execution</b></p>	<ol style="list-style-type: none"> <li>1. Feet are hip width, toes are turned slightly outward. Legs are flexed at the knee slightly (around 100-120 degrees). Trunk is flexed, back is tightly arched. Shoulders are in front of the bar. Arms are straight. Traps are stretched. Head is looking forward. Grab the bar with a shoulder-width grip.</li> <li>2. From the ground to the knees lift the bar under control while keeping a stable torso angle.</li> <li>3. At the knees explode upward with a powerful leg and back extension. The bar should be kept close to the body at all times. The traps contract forcefully to further accelerate the bar.</li> <li>4. Catch the bar in a quarter squat. Catch the bar on your shoulders and whip your arms around.</li> </ol>
<p><b>Key points</b></p>	<ol style="list-style-type: none"> <li>1. Think beach position: lower back arched, chest out and shoulders back at all times.</li> <li>2. From mid-thigh it is basically a jump.</li> <li>3. Keep the bar close to your body at all times.</li> </ol>
<p><b>Target capacities</b></p>	<ol style="list-style-type: none"> <li>1. Strength-speed</li> <li>2. Speed-strength</li> <li>3. Limit strength</li> <li>4. Reactive strength</li> </ol>
<p><b>Target region</b></p>	<p>Whole body</p>

## 24. Power snatch from floor



<p><b>Execution</b></p>	<ol style="list-style-type: none"> <li>1. Feet are hip width, toes are turned slightly outward. Legs are flexed at the knee slightly (around 90-110 degrees). Trunk is flexed, back is tightly arched. Shoulders are in front of the bar. Arms are straight. Traps are stretched. Head is looking forward. Grab the bar with a wide grip.</li> <li>2. From the ground to the knees lift the bar under control while keeping a stable torso angle.</li> <li>3. At the knees explode upward with a powerful leg and back extension. The bar should be kept close to the body at all times. The traps contract forcefully to further accelerate the bar.</li> <li>4. Catch the bar in a quarter squat. Pull the bar overhead in one motion, <u>do not</u> press it. You must catch it with your arms locked.</li> </ol>
<p><b>Key points</b></p>	<ol style="list-style-type: none"> <li>1. Think beach position: lower back arched, chest out and shoulders back at all times.</li> <li>2. From mid-thigh it is basically a jump.</li> <li>3. Keep the bar close to your body at all times.</li> </ol>
<p><b>Target capacities</b></p>	<ol style="list-style-type: none"> <li>1. Strength-speed</li> <li>2. Speed-strength</li> <li>3. Limit strength</li> <li>4. Reactive strength</li> </ol>
<p><b>Target region</b></p>	<p>Whole body</p>

## 25. Power clean from blocks



<p><b>Execution</b></p>	<ol style="list-style-type: none"> <li>1. The bar starts on blocks at the knees. Feet are hip width, toes are turned slightly outward. Legs are flexed at the knee slightly (around 130-140 degrees). Trunk is flexed, back is tightly arched. Shoulders are in front of the bar. Arms are straight. Traps are stretched. Head is looking forward. Grab the bar with a shoulder-width grip.</li> <li>2. At the knees explode upward with a powerful leg and back extension. The bar should be kept close to the body at all times. The traps contract forcefully to further accelerate the bar.</li> <li>3. Catch the bar in a quarter squat. Catch the bar on your shoulders and whip your arms around.</li> </ol>
<p><b>Key points</b></p>	<ol style="list-style-type: none"> <li>1. Think beach position: lower back arched, chest out and shoulders back at all times.</li> <li>2. From mid-thigh it is basically a jump.</li> <li>3. Keep the bar close to your body at all times.</li> </ol>
<p><b>Target capacities</b></p>	<ol style="list-style-type: none"> <li>1. Strength-speed</li> <li>2. Speed-strength</li> <li>3. Limit strength</li> <li>4. Reactive strength</li> <li>5. Starting strength</li> </ol>
<p><b>Target region</b></p>	<p>Whole body</p>

## 26. Power snatch from blocks



<p><b>Execution</b></p>	<ol style="list-style-type: none"> <li>1. The bar starts on blocks at the knees. Feet are hip width, toes are turned slightly outward. Legs are flexed at the knee slightly (around 130-140 degrees). Trunk is flexed, back is tightly arched. Shoulders are in front of the bar. Arms are straight. Traps are stretched. Head is looking forward. Grab the bar with a wide grip.</li> <li>2. At the knees explode upward with a powerful leg and back extension. The bar should be kept close to the body at all times. The traps contract forcefully to further accelerate the bar.</li> <li>3. Catch the bar in a quarter squat. Pull the bar overhead in one motion, <u>do not</u> press it. You must catch it with your arms locked.</li> </ol>
<p><b>Key points</b></p>	<ol style="list-style-type: none"> <li>1. Think beach position: lower back arched, chest out and shoulders back at all times.</li> <li>2. From mid-thigh it is basically a jump.</li> <li>3. Keep the bar close to your body at all times.</li> </ol>
<p><b>Target capacities</b></p>	<ol style="list-style-type: none"> <li>1. Strength-speed</li> <li>2. Speed-strength</li> <li>3. Limit strength</li> <li>4. Reactive strength</li> <li>5. Starting strength</li> </ol>
<p><b>Target region</b></p>	<p>Whole body</p>

