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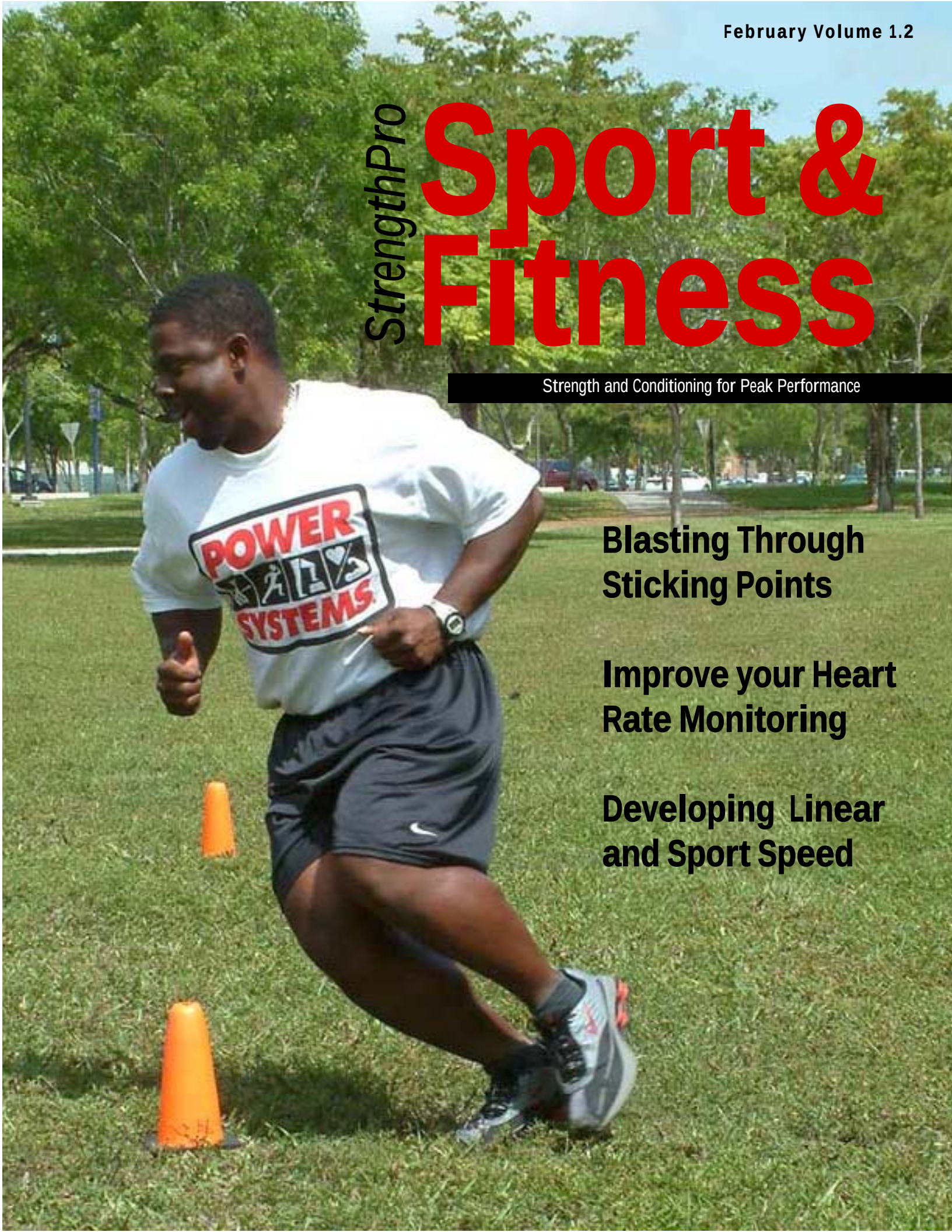

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Bench Press: Powering Through the Sticking Point

David Sandler and Ed McNeely

Historically, the bench press, among strength training athletes, has been considered the base mark of strength. The bench press far and away outweighs any other exercise in terms of the number of training programs it is employed within. In fact this exercise is so heralded, it is always performed on the same day, without fail: Monday, AKA "International Bench Press Day." Yet, with all the practice, this exercise still torments even the greatest of lifters as the secret mystery to mastering the sticking point has yet been revealed. Deep in the sarcophagus of lifting lore lies the answer to "How do I prevent the sticking point from occurring?". At last, the answer…….

