

Pain and Tension – Two Important Keys To Muscle Growth



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No More Comfort

Relief is another term that must be clarified. Webster's defines it as the removal of something oppressive, painful, or distressing. Why is this concept important you ask? Because I intend on eliminating it completely. The following methods are devoid of any comfort. In fact, I have none to give. But I will say this, you will grow, which is why you entered hyperplasia magazine in the first place.

Tension Under The Microscope

When devising a plan of attack, one must take each aspect of the opposition into mind. This is our aim, and we begin by analyzing the concept of tension.

While performing the bench press, the force which your contracting muscles exert against a barbell is defined as tension, where as the force which is exerted against the muscle, by the barbell is called the load. – [Quote Biomechanics And Sport – An Introductory Viewpoint](#)

From the above quote we can conclude that tension and load are opposing forces. I would also add that contraction can be defined as the actual tension that is produced as myosin thick filaments bind to actin binding sites. If you have not yet read my articles on this subject I will briefly explain. A muscle is made up of long cylindrical units called muscle fibers. These are made up of units capable of contracting. In its simplest form, these units are called thick and thin filaments. Thick filaments can bind to thin filaments and form tension. Think of it this way. If you pick up a dumbbell, your hand binds to its shaft, if this did not occur then the dumbbell would fall to the ground. The principle is similar, when a load, such as a barbell is in your hand, you need to be able to support that load. So, myosin thick filaments bind to actin thin filaments, producing an opposing force. For further discussion on this topic

I would recommend reading the [anatomy of a muscle](#), and my article on the [all or none principle](#).

What needs to be realized is this: " The more myosin heads that bind with actin, the more tension is built up. Just like in a tug of war, the more people at the end of a rope, the greater the force on that end.

My main concern in this article however is to define a variety of contractions. Again, this is defined as the occurrence of tension building properties within a muscle.

The best way to understand varying contractions is to compare and contrast muscles in a laboratory environment. In such a situation, there are two ways to test muscular contraction. When a muscle is detached from the body, we call this an in vitro protocol. Such a set up is extremely useful, as it provides extremely stable conditions, devoid of joints, and unnecessary angles. When a muscle remains in the body, such as is performed on human experimentation, the protocol is performed in vivo(in life).

By comparing and contrasting the two, you will grasp in much greater depth exactly what is occurring while lifting a weight, and in addition how to manipulate these physiological parameters to reap maximum stimulatory effects(i.e. heightened growth).

Isotonic Vs. Dynamic Contraction

Isotonic Contraction - In Vitro, a muscle group can be clamped at both ends, and thus controlled. For example, if you took the biceps brachii and were able to clamp it at the top, so that it hung in the air. Then following this, you attached a load to its bottom, you would create a clean, up and down atmosphere in which the muscle could contract.

In these optimal conditions, you could electrically stimulate the muscle to contract. As it shortened to move the load, tension would be constant, if all outside variables are eliminated. Such an occurrence looks like this.

- A. The muscle builds enough tension to support and overcome the load.
- B. It is able to shorten, as thick filaments slide thin filaments over them
- C. No outside force obstructs this, therefore no new amount of tension needs to be produced.

D. Iso = Same Tonus = Tension

Dynamic Contraction – In Vivo, it is almost an impossibility to perform an isotonic contraction. In order to understand this, you must consider a concept known as “torque.” Our body can be broken into distinct segments. The Upper arm, more correctly referred to as the arm, articulates, or forms a joint with the lower arm or forearm. When you flex(decrease the angle between two body parts) at the elbow joint, you flex your forearm, bringing it closer to your humerus(arm bone). An axis is defined as a straight line about which a body or a geometric figure rotates. Therefore, a body part rotates around its joint axis. The force which is used to cause this rotation is known as torque. As you know, the force required to move the bone, changes through the specific range. I will further explain this relationship in future articles. However, the point is this: In a barbell curl, as the weight is curled, varying amounts of tension must be applied to maintain your ability to move the load. Therefore tension does not remain constant, but is rather dynamic, or in a **continual state of flux**. Here is a brief summary:

- A. Dynamic Tension, is also Referred to as Isotorque
- B. In Life, you must rotate a body segment around an axis, thus calling for varying levels of tension, unlike a controlled in vitro experiment.
- C. Change in muscle length also effects this variable.

Positive Work Vs. Negative Work

In both of the above examples, a muscle can perform both positive and negative work. Work, is of course defined as force \times distance. The first domain we will deal with is concentric contraction. During such an occurrence, force produced by muscular tension overcomes a particular load, this is known as positive work. Isotonically, the tension never varies once the load is overcome, however Dynamically as we have seen this does change, though the load remains constant. Therefore, concentric contractions, are your petal to the medal. Just as you step on the gas to make yourself go faster, you use positive work to accelerate your body, or a load.