## 27. Power clean from the hang



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. The bar starts at the knees while the lifter is holding on to it. Feet are hip width, toes are turned slightly outward. Legs are flexed at the knee slightly (around 130-140 degrees). Trunk is flexed, back is tightly arched. Shoulders are in front of the bar. Arms are straight. Traps are stretched. Head is looking forward. Grab the bar with a shoulder-width grip.</li> <li>2. At the knees explode upward with a powerful leg and back extension. The bar should be kept close to the body at all times. The traps contract forcefully to further accelerate the bar.</li> <li>3. Catch the bar in a quarter squat. Catch the bar on your shoulders and whip your arms around.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Think beach position: lower back arched, chest out and shoulders back at all times.</li> <li>2. From mid-thigh it is basically a jump.</li> <li>3. Keep the bar close to your body at all times.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Strength-speed</li> <li>2. Speed-strength</li> <li>3. Limit strength</li> <li>4. Reactive strength</li> <li>5. Starting strength</li> </ol>
<b>Target region</b>	Whole body

## 28. Power snatch from the hang



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. The bar starts at the knees while the lifter is holding on to it. Feet are hip width, toes are turned slightly outward. Legs are flexed at the knee slightly (around 130-140 degrees). Trunk is flexed, back is tightly arched. Shoulders are in front of the bar. Arms are straight. Traps are stretched. Head is looking forward. Grab the bar with a wide grip.</li> <li>2. At the knees explode upward with a powerful leg and back extension. The bar should be kept close to the body at all times. The traps contract forcefully to further accelerate the bar.</li> <li>3. Catch the bar in a quarter squat. Pull the bar overhead in one motion, <u>do not</u> press it. You must catch it with your arms locked.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Think beach position: lower back arched, chest out and shoulders back at all times.</li> <li>2. From mid-thigh it is basically a jump.</li> <li>3. Keep the bar close to your body at all times.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Strength-speed</li> <li>2. Speed-strength</li> <li>3. Limit strength</li> <li>4. Reactive strength</li> <li>5. Starting strength</li> </ol>
<b>Target region</b>	Whole body

## 29. Power shrugs



<p><b>Execution</b></p>	<ol style="list-style-type: none"> <li>1. The bar starts at the knees resting on blocks or in the power rack. Feet are hip width, toes are turned slightly outward. Legs are flexed at the knees slightly (around 130-140 degrees). Trunk is flexed, back is tightly arched. Shoulders are in front of the bar. Arms are straight. Traps are stretched. Head is looking forward. Grab the bar with a shoulder-width grip.</li> <li>2. At the knees explode upward with a powerful leg and back extension. The bar should be kept close to the body at all times. The traps contract forcefully to further accelerate the bar.</li> <li>3. Hold the completed shrug position for 2-3 seconds then return the bar to the blocks/pins.</li> </ol>
<p><b>Key points</b></p>	<ol style="list-style-type: none"> <li>1. Think beach position: lower back arched, chest out and shoulders back at all times.</li> <li>2. From mid-thigh it is basically a jump.</li> <li>3. Keep the bar close to your body at all times.</li> </ol>
<p><b>Target capacities</b></p>	<ol style="list-style-type: none"> <li>1. Strength-speed</li> <li>2. Limit strength</li> <li>3. Starting strength</li> </ol>
<p><b>Target region</b></p>	<p>Whole body</p>

### 30. Resisted side-to-side skate jumps



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Hold a therapeutic elastic band (low resistance) with your outer arm.</li> <li>2. Knees are flexed slightly (athletic position).</li> <li>3. Using only the outer leg, propel yourself sideways as explosively as possible.</li> <li>4. Land on the opposite leg and walk back to the starting position.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep the same torso angle at all times.</li> <li>2. Focus on fully extending the outer leg (knee and ankle).</li> </ol> <p><u>* Note that this drill can, and should, also be done without resistance (contrast method).</u></p>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Starting strength</li> <li>2. Speed-strength</li> </ol>
<b>Target region</b>	Lower body muscles

### 31. Resisted forward-angled skate jumps



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Hold a therapeutic elastic band (low resistance) with your outer arm.</li> <li>2. The outer leg is on the floor, slightly bent. The inner leg is lifted off the floor.</li> <li>3. Using only the outer leg, propel yourself forward and out as explosively as possible.</li> <li>4. Land on the opposite leg and walk back to the starting position.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep the same torso angle at all times.</li> <li>2. Focus on fully extending the outer leg (knee and ankle).</li> </ol> <p><u>* Note that this drill can, and should, also be done without resistance (contrast method).</u></p>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Starting strength</li> <li>2. Speed-strength</li> </ol>
<b>Target region</b>	Lower body muscles

### 32. Resisted goalie turnaround



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Hold a therapeutic elastic band (low resistance) with your outer arm. The torso is rotated outward.</li> <li>2. The outer leg is on the floor, slightly bent. The inner leg is lifted off the floor.</li> <li>3. We want to jump laterally and slightly forward. Initiate the movement by whipping the torso and hips inward then pushing with the outer leg.</li> <li>4. Land on the opposite leg and walk back to the starting position.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. Keep the same torso angle at all times.</li> <li>2. Focus on a powerful and fast torso and hip whipping action.</li> </ol> <p><u>* Note that this drill can, and should, also be done without resistance (contrast method).</u></p>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Starting strength</li> <li>2. Speed-strength</li> </ol>
<b>Target region</b>	Lower body muscles