You Don't. You don't need to read any further, unless you are prepared to work hard, because the truth is, no matter who you are, you will inevitably find a precarious position during the lift that affords much frustration. In fact, a sticking point exists in most multi-joint dynamic exercises.

The Lever Issue

Simply put, your body is a complex system of levers built for speed, not strength. When you try to challenge your body against its normal will, meaning moving an object along an undesirable path, the body's architecture prevents you from achieving certain things, or at the very least, changes the way in which you do things. The theory of levers holds the answer. To help explain this, lets quickly examine the bench press mechanically. We know that the bench incorporates the pectoralis major, the anterior deltoids, and the triceps (among other muscles). Although each of these muscles perform different actions at separate joints, the goal is to perform a single effort combining all muscles. While a muscle pulls on a bone (remember muscles do not push, they only pull bones together causing a pushing action), it forces the bone to follow a path around the joint. The joint acts as a pivot point causing a rotational force known as torque. Each muscle exerts a specific amount of force according to the angle and velocity of the movement. During the initial push, the pecs (and lats for a brief moment) exert more force then the triceps and deltoids because these muscles are not yet in a position to contribute fully. As we continue through the motion, the tri-

ceps and deltoids become more active helping contribute to the overall force. However, during this transition, the interaction between the pecs, tris and deltoids in concert with the fall-off from the lats, causes a decreased force production and hence decreased velocity in the bar. The further the object being lifted gets away from the line of action of the muscle, the more force is required by the muscle to overcome the resistance. The entire system of muscles acting together to produce a movement forms a system of varying torques. Whew, that just about confuses us too. You can imagine how complicated the system becomes when each muscle has different points of origin (where the muscle originates), different points of insertion (where the muscle pulls against), different shapes and sizes, and different lines of pull. It is only natural to assume, that with all these factors contributing to lifting a barbell, that at some point, competition between opposing muscle groups will cause a period where the overall production of force is minimized. This, my friends, is the reason why we have a sticking point. At some point during any movement, a barbell will slow down while the muscle fights through the transition of least leverage. Of course, the more complicated a lift and more joints/muscle groups involved, the more likely a sticking point is to occur (even multiple sticking points may occur)

The Four Rules of Breaking the Sticking Point

The easy solution to overcoming the sticking region is to cheat. Yep, push the bar right through the sticking region bypassing the most difficult muscle taxing part of the lift by using some other non-related body part. Hmmm, my guess is that you have all tried this before, yet the sticking point still exists! There is only so far you can elevate you butt off the bench and only so many CPR compressions you can do to avoid cracking your sternum before you finally give up! Not to mention there is a butt elevation limit requirement by most gyms; you should not be able to slide a triple-decker wedding cake under it! In fact cheating merely augments the sticking region because the muscle required to overcome it are never properly trained. Therefore, the very first rule

is to use proper technique and proper form.

Second Rule:, remember the old saying, the fastest way to get to another point is to travel in a straight line. Rule number two: avoid extraneous horizontal bar movement. The bar should travel in as-close-to-a-straight-line-as-possible. Yes it will follow a slight curvilinear motion, however, it should be minimal.

Third rule:, the bar's line of force (the bar would fall straight down due to gravity), should be directly over the major force line being produced by your body. That means, the force should travel down through the wrist, through the forearm to the elbow and the bar should be parallel to your upper arms when at the chest.

A fourth and final rule is to maintain body stability on the bench. Any erroneous movement will inevitably steal from your overall ability to produce that all important linear force.

Technique Tips for Working Through the Sticking Point

If you are still reading, you have begun to win the battle. The following list represents the top 10 ways to improve your chances of powering through the sticking point without cheating.

1.Dig your shoulders into the bench, and keep your butt on the bench. This allows you to stabilize your shoulder capsule (minimize horizontal bar movement) and keeps the bar moving upward in a straight line.

2. Wrap your thumb around the bar. A very common error used by many who were improperly informed that the thumbless grip isolates the chest better. In fact, there is no difference in muscle activation, however, a small "extra" torque is created about the wrist as the bar mass does not travel down the forearm (rule #3).