A very important concept to introduce is one known as negative work. Here, the external load, actually assists the muscle in lengthening. The muscle still produces force, and the load is still moved, but it is negative work. Keep the concept of assisted lengthening in mind, because we will use it for a sure fire shocking technique latter in this article! Such contractions are used by athletes to decelerate, much like breaking while in your vehicle. When we refer to these throughout the article, we will do so dynamically.

Isokinetic Contractions

The term kinetic refers to motion. Isokinetic refers to an exercise which maintains a constant, or same velocity throughout. This again, would be more accurately used in vitro, and under more controlled conditions. In vivo, velocity does change due to changes during rotation. However, the rate at which joint displacement takes place can be regulated, even in Vivo. Thus, the term isokinematic(remember kinematics refers to space and time) is more appropriate. It is not what is used by most

trainers however, therefore to stay within this frame we will use the term isokinetic. And in doing so, we are referring to a contraction, in which the rate of a concentric or eccentric movement is constant. If you were to therefore lift a weight 5 inches, in 5 seconds, you would move an inch per second. Consistency is the key.

Isometric Vs. Static Contractions

Isometric – As the name implies(metric), this implies a build up of tension, devoid of work.

Force X Distance(0) = Work Done = 0 (Load is not overcome)

Therefore, though tension is developed, no shortening in the muscle group occurs.

Static – The properties of your muscles, the connective tissue which binds them, the tendons anchoring them, and the ligaments joining bones together are elastic. Meaning, when you train, and you attempt to contract against a load without moving, you are unsuccessful. That is-a small amount of shortening actually does take place, but it is not appreciable, and also not rather noticeable. Therefore, static is a more proper term used in Vivo. In Vitro a muscle can be clamped and completely anchored so as to eliminate any shortening.

Manipulation of The Above Concepts

Now for the pain aspect of this article. Our intension is to apply the above concepts in order to maximize growth. Before moving on, it is vital that you understand them.

Eccentric-Static-Concentric Coupling

It is a well known fact, that higher levels of force can be produced during certain portions of a repetition then others. This is based highly on the total amount of cross bridges formed between myosin heads and actin binding sites.

Lowest To Highest Force Production

1. Concentric contractions produce the least amount of force. This is due to the fact that only half of the available cross bridges cycle. Ccs are also the most energy costly of the three phases discussed.

2. Static contractions can sustain greater poundages. In order to understand this, you must realize the nature of such contractions. You see, tension actually builds as you engage in such a movement. More and more myosin heads bind to actin binding sites, until so many are bound that shortening is eliminated! As you recall this is what creates the force produced by the muscle, and consequently it is much higher than its accelerating counterpart.

3. Eccentric Contractions can handle the highest loads, and are the most energy efficient. The key to understanding this again lies in cross bridge cycling. You see, though many of the cross bridges do not actually cycle during eccentric training, they are pulled backwards. This means that myosin heads cannot move forwards. In order to shorten, the myosin head, like an oar you use to paddle a boat must come out of the water and cycle forward first before a power stroke backward is used to propel your boat forwards. During lengthening this does not occur, meaning that the myosin does not come forward but rather remains bound to the actin. As the eccentric phase continues, more and more myosin-actin cross bridges are formed without subsequent forward movement, and therefore more tension is able to be produced(force).

Re-imagine yourself in that boat. What is easier, to pull your oar out of the water to stroke, or to just leave it in the water? Obviously the latter, and it is the same concept. Tension is able to build to much greater levels and use no where near the energy required to produce it.

Let The Pain Begin!

With this knowledge it is easier to see why eccentric exercise is more energy efficient. Not only are fewer muscle fibers recruited, but less atp is used due to the non cycling fibers(A good illustration is found when sprinting up a hill as opposed to going down it).

If one can handle heavier loads within specific ranges of a lift, then it would be of great benefit to use such knowledge to optimally overload the target muscle group.

I call the following method, optimal force or ETC coupling. Here is how you execute it.

Version A

A. Choose your normal target weight for a particular exercise. Lets use the Bench Press as an example

B. You will concentrically accelerate the weight upwards. (1-2 second lift)

C. When you reach the top range of motion, your training partner will increase the resistance by pushing down on the weight. You will resist for 1-3 seconds

D. This will be followed by an eccentric contraction, In which your partner will further increase the resistance on the bar

E. You will begin again, with only the original weight as your resistance. With partner's assisted resistance once again applied statically and eccentrically.

Version B

The following is based on energy expenditure and force production. It is meant to isolate separate aspects of the lift, so as to reap optimal benefits from each.

A. You will utilize concentric super overload here. This means that you only perform concentric contractions to absolute concentric failure. Your partner will take the negative portion of the rep, and you will not focus on the static(peak) contraction.