### 33. Jump Stretch band triple extension (knee, hip, ankle)



<b>Execution</b>	<ol style="list-style-type: none"> <li>1. Loop a Jump Stretch elastic band around your foot and attach the other end to a stable post.</li> <li>2. The working leg is bent 90 degrees. The opposite leg is on the floor, slightly behind the center of gravity.</li> <li>3. Explosively kick the working leg down and back by using a powerful knee, hip, and ankle extension.</li> <li>4. Bring the leg back to the starting position as fast as possible and go again.</li> </ol>
<b>Key points</b>	<ol style="list-style-type: none"> <li>1. The objective of this drill is to do as many good triple extensions as possible in a set time period.</li> <li>2. The band will help you bring back your working leg at rapid rate, which will help you increase your stride frequency through motor learning.</li> </ol>
<b>Target capacities</b>	<ol style="list-style-type: none"> <li>1. Starting strength</li> <li>2. Speed-strength</li> <li>3. Reactive strength</li> </ol>
<b>Target region</b>	Lower body muscles

### 34. Forward medicine ball scoop



<b>Execution</b>	<ol style="list-style-type: none"><li>1. Grab a medicine ball with both arms.</li><li>2. Bring the ball between your legs by bending the torso forward, bending the knees, and bringing the hips far back (center of gravity moves back on the heels).</li><li>3. Explode upward by bringing the hips forward, extending the torso, legs, and ankles. Throw the ball forward as far as possible.</li></ol>
<b>Key points</b>	<ol style="list-style-type: none"><li>1. If you do this drill correctly your body should move forward at the point of release and you will land on the floor 2-5" further forward than in the starting position.</li></ol>
<b>Target capacities</b>	<ol style="list-style-type: none"><li>1. Starting strength</li><li>2. Speed-strength</li></ol>
<b>Target region</b>	Whole body

# Part 10

## Special Topic:

### Women and

# Strength Training



*Let's kill the myths!*  
*(originally published at T-mag.com)*

I'm the kind of guy who enjoys a good laugh and a good time. Most *T-mag* readers might find that hard to believe because it seems that I spend so much time answering questions on my *T-mag* forum, working on articles and books, and training athletes. With all of this going on, it doesn't seem possible for me to have a life.

I'll agree that I may not have much free time, but I couldn't live without my daily dose of humor. So I found a brand new way to amuse myself in the gym. I call this activity *humiliating the macho wannabes*.

Every gym in the world seems to be populated with several macho wannabes, guys who *think* that they're the living incarnation of motion-picture tough guys (despite quite a bit of visual evidence to the contrary). You know who I'm talking about; guys who act tough in the gym, especially when there are no "real" lifters/bodybuilders around to show them up.

They even "prey" on newcomers by acting superior and having a condescending attitude. In short, I can't stand them!

But I love to put these bozos in their place. Oh, I'm not talking about out-lifting them by, say, about a zillion pounds. They know I'm stronger than they are. No, what I'm talking about is a *real* lesson in humility. I have one of my *female figure skaters* train at the same time as these guys.

One particular girl is all of 16 years of age. As mentioned, she's a competitive figure skater and not what you'd call a physical beast. However, this gal has something special. In her spare time she also competes in Olympic lifting. As a result, she can clean and jerk what most of the macho boys can *deadlift* and she can power snatch what they *bench press*. And her deadlift... well, let's just say that the macho boys would probably need to add up their bench press and squat poundage to match her deadlift!

I tell you, seeing the faces on these guys when they see this 5'0" *little girl* completely destroy them in the gym is worth more to me than winning the lottery. Honestly, this is what I would define as a gigantic, hard and swollen *psychological* erection!

And you know what makes it worse for these bozos? The girl actually looks very feminine and is extremely pretty. If she were some kind of 240-pound hermaphrodite, then the former-macho-now-humiliated men could at least mock her to help themselves recover a little bit of their manhood (funny how insecure guys will always use the most insignificant detail to put you down in hopes of bringing themselves back up). But no, we're talking about a pretty, feminine, um... *proportioned* girl out-lifting them by a mile.

In the illustrious words of many popular sportscasters: "Owww, that's gotta hurt!"

Obviously this girl has a lot of potential and is a great athlete with a thorough sports background. So her performances are understandable. But there's a lesson in there ...women can get strong, muscular, and fit while staying incredibly attractive and

feminine. Women should not be afraid of lifting big weights and using typically (and wrongfully stereotyped) male/macho exercises such as the deadlift, squat, clean, jerk, snatch, etc.

In this chapter I'll explain why women are often afraid of what I call "serious strength training" and why they shouldn't be. I'll also explain the slight differences in planning the training program of female athletes compared to male athletes.

I'm not the biggest fan of feminist extremism; you know, the type that claims that men and women are equal in everything. This just isn't true! Men and women each have different strength and weaknesses as well as different needs. Their respective training programs should reflect this.



### **Why women are afraid of lifting big weights**

Since the dawn of time, big manly physiques and strength have been bonded together tightly, so much so that many women were led to believe that if they got stronger they'd build a big, bulky, manly physique. Those of us who are slightly more illuminated know that an increase in strength can be associated with neural factors as well as muscular factors. As a result, just because a woman gains a lot of strength doesn't mean that she'll look like Jay Cutler with hooters. Here's why:

First of all, most women have much lower testosterone levels than men. In fact, they have approximately 10 times less. Since testosterone is known to increase protein synthesis and muscle size, it seems evident that women would be much less likely to build up huge muscles than their male counterparts when using intense strength training.