3. Actively squeeze the bar. The contraction of the forearms when the bar is squeezed creates a solid connection to the bar allowing the force developed by the pecs, delts, and tris to be transmitted more effectively to the bar.

4. Use your legs. Place your feet wide apart, to stabilize you body, and slightly backward so there is a sharp ankle angle. As you press the bar up, the contribution from the legs keeps your body tight and forces your butt to stay on the bench.

5. Retract your scapula while lowering the bar. During the descent, actively squeeze your shoulder blades together. Again this stabilizes the shoulder, but more importantly, when you push, the first portion of your bench will incorporate the lats adding increased force to your push.

6. Explode off your chest. Imagine a chunk of TNT is on your chest. When the bar touches your chest, rather then bounce, pause for a moment then try to ignite the TNT and drive the bar up past the sticking point.

7. Lower the bar slowly. You spend a huge amount of effort trying to slow a bar down, not to mention trying to control the rebound effect when the bar makes contact with your chest. A controlled descent allows for the stored energy and the muscles elastic properties to aid in producing the force for the concentric portion of the lift.

8. The bar should touch across the nipples, not much lower. When the bar is at the

chest, you should have a 90^{o} angle with the armpit and a 90^{o} angle with the elbow. This can be achieved by taking a slightly wider then shoulder width grip or even wider.

9. Protract the shoulders (round the upper back) and drive your body into the bench away from the bar when you explode out of the bottom. Although this is hard to actually do by attempting to push your body into the bench, you help drive the weight up.

10. Take a huge breath in when you lower the bar. This expands the chest, shortening the distance the bar has to travel. When you get to the bottom, as you explode the bar off your chest, forcefully exhale to help power the bar up.

Training Through the Barrier

Don't train the shoulders too soon before you bench. Keep at least 48 hours of shoulder-free work prior to a big bench day. The deltoid muscles are the weakest link, they fatigue quickly and limit the overall lifting capacity. If the bench press is the focus of your training consider making delts the first training session after a day off from your heavy bench session.

Try training using pause repetitions occasionally. This forces the muscles to work even harder to generate force. This added strength will power your way through the sticking point.

There is no way to truly train portions of the lift, contrary to

the opinions of many of our colleagues. While training partials has benefit, if you cannot get the bar moving off your chest with enough velocity, you will fail at some point. The best way to get through the sticking point is to increase the initial power and drive off your chest. Always focus on being as explosive as possible as the bar comes off your chest. Drive all the way through the movement, continually attempting to accelerate the bar. You may not move very fast if you are using a heavy weight but the intent to move fast is the crucial ingredient. Timing transitions and bounces are very difficult and should be avoided.

Some Training Suggestions

There are many great exercises, but few help truly improve the bench other then hardcore, gut-wrenching benching. Meaning go all out, work different grips such as wide and narrow into the program. Doing various angled bench versions and dips also complement the bench well, however, the sticking point remains to be an issue. If at all possible, use dumbbells in your auxiliary exercises as these will help to increase efforts from your shoulder stabilizers in controlling extraneous bar movement. And most importantly, USE WEIGHT YOU CAN HANDLE, otherwise you are wasting your time. If you can't lift it, you can't force yourself to lift it. Reduce the weight, work the technique and you will surely improve your chances of beating the sticking point.

Fun Fitness Facts

Children from families with high television use consumed 6 percent more of their total daily energy intake from meats, 5 percent more from salty snacks and pizza, and 5 percent less from fruits and vegetables than children from families with low television use.

A study in the February 2001 issue of the Journal of Nutrition found that girls who drank more sodas got less calcium in their diets -- a situation that could lead to osteoporosis later in life.

Kids who watch TV at mealtime eat far fewer fruits and vegetables than children who sit down to a quiet dinner, according to new research in a recent issue of Pediatrics.

Research Reviews:
the Science of Training

Acute Negative Effect of a Hypertrophy-Oriented Training Bout on Subsequent Upper-Body Power Output

Baker,D. The Journal of Strength and Conditioning Research, Aug. 2003. Volume17(3), pages 527-530.