B. This is followed by 30-60 seconds of pure static contraction.

C. Upon completion have your partner spot you concentrically, while you take the eccentric load(they lift the weight for you, while you lower it). Continue until negative failure is reached!

The above methods maximize workload, cross bridge formation, pain and of course muscular growth.

Hyperplasia Prying Method – Underground Shock Training At Its Best!

This ain't hypertrophy specific, its hyperplasia specific! Throw your genetic preconceptions out of the window! First, I need to state that this is a very hardcore training method. I must warn you, warming up is an extreme necessity! You should be thoroughly stretched, and have broken an excellent sweat.

I need you to once again examine a normal eccentric repetition. During such a phase you " voluntarily " lower the weight under control. As discussed you are performing negative work, and it is important to realize this: the load is assisting the muscle to actually lengthen, i.e. filaments are being pulled apart.

The prying method increases the assist aspect. It is a fact, that lengthening exercises cause the highest homeostatic disruption in a muscle group. We take it to a new level here. Instructions are as follows:

A. Choose an exercise. Here we use pull-ups an an example

B. When you reach the top of the movement you will not lower yourself

downwards. Instead you will be forced downwards! This means that your partner will pull you down, as you fight to resist him. Normally, you would voluntarily move with him, even if you did provide great resistance, it would still be to some extent voluntary on your part. This is not the case within this method! You must not allow him to pull you down. That is why this is called the prying method. You are forcing the eccentric contraction here, not voluntarily lowering the weight!

Again, this is an extreme training method. And you will need to be warm, carbed up, and allow plenty of recovery time, as much micro trauma will occur.

Additional Guidelines For Methods Use

Because this is an extreme method, a tempo should be set. In other words, the training partner applying pressure must control his prying technique. It should be a slow and painful process lasting 4-10 seconds. If you can overpower your partner, do not rip their arms off! You are prying, but it must be done with caution.

Ground Zero Method

Abc's own super moderator Venom introduced this number to me. He calls it ground zero because of the extreme stabilization disruption produced by it. I liken it to moving from a machine to a free weight station in immediate transition. We will again use the bench press as an example

- A.** You will choose an extremely light weight here. If you normally can bench 250 10 times you will choose 135 here instead.
- B.** Your partner will resist you on each concentric contraction only(meaning they only add extra resistance on the up phase of the lift, which is the most taxing, aspect energy wise in the exercise).
- C.** As you weaken, he or she will lower the tension
- D.** When you can no longer take your partners resistance, they will release the weight, and you will pump as many extra reps as you can. Here's what you will find. The resistance provided by your partner provides a constant tension type of feeling, as if you were performing bench presses on the smith machine. As soon as they release the load, you will be in free weight mode again. Your stabilizer muscles will kick into gear, and as they do so you will experience what venom calls GROUND ZERO! It is at this time when disarray causes your arms to shake like leaves blowing in the wind! A concept which is almost unavoidable. As your nervous system catches on, the shake ends, but the stimulus for growth continues well into the next several 24 hour periods!

Relentless Tension Method

As discussed above, torque is the varying tension produced to rotate a limb around a joint axis. The amount of tension varies throughout the lift. There are two points that we will examine within a lift:

1. The first is the bottom portion of the rep. During this phase, the weight has been decelerated. Take the barbell curl, when the weight is lowered, the biceps no longer have to support the load, and they are relieved momentarily from their duty.
2. On the up phase, much of the tension is shifted on a number of exercises. For example, on the barbell curl, we tend to shift the weight to the anterior deltoids and lower back.

The relentless tension method takes care of these two aspects by eliminating them. Thus, you will stop approximately 5-10 degrees before the weight is completely lowered, and also fully lifted. Such a method is optimal for blood pumps. Try performing 40 repetitions on the leg press or extension machine with no release in tension. It will be a workout you won't soon forget, guaranteed.

The second way to manipulate such a method is to eliminate just one aspect of the movement. Take the dumbbell fly for example. The whole point of the exercise is to emphasize the stretch, and to not only stretch the fascia, but also add sarcomeres in series. The same can be applied to sissy squats and preacher curls. Emphasizing the stretch has been shown in countless studies to boost hypertrophy to unfathomable heights!

Isokinematic Contractions Utilized

Isokinematic contractions factor in the rate at which a repetition is performed. In the strictest sense, the entire rep, from eccentric to concentric should remain constant from start to finish. The following is also referred to as the isotempo method. It is important to realize that training adaptations are based on homeostatic disruption. As Old School has discussed, change is a vital tool in achieving this desired effect. When I say change, I am not simply referring to repetition range, and exercise selection, but also to tempo. Indeed, the rate at which you lift a weight will most definitely effect the outcome. Isotempo training is simply a tool of the trade. A shocking method if you will, and one which will give you that much needed edge.