I firmly believe that the neural factors involved in strength production are much less developed in female beginners than in male beginners. This is probably because, by tradition, young boys are more active. As a result, women will improve this function to a greater extent than men.

That's not to say that women can't build muscular physiques. Women can build muscle with training, but not to the extent of their male counterparts.

However, their potential for strength improvement is similar or greater than men's, mostly because of a beginning set-point that's lower than that of men. Trainer Jennifer Blomquist agrees that women can gain strength sometimes at a faster rate than men:

*I find this to be true, especially when the women get passed the "I don't want to get huge" mindset and they finally give it their all.*

It's obvious that most men have a hard time gaining 15-25 pounds of muscle in a year (in my opinion this size improvement will lead to significantly visible changes). So women should not be too worried about morphing into the Incredible Hulk!

I'd say that a woman can build 7-12lbs of quality muscle tissue in a year (once she's past the beginner level), which will give her a nice firm body! And to quote strongwoman competitor Patricia Smith:

*I do firmly believe that most women would look better with the addition of 5-10lbs of LBM anyways. And that the current trend of that too skinny look has just got to go!*

Jennifer Blomquist leans distinctly in the same direction when she talks about a woman's fear of getting too big:

*I used to tell my female clients that they weren't going to wake up one morning screaming "My God, I went too far at the gym yesterday and now I'm HUGE!!!"*

Another fear of women (and their *dimwit* personal trainers) is getting injured. I don't know why, but most people seem to think that women are more injury prone than their male counterparts. There is absolutely no data indicating that women are generally more susceptible to weight-training related injuries. We need to take this myth of the frail, fragile woman out to the curb!

However, in recent years we have noted an increase in ACL injuries in female athletes. This may indicate that women may be more prone to ACL injuries (because of the configuration of their hips and legs), or simply that women are now more active and thus the chance of injury is increased. This is yet another good reason to utilize strength training. Strengthening the leg muscles, especially the vastus medialis, will improve knee stability and thus reduce the risk of sport injuries to the knees.

### **Why women should strength train**

Women can greatly benefit from strength training.

Here are some benefits we can note:

1. Reduced risk of osteoporosis as a woman ages. The mechanical stress placed on the body structure during strength training (especially ground-based movements) will help increase bone density and prevent calcium loss and bone frailty in latter years.
2. Reduced risk of sport injuries. While women are no more prone to weight-training injuries than men, it's true that women who practice sports are often more prone to injury than their male counterparts. But this is probably because, by tradition, men have been involved in a more serious off-season strength training regimen, which can help reduce the risk of injuries. A woman who is heavily involved in sports has a much smaller chance of being injured if she trains seriously in the gym.
3. Change in body composition. With proper strength training a woman will add more lean body mass and will lose fat mass. Furthermore, including serious strength training while dieting down prevents loss of muscle, and as a result will prevent the "yo-yo" effect of regaining all the lost weight and then some!
4. More strength to use in daily chores or sport activities. If women gain strength in the muscles involved in their daily tasks, they'll have to use a lesser proportion of their available strength, and thus they'll perform their tasks more efficiently and with less fatigue accumulation.
5. Better in-and-out. Improving strength will enhance self-confidence and self-esteem and make a woman feel sexier and sleeker.



## How women should train

Parameter	How women traditionally train	How men should train	How women should train
Load (intensity)	Light (40-65%)	Moderate to heavy (75-100%)	Slightly lighter than men (70-95%)
Tempo	Super slow eccentric, slow concentric	Slow eccentric, fast concentric	Slow eccentric, fast concentric
Reps per set	High (12-20)	Low to moderate (1-10)	Slightly higher than men (3-12)
Sets per exercise	Low (1-2)	Moderate (3-5)	Slightly higher than men (4-6)
Exercises per session	High (5-6)	Moderate (3-5)	Moderate (3-5)
Type of exercises	Light isolation exercises	Emphasis on multi-joint exercises with some isolation work	Emphasis on multi-joint exercises with some isolation work
Frequency	2-3 times per week	3-5 times per week	3-5 times per week
Type of training plan	None, repeat same program over and over	Periodized with periods of loading and unloading	Periodized with periods of loading and unloading

The preceding table gives a good guideline when planning training programs for females. You must understand that women can lift relatively heavy weights, do a greater volume of work than believed by most (in fact they have a greater tolerance for volume than most men), and should focus on multi-joint exercises.

Basically, women should train almost exactly like men, with a few minor differences:

**1. Slightly more reps per set:** Women do not have the capacity to recruit as many motor units as men do. As such, they'll need 1-2 more reps to fully stimulate their muscles. So when training for strength, a man should use between 1 and 5 reps while a woman will benefit more from doing 3-6 reps. When training for muscle gains, men will benefit from doing 5-10 reps while women should stick to 7-12 reps.

**2. Slightly more sets per exercise:** The reason is the same as above. Most women will need to perform 1-2 more sets of an exercise to achieve the same degree of stimulation as a man, once again because of their lower motor unit activation.

**3. Slightly less intensity:** This is *not* to say that women aren't as strong as men. But since they need a few more reps and a few more sets, the relative intensity must be decreased a little to allow for proper progression.



### Good exercises

Since women have a lesser *starting* neural efficiency, I suggest using exercises that solicit the nervous system intensely. Complex movements such as power cleans from the hang/blocks/ground, power snatches from the hang/blocks/ground, lunges, deadlifts, squats, and push presses are all very good choices.