Many athletes and strength professionals now regularly combine maximal strength, power and hypertrophy-oriented training within the same workout. Often alternating exercises for each of these elements each set. Traditionally, it has been widely accepted that power oriented exercise precedes strength and hypertrophy exercise in a workout. This is to avoid the potential negative effects of acute fatigue that may compromise maximal power output. However advocates of contrast/complex training embrace the alternating of hi-intensity low volume strength exercise and power training. Research supports that this does in fact increase power output but the strength training involved is of a very low volume and is distinguished from the much higher volumes associated with hypertrophy-training. Theoretically this higher volume of training may acutely impair power output. The purpose of this study is to examine the acute effects of a dose of high-volume, hypertrophy training on power output during upper-body training.

Twenty-seven college-aged, rugby league players, volunteered for the study. All were experienced in power training. The subjects were divided into two groups. Fifteen were assigned to the experimental (Hyp) group, who were to perform the hypertrophy intervention, while twelve served as controls (Con). 72 hours prior to testing subjects performed a 1RM bench press (1RM BP) and a bench press throw maximal power output test (BT Pmax).

Testing was conducted was conducted using an absolute resistance of 40kg (BT P40) using the Plyometric Power System (PPS). Prior to pre-testing subjects warmed up by performing 5 rep-

etitions of both the bench press (60kg) and the bench press throw exercise (20kg). After 3 minutes of rest subjects performed 5 consecutive attempts with the investigated resistance (BT P40). The best attempt was recorded. After 3 minutes of rest Con subjects performed their post-test and Hyp group performed 3 sets of 10 repetitions on the free weight bench press at 65% of 1RM, with a 1.5 minute rest interval between each. The rational was to reproduce a typical hypertrophy-oriented workout. Subjects were post-tested 1.5 minutes after the hypertrophy intervention and again 5 minutes later.

The data show the hypertrophy group experienced an acute 18% decrement in power output at 1.5 minutes after the last hypertrophy set and power output was still significantly depressed by 6.6% after 5 more minutes of rest (7 minutes total since the last set). Further the data was stratified to identify two sub-groups, the 5 strongest subjects and 5 weakest. Comparison of these groups revealed that the subjects capable of the greatest absolute workload experienced a greater decrease in power than the weaker subjects.

These observations support the commonly held edict that power should be addressed before or separated from hypertrophy training. It could be posited as well that if a number of exercises were performed in this hypertrophy-oriented manner the cumulative effects on power decrement would be even more severe.

The implications of this study for those of us in the field is to recommend that high-repetition, short-rest period training not be alternated with or performed before power training sets or exercises. Strength coaches should also realize that their strongest athletes may experience the greatest adverse effect in power output and that their hypertrophy-oriented training needs to be carefully managed to avoid seriously compromising the development of power.

Bill Hebson

Undertanding *Speed*

Ed McNeely and David Sandler

There are two kinds of speed. The most commonly trained speed is straight-line or sprint speed. However, the most important, in terms of the athlete performance is sport speed. A very fast sprinter may not be as valuable if his/her speed cannot be converted to speed performance on the field. Since most team sports and non-track sports do not have much straight line running, as it is more important to be able to rapidly change direction and have rapid acceleration, it is more important to have a combination of speed, power, and acceleration. These components make a better, faster athlete.

We must not forget that "4th Quarter" speed is also important. Not only must we help our athletes become faster, we must help them develop an overall ability to call upon their speed when it is needed, even when the athlete is exhausted. Training speed while fatigued will increase an athlete's tolerance and improve his/her overall athletic performance.

Straight-Line Speed

Speed training is a vital link to increasing the athlete's chances of being successful at his/her sport. Often coaches spend many hours teaching form running drills, start technique, acceleration drills and stride modifying drills. All of which help to successfully increase

straight-line speed. However, since these drills are technique oriented, they often take time to perfect and therefore progression is a key element.

For proper straight-line speed training of athletes, emphasis should be on using a few good drills properly and increasing the speed at which they are performed to perfect the movements. With training, the drills should be executed at top speed before introducing "new" speed drills. The best teaching order for drills is to start with low skills non-specific movements and progress to more specific and complex exercises. When performing drills to increase straight-line speed, the emphasis should be placed on the phosphagen (ATP-PC) system to prevent lactic acid accumulation and early fatigue. The key to increasing straight-line speed is to have maximum power for each rep. Practicing drills with little rest prevents the athlete from developing the ability to perform the drill at maximum speed. If the drills cannot be performed maximally, then the required technique begins to falter and the value of the drill for increasing straight-line speed begins to weaken.