Basic Isotempo Guidelines

1. For nervous system Adaptation and Fast Twitch IIB fiber stimulation, you will choose a weight that does not exceed 20 seconds. This is mainly a tool for strength gains.

2. For Hypertrophy of both fast IIB and IIA fibers the set should last from 30-70 seconds
3. Above This will build mitochondrial density in IIB and IIA and target slow twitch Fibers.
4. Choose weight that will cause you to fail in the desired time range. If this is a barbell curl, and it lasts 32 seconds, you will then divide the time into equal segments. Meaning the eccentric portion will mirror the concentric portion. Your partner will count for you. Thus, if you decide to choose a two second tempo, then you will lower the weight in two seconds, and raise it in two seconds. This is a continual motion and the eccentric should blend smoothly as it transitions to a concentric repetition. The above tempo would give you 8 repetitions in 32 seconds.
5. For maximum **homeostatic shock**, choose a tempo which challenges your preconceived habits. Take the squat as an illustration. You may be used to slower movements. By choosing a faster rate, you will build greater explosive properties in the muscle, enhance coordination, and build your lung capacity. Conversely, if you are used to a more explosive tempo, slowing the pace(while staying within the desired time frame) will build stabilizer muscles in the back, abdominals, and adductors that are not used to being called into play. In fact, a faster pace relies more heavily on momentum, so a decelerated rate can yield tremendous hypertrophic benefits.

Isokinematic Strips

There are many trainers who judge sets based purely on tempo. This means that when an athlete can no longer handle a weight, at a specific time, that the set is complete. Such strategies assist trainees in many ways. For one, during the squat, form is of the essence. If the goal is completeness and to improve form, then it is beneficial to perform the set under complete control. Secondly it provides a more quantitative assesment for athletic progress(see [biomechanics an introduction](#)). Thirdly, this can be used for extreme poundages. If one is to use extreme weight, then it is important to control that weight. Lets apply the following steps

1. The following example is meant to monitor the quality within a strip set. We will use the heavy squat to illustrate our point. Lets say, that you can squat 400 pounds 3 times at approximately 3 seconds per eccentric and concentric phase. This totals 18 seconds.
2. As soon as you no longer can maintain this controlled rate of ascension and decention, then you will immediately strip the poundage by 10 percent, meaning you will now be lifting 360 pounds. The tempo will again be three seconds down and three seconds up. When control cannot be maintained for the allotted time, you will again strip 40 pounds off of the weight and continue.
3. Enter as deep into the pain zone as is possible.

Such controlled lifting speeds will facilitate one of the greatest shocks of your life! You see, most people perform strips sets, and the quality of their repetitions falters horribly, this corrects such habits. Consequently this same ideal can be applied with varying tempos. I.E. a longer negative then positive tempo.

Adaptive IsoKinematic Tension

When I say adaptive, I am referring to a two partner system, based purely on control. Here is how it is accomplished

1. Begin by choosing an exercise. We will use the barbell curl. Place a light weight on the bar, or no weight at all. This can be used with a broom stick if on a trip. A towel can also be instituted if triceps are being worked, or if hammer curls are being mimicked.
2. Choose a sufficient tempo you would like to maintain. As you lift the weight, your partner will maintain a steady amount of tension on the bar. It should be notably heavy(depending on the desired effect).
3. When you can no longer maintain tempo, your partner " adapts " by lessening their manual resistance on the bar. Thus, you continue in a smooth fashion, until the bar itself becomes impossible to lift!

Torturous Varying Tension Method

I saved this for last, because it is truly one of my all time favorite shocking methods. Most will never have what it takes to gut this one out.

Steps

1. As with the adaptive tension method, this can be performed with a broom stick, or a light weight. Take the barbell curl. If you normally can curl 135 10 times, you will perform this with 65 to 95 pounds(or with pure partner assisted tension).
2. Similar to 21's the focal point will vary throughout the duration of the set
3. The person lifting the weight will lift like normal through a full range of motion.
4. The partner is who determines the pace of the set! It is their job to do as follows: To stay true to form, we will use a 21 rep scheme. On the bottom half of the rep both concentrically and eccentrically the training partner will apply an extra amount of tension. However for the second half of the repetition they will not apply any tension. This is to continue for seven repetitions
5. Now, your partner will stop applying tension to the bottom half of the rep, and begin applying it to the top half of the repetition for 7 total reps.

6. Rep out the weight to failure!

There are variations to this theme. For example, there may be an aspect of your lift you want specifically strengthened. With this in mind, your training partner will only apply excess pressure during that specific portion of the repetition.

Final Thoughts

Take No Prisoners Soldier!

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