I believe that the Olympic lifts have two great benefits for women:

1. They aren't exercises in which you feel a localized pump. As a result women will not have the impression of bulking up. Obviously this is just a subjective and psychological benefit, but if it keeps them interested in training, it's all good!
2. They probably improve confidence and self-esteem more than any other lift. There is nothing more gratifying than picking up a weight from the floor and lifting it overhead in one powerful and swift motion.

Jennifer Blomquist told me:

*When I started doing the O-lifts, I experienced more joy and motivation about training than I ever had, and within a short amount of time my body has never looked or felt better or has been so damn strong!*

Women also benefit from doing ballistic work such as throwing medicine balls from various positions and jumping exercises. They should also include exercises for *problem areas* such as the triceps, glutes, hamstrings, vastus medialis, and abdominals.

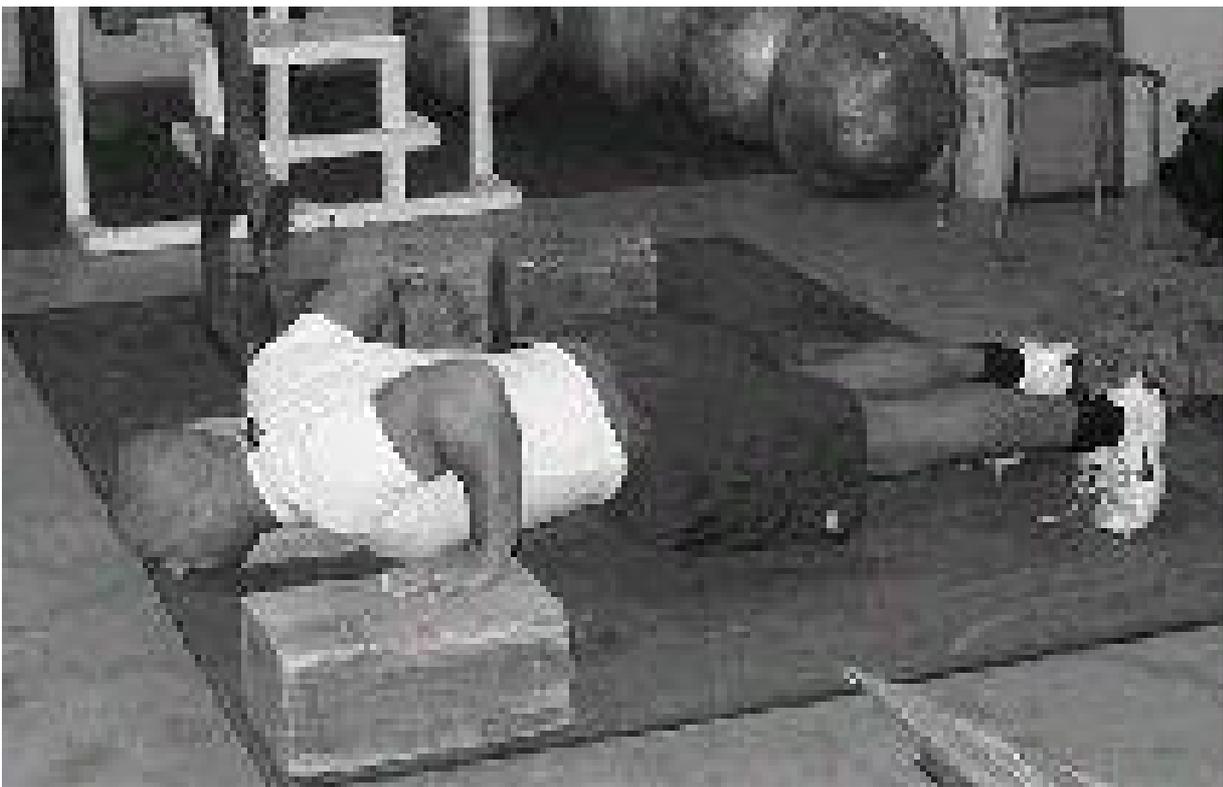
## **Conclusion**

There's a French movie called "*L'homme parfait est une femme comme les autres*" (The perfect man is a woman like any other). We could use the same title for this article: "The perfect woman is a man like any other," meaning that when it comes to training, both genders can and should train alike, with a few slight modifications.

Make no mistake about it, those Hollywood celebrity training videos have got to go!

# Part 11

## Special Topic: Eccentric Quasi- Isometrics



*Improving flexibility and performance*  
*By Tony Schwartz*

## Introduction

Eccentric quasi-isometrics (EQIs) (Siff 1994) are not your ordinary type of stretching. As such, they *may* be able to deliver results and benefits that you won't see with any other type of stretching.

Please notice that I say, “*may* be able to.” This statement is in reference to the fact that no direct research has been done on the effects of this specific type of muscle action. All of the information presented below is based on either published research on topics indirectly related to EQIs or on anecdotal evidence gathered from the real-world application of EQIs with athletes. Please make no mistake about it, the effects of EQIs have not been written about in many other publications. Thus, the information presented below is theory based on direct anecdotal and indirect empirical evidence.

## What are EQIs?

EQIs are essentially just what the name says:

**Eccentric:** The muscles are lengthening as they are contracting.

**Quasi-Isometrics:** The action is very slow (nearly static).

Strictly defined, EQIs are simply an eccentric action. However, the eccentric action takes place at such a slow rate that the term “quasi-isometric” is applied (EQIs can also be described as a yielding-isometric). The descriptive term “quasi-isometric” lets us know that the action is nearly isometric, because almost no movement takes place relative to the duration of the muscle action.