Change of Direction Speed

This is the ability to turn straight-line speed into "useable" speed for sport. Often athletes run a very fast 40, 60, or 100 yard dash but their speed is only "good" when they get open to run free. While the athlete may have excellent stride mechanics, his/her acceleration, agility, quickness, or strength may not be adequate enough to get the athlete into the "open" position. For example, a wide receiver in football that can run a very fast 40 or 100 but gets held up at the line of scrimmage by the defender cannot use his speed to break away. That is not to say that he doesn't possess sport speed, but due to the lack of strength or agility, his sport speed may be hampered.

In order for an athlete to be successful, the speed he/she possesses must be converted to on-field performance. That means that not only must he/she be fast, but must also be explosive, as well as conditioned to use it. Therefore, it should be obvious that sport speed is sport specific, and should be trained according to the sport's physical demands, movement patterns and the sport's energy system requirements. For example, the application of speed for a soccer player would quite different than that of a football player. The soccer player needs breakaway speed from a moving position, while a football player may need explosive speed from a starting position. The soccer athlete is continually moving in a more "endurance-like" manner while the football player has definite periods of rest. When training for speed development, more time should be spent on conditioning with speed than on increasing straight-line speed in the sport speed program.

Defining Speed

Speed is actually the distance covered divided by the time it takes or from physics, $V=D\div T$, where velocity is V, distance is D and time is T. When starting from rest, or no motion, there has to be an acceleratory force to help begin the movement. Acceleration is defined as the velocity divided the time or $A=V\div T$. To be fast, from rest, the athlete needs to accelerate as rapidly as possible. It may be obvious then, that training should emphasize explosive acceleration. This concept is best described as power - the ability to combine speed with strength executing the movement as fast as possible.

Acceleration and technique are key in establishing the start of any sprint, whether it be from a moving or stationary position. The transfer of momentum from one type of movement (crossover step, etc.) to the

straight sprint is crucial in the development of speed. Therefore, a great deal of time should be spent perfecting the quick feet drills and establishing overall quickness in the athletes.

Biomechanics of Running

Like any skill, analyzing the movement into its base components will help understand the complexity of the skill and prepare the coach to better train his/her athletes. The actual running movement requires hundreds of muscles in the lower body and upper body as well. In fact, strengthening the upper body has shown to increase power and speed in running strides. Running requires the use of the upper body arm swinging motion to help propel the body and stabilize during the movement. The lower body uses nearly all of its muscles in the running motion. If you analyze each joint in detail, you will find both agonist and antagonist muscles acting at each joint. The major joints are the hips and knee requiring both forceful extension and flexion of both. The ankle is a complex series of joints working together to absorb shock and push-off explosively. To accurately predict force by individual muscle would be a daunting task at best. While we take running for granted, it is perhaps one of the most complex movements we perform.

Running has three components. The stride frequency refers to the number of times the leg cycles through the movement. The stride length is the distance each stride covers. The third component is the stance time. The length of time that the foot is in contact with surface determines the how forceful each stride is The push-off is the point where all of the stored energy from the landing is converted in to force to drive the body forward. Running is very complex. The cycle movement is the point where the leg actually goes from pushing off the ground (acceleration) through cycling around (speed) to braking (deceleration) prior to the foot re-striking the ground again. This incredible process occurs in less then .06 seconds. Training, by breaking down the movement is not possible. Therefore, all training needs to encompass the entire movement into the specific protocol.

Stride Frequency

Obviously the more times the foot contacts the ground and the shorter the foot is on the ground, the faster one can be. Stride frequency can be manipulated by forcing the legs to turn over quicker or by attempting to make the legs turn over quicker. Generally this is done through "towing" drills, like the one pic-

tured at the bottom of the preceeding page. These kinds of drills actually pull the athlete along, forcing the legs to turn over more rapidly. Other methods include running down a gentle decline and drills that emphasize leg turnover mechanics.