To better understand just what EQIs are, it is best that we take a look at an example.



EQI Push-up

In this example, the athlete is in a push-up position with his hands on blocks. This is the starting position. In this position, the athlete will attempt to hold an isometric contraction. As time goes on, the athlete will begin to fatigue. Because an isometric contraction is nothing more than a slow eccentric, the athlete will slowly start to “sink down” between the blocks. The athlete is still attempting to hold an isometric contraction, but it has turned into a very slow eccentric contraction.

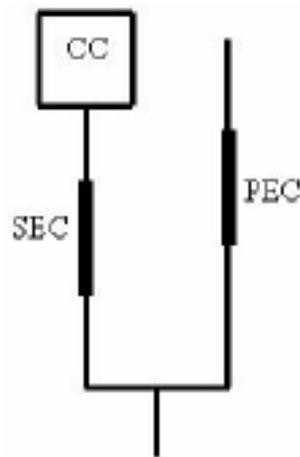
As the athlete sinks lower and lower, the muscles (and their associated connective tissue) begin to lengthen. The athlete continues to attempt an isometric contraction. This contraction in the lengthened state is where most of the benefits of EQIs are derived.

## Benefits of EQIs

As previously mentioned, EQIs offer a myriad of potential benefits that cannot be had with traditional stretching. These benefits include everything from injury prevention to increased lactic acid tolerance. Let's explore a few of these benefits in depth.

### *Primary Benefits*

With traditional stretching methods (static stretching of a relaxed muscle) primarily the parallel elastic component (PEC) of a muscle is stretched (Siff 1993; Tumanyan and Dzhanyan 1980; Iashvili 1982). Stretching of a contracted muscle will have a more pronounced effect on the series elastic component (SEC). To understand what this means, we must understand the difference between the PEC (made up of the sarcolemma, titin, and other structures) and SEC (made up of tendon and other structures).



Graphic adapted from "Tendinitis: its etiology and treatment" by Sandra Curwin and William D. Standish

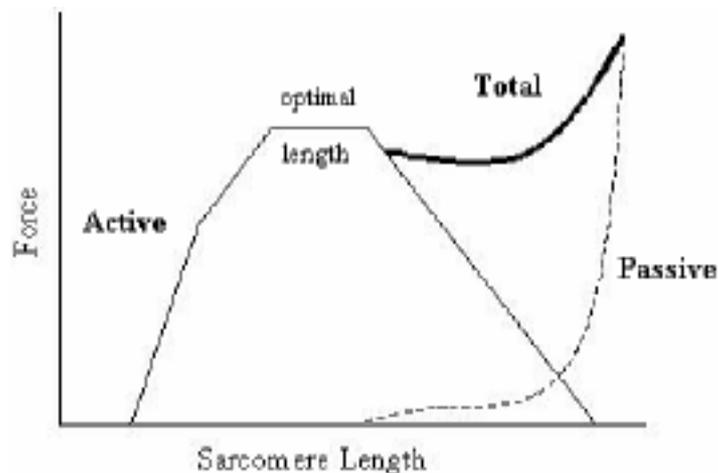
From the picture, we can see that the contractile component (CC) of muscle is "in series" with an elastic component (the SEC).

Having the SEC in series with the contractile component means that the SEC will be under tension when the contractile component produces tension (Levangie and Norkin 2001).

With the PEC things are a little different. The PEC is an elastic component of muscle that functions in parallel with the contractile component. This means that as the contractile component lengthens or shortens, so does the PEC (Levangie and Norkin 2001).

What does all this have to do with EQIs? Well, there are two types of tension, active and passive. The PEC is responsible for producing passive tension, while the contractile component is responsible for producing active tension. The total tension in a muscle is the sum of both active and passive tensions.

As the PEC lengthens it produces more and more passive tension. However, the contractile component of muscle has a specific range in which it produces the greatest amount of tension. If the contractile component is shortened or lengthened beyond this range, then the tension it produces will decrease. This is known as the isometric length-tension relationship (Levangie and Norkin 2001).



Graphic adapted from "Joint Structure and Function: A Comprehensive Analysis"  
3<sup>rd</sup> Ed. by Pamela K. Levangie and Cynthia C. Nixon

Let's go back and relate this information to our EQI push-up example. At the beginning of the action the athlete is producing tension with the contractile component of muscle. Since the SEC acts in series with the contractile component, the SEC is also under tension. However, since the athlete has not yet begun to fatigue and "sink down," the contractile component is not lengthened significantly and therefore, neither is the PEC.

As the athlete begins to fatigue and sink down, the contractile component begins to lengthen, and so does the PEC. At this point, both passive and active tensions contribute to the total tension.

This is one of the strengths of EQIs over other stretching methods. It allows the athlete to stretch both the SEC and PEC at the same time.

As mentioned before, with traditional stretching methods (static stretching of a relaxed muscle) primarily the parallel elastic component (PEC) of a muscle is stretched. If the emphasis is put on traditional methods of stretching, then primarily the PEC will become more flexible. This worsens the ratio of passive (which the PEC is responsible for) to active flexibility (which the SEC is primarily responsible for), which may cause a higher incidence of injuries in athletes (Iashvili 1982). In addition, increasing only passive flexibility will not improve dynamic flexibility (the kind needed in most sport actions) to a significant extent. Furthermore, Iashvili (1982) has shown that there is a greater correlation between active flexibility and sport achievement than passive flexibility and sport achievement.

Since passive static stretching primarily impacts the PEC, the SEC is left un-stretched. This is important to note because one of the primary applications of passive static stretching is to re-lengthen the muscle after work that involves contraction (i.e. strength-training). However, passive static stretching does not stretch the components of muscle that are involved in contraction! This is another reason why EQIs are superior to traditional stretching.

### *Secondary Benefits*

In addition to the injury prevention and SEC lengthening benefits of EQIs, there are several other benefits that they may offer:

**Shifting the length-tension curve:** As mentioned above, muscle contracts most effectively at a specific length. By putting your muscles into a quasi-isometric contraction in a lengthened position, you are requiring your muscles to produce force in an area of the length-tension curve in which they are typically weak. By doing this over and over again, it may be possible to shift this curve slightly, so that your muscles can produce greater force in a lengthened state.

**Strengthening the tendon:** Because eccentric training leads to more hypertrophy at the distal portions of the muscle (Seger et al. 1998), it is logical to believe that more stress is put on the distal ends of the muscle during an eccentric contraction. Consequently, this is where the tendons are located. In addition, Griffiths (1991) has shown that stretches at a slow or moderate rate occur entirely at the tendon. Combine this with the fact that EQIs put the SEC (of which the tendon is a major component) under tension, and it seems obvious that EQIs put a tremendous amount of stress and strain on the tendon.

It has been shown that changes in activity can promote subsequent changes in the structure and strength of connective tissue (Komi 2003; Hayashi et al. 1996). This is one of the reasons that EQIs have the potential to reduce injury. EQIs may also produce changes in the SEC that allow more elastic strain energy to be stored by the tendon.

**Strength transfer to all joint angles:** Unlike traditional isometric exercises, which only produce strength gains at the specific joint angle, EQIs produce strength gains at all joint angles. This is due to the fact that EQIs are done with the muscles in extension. Raitsin

(1974) showed that training muscles isometrically in a stretched position leads to a greater transfer of strength gains to all joint angles. In addition, EQIs are not a strict isometric contraction. Rather, they are a *quasi*-isometric contraction. Because of this, the muscles are trained at more than one joint angle, enhancing the carry-over to all of joint angles used.

**Hypertrophy and possible hyperplasia:** The work of Dr. Jose Antonio with birds has shown us that a prolonged, weighted stretch of a muscle can result in a 318% increase in muscle mass (Antonio and Gonyea 1993). In addition, this same study showed an 82% increase in fiber number. This study was performed on birds that were stretched for hours and days at a time however. The types of results seen in this study are not likely to be replicated with EQIs, but some hypertrophy (and possibly hyperplasia) may result.

**Lactic acid tolerance:** One peculiarity of EQIs is the fact that blood cannot effectively travel into or out of the muscle due to the strength of the contraction (assuming the strength of the contraction is great enough). This results in a build-up of metabolic by-products that cannot effectively be cleared from the muscle until the contraction has stopped. One of these by-products is lactic acid.

During many sports (basketball, hockey, etc.) it is common for a large amount of lactic acid to build-up in the muscle. Being able to tolerate this lactic acid build-up and continue contraction of the muscles is an important matter in these sports.

**Reactive hyperemia:** As mentioned above, during EQIs a tremendous amount of lactic acid and other by-products build-up in the muscle. However, when the contraction is completed the body attempts to wash all of these by-products out of the muscle. This is accomplished through a process called “reactive hyperemia.” During reactive hyperemia the blood vessels of the previously contracted muscles dilate. This transient phenomenon can be doubly beneficial if the blood contains large amounts of glucose, amino acids, and other nutrients that may aid in the muscles’ recovery from an exhausting contraction.

**Increase mental toughness:** Anyone who has ever done interval training, or any other type of work where lactic acid builds-up in the body, knows what a challenge it is to keep going when your body is telling you to stop. EQIs can present this same challenge. The difference is, there is nothing else to look at, nothing else to concentrate on. For an athlete, this can be a very effective tool to increase mental toughness and relaxation. If, while doing EQIs, you start to think about how hard it is and how you don’t want to go on, you are almost guaranteed to fail long before your body is done. However, if you can relax while your body is in tremendous pain, then you will be able to push your body to its true limits. This is an aspect of EQIs that is not often talked about, but it is also an aspect that may carryover to the playing field better than any other.

**Recognition of postural weakness:** One of the major determinants of a good training program is whether or not it addresses the individual weak points of an athlete. To do this however, either the athlete or his coach must first recognize what these weak points are. There are several ways to determine weak points (and there are various types of

weak points), but EQIs offer a distinct advantage over some of the other methods currently used to determine postural weaknesses during sport actions. Namely, EQIs are a nearly static (quasi-isometric) exercise. This affords the coach the opportunity to analyze an athlete's posture in sport-specific positions over a prolonged period of time. Effective analysis of posture during rapid dynamic actions without a highly trained professional and/or the use of special equipment (i.e. high-speed cameras) is nearly impossible.

Admittedly, the nearly static nature of EQIs is also one of the downsides to using them for postural analysis, as sports involve dynamic actions. However, EQIs can be an important weapon in the analysis arsenal, because more information about an athlete's condition can translate into the formulation of a more effective training program.

## **Practical Applications of Eccentric Quasi-Isometrics**

### *EQI Exercises and Performance*

EQIs can be done with nearly all the muscles of the body. However, it is best to select those muscle groups and sport actions that will benefit the most from the aforementioned benefits.

Some examples of EQIs:

- EQI Push-up (performed with hands on blocks)
- EQI Dip (performed on parallel bars)
- EQI Lunge (performed with feet on blocks)
- EQI 1-Leg Squat (performed with back foot on block)

The possibilities are endless.

In regard to the duration and intensity of EQIs, it is important to note that to reap all of the benefits mentioned above, duration must be emphasized. Because of this, intensity must be sufficiently low so as to allow sufficient duration of the muscle action.

However, while duration is favored over intensity, proper posture is emphasized above all else. As soon as posture begins to degrade, the exercise should halt. This is a small point, but is cannot be emphasized enough.

EQIs should be performed to muscular failure (or the aforementioned degradation in form) in order to get the most benefit. This is due to the fact that as you fatigue, you will sink lower into the stretch. The further (up to a point) the SEC and PEC stretch, the more benefit you can expect to see.

The time you can hold an EQI for is largely dependent on what exercise you are doing. However, as a guideline, I have provided a table below so that you can have an idea of how your athletes' performances rate. Again, keep in mind that proper posture must be

emphasized over duration. A long duration EQI with poor posture will not translate into good results, and may even have negative effects.

<b>Categorization of Performance in Multi-joint EQI Movements (Lunge and Push-up on Blocks)</b>	
<i>Time (seconds)</i>	<i>Category</i>
below 60	Poor
60-90	Below Average
90-150	Average
150-240	Above average
above 240	Excellent

### *Timing*

With such a wide-array of benefits it is possible to justify the use of EQIs at nearly anytime during a training session. However, I feel that the primary benefit of EQIs is the re-lengthening of contracted tissue. With this in mind, EQIs can be used before and/or after a training session.

#### **Pre-Training**

Since muscles are less compliant when they are contracted (Hawkins 2002), injuries are more likely in a contracted muscle. Using EQIs before a training session may prevent injuries during the session since EQIs stretch the SEC and PEC, resulting in a lengthened muscle. Remember that traditional stretching does not offer this injury prevention benefit because it only stretches the PEC. In addition, the duration of the EQI will be longer since isometric endurance is higher at the beginning of a training session due to a lower body temperature (Siff 2000).

Another added benefit of performing EQIs at the beginning of a session is that they may enhance the performance of the following dynamic work. Karaev et al. (1978) found that static work performed 5-8 minutes prior to dynamic work resulted in increases in reflex excitation (particularly beneficial prior to KEAT training), amplitude of muscle tone, maximal strength, and stride frequency (running). If used to enhance the following dynamic work, then the EQI action should not be taken to muscular or technical failure.

#### **Post-training**

Using EQIs after a training session will re-lengthen the contracted tissue. This is important because if the muscles are left in a contracted state, then blood flow to the muscle will be significantly reduced (Zatsiorsky 1995). This is bad news for those of you who are worrying so much about post-workout nutrition. If blood can't effectively reach the muscle, then how do you expect it to utilize the various nutrients in the blood to repair itself?

One of the first benefits people notice is that they are not nearly as sore the next day if EQIs are done after a training session. This is most likely because the muscles have been re-lengthened, allowing for optimal recovery. The implications of this are great. If the body can achieve complete recovery at a rapid rate, then more training sessions are possible in a given time-period. To further accelerate the recovery process, take advantage of reactive hyperemia by drinking your post-workout shake 15-30 minutes before doing your EQIs. This will provide the exhausted muscles with a large dose of the substrates they need to recover.

### *Periodization*

Due to the potential long-term benefits of EQIs (strengthening the tendon, shifting the length-tension curve, hyperplasia) it is beneficial to introduce EQIs early on in an athlete's training. However, this does not mean that EQIs must always be present in the training program. Like any other training methodic, EQIs must be periodized in order to reap the most benefits from them.

Keep in mind that strength is regime-specific. Because of this, EQIs must be developed individually. Left untrained for too long, your strength in EQI exercises will decline even though your performance in other exercise regimes may increase.

### **Conclusion**

Traditional stretching has recently been looked down upon, and rightly so, by many as being ineffective at promoting flexibility during dynamic sporting actions, as well as being ineffective at relieving muscle soreness. While both of these criticisms are valid, traditional stretching has often been removed with nothing to take its place.

EQIs not only do a better job of enhancing dynamic flexibility and relieving muscle soreness, but they offer a myriad of other benefits to the strength coach and the athlete who are willing to put in the hard (and painful) work involved.

# Part 12

## Conclusion



*Parting words*

### **Our journey comes to an end...**

Hopefully you have added quite a few tools to your toolbox in the process. I sincerely believe that you are better equipped to deal with high-level athletes and design training program that will produce freaky results.

Always remember that idiocy is doing the same thing over and over and expecting different results! This book has provided you with a myriad of ways to skin the proverbial cat. If you can make the best of it you will raise your level of performance or professionalism by a few notches.

Be assured that all of the info presented in this book is backed both by science and practice; so it's now up to you to reap the benefits that await you!

If you need some support don't hesitate to contact me at the\_beast@t-mag.com. It will be my great pleasure to be of some assistance to you, either as an athlete or as a fellow strength coach!

Yours in strength,

Coach Christian Thibaudeau