Stride Lengthening

To increase an athlete's acceleration and power, improving the stride length is the key. While the optimum length is unknown and varies from individual to individual it can certainly be trained. When you increase stride length, you must still consider the fact that altering "normal" mechanics requires the athlete to re-learn the movement. For neurological timing and body control to be perfected, the athlete needs to continually practice regular running while working on stride increasing drills. Therefore, a very fast athlete (that does not run track events) should not necessarily attempt to change his/her running pattern by altering stride length per se. Resistive running is the best method for increasing stride length.

Stride length and frequency is enhanced by increasing the strength or force production of the running muscles. Most people believe that stride lengthening can be achieved through weight training alone. It may seem obvious that increasing muscle strength will help produce a more forceful contraction which will naturally increase the distance of the stride by increasing the push-off strength. Improving stride length through drills requiring similar running movements decreases the likelihood of mechanical issues. The key is to continue regular running drills and incorporating resistive running drills.

Push-Off

As previously stated, increasing the strength of the muscles will help increase the force production of the running movement. Hence, the push-off strength will increase. If the strength is

Form running drills help improve the body mechanics that maximize straight line speed

increased in the pushing muscles and also increased in the pulling muscles, the leg will cycle more quickly, producing better stride frequency and thus speed.

Form Running Drills

Form running drills are often used by coaches to help develop speed. The main goal is to help the athlete perfect arm motion and foot push-off strength. The athlete moves through the form running drills by forcefully pushing his/her feet into the ground while concentrating on leg and arm motion. Form running drills are not necessarily specific to running in that most drills exhibit leg movements that are not exactly "run like." However, from a sport speed standpoint, if done correctly and quickly, form drills can help increase speed. Use your Power Chute while performing the various drills to provide an additional challenge of keeping the body in a perfect position while running against resistance.

Exercise of the Month:

Half Twisting Lateral Hop

This is a great drill for developing lateral jumping power and body control. You will need a Lateral Plyo Box for this drill. Start with feet hip width apart. Swing the arms back and quickly dip until the knees bend to about 120 degrees. Explode upward and sideways extending the knees, hips, ankles and trunk while swinging the arms forward and slightly sideways as explosively as possible. Rotate your body in the air so that when you land you are facing in the opposite direction. As soon as you land jump back to the starting side of the Lateral Plyo Box

StrengthPro

Speed and Power Certification

The quickness to break through the line and accelerate past tacklers, grabbing a rebound out of the hands of your opponent, ripping off a 130 mph tennis serve or driving a golf ball 300 yards all have one thing in common. They all require incredible power.

Power, the optimal combination of speed and strength is essential for sport performance and is the difference between good and great athletesNot every sport has the same power requirement, being able to determine the ideal relationship between speed and strength for a sport, test an individual athlete for their strength and weaknesses and teach proper exercise progressions will allow you to develop more effective training programs and separate yourself from other trainers in the filed of athlete development.

With this in mind StrengthPro has created a certification that covers every aspect of power and speed development, from the science, to the exercises, to the development programs to maximize you clients results.

This four session lecture-workshop will provide each participant the skills and knowledge needed to develop explosive power programs. Examining both historical perspectives and the newest, scientific approaches for developing power the workshop will consist of approximately 50% of the time being devoted to lecture and 50% to practical application hands on applications, allowing participants to bridge the gap between science and practice.

Session 1: The Strength-Speed-Power Continuum

This lecture session will introduce participants to the physiological basis of power development and the Strength-Speed Power continuum. To develop optimal power one must first know whether that power is strength based or speed based. The continuum allows the participant to analyze the power demands of a sport or activity and determine the proportions of strength and speed needed to excel. Other topics covered include:

- Muscle and Nervous system physiology

- Force-velocity curve
- The length-tension curve
- Acceleration, Torque and Impulse
- Elastic energy, the stretch reflex and momentum
- Dynamic Power Expression
- The trade – off between strength and speed
- Where does optimal sport specific power lie?
- Sport and position specific power analysis

Session 2: Developing a Power Profile

During this practical workshop participants will be lead through a series of specific and general strength, speed, and power tests. They will learn to administer the test protocols, interpret the results and set training priorities and goals based on the testing and how the results match the strength-speed-power continuum analysis.

Session 3: The 5 Step Power Program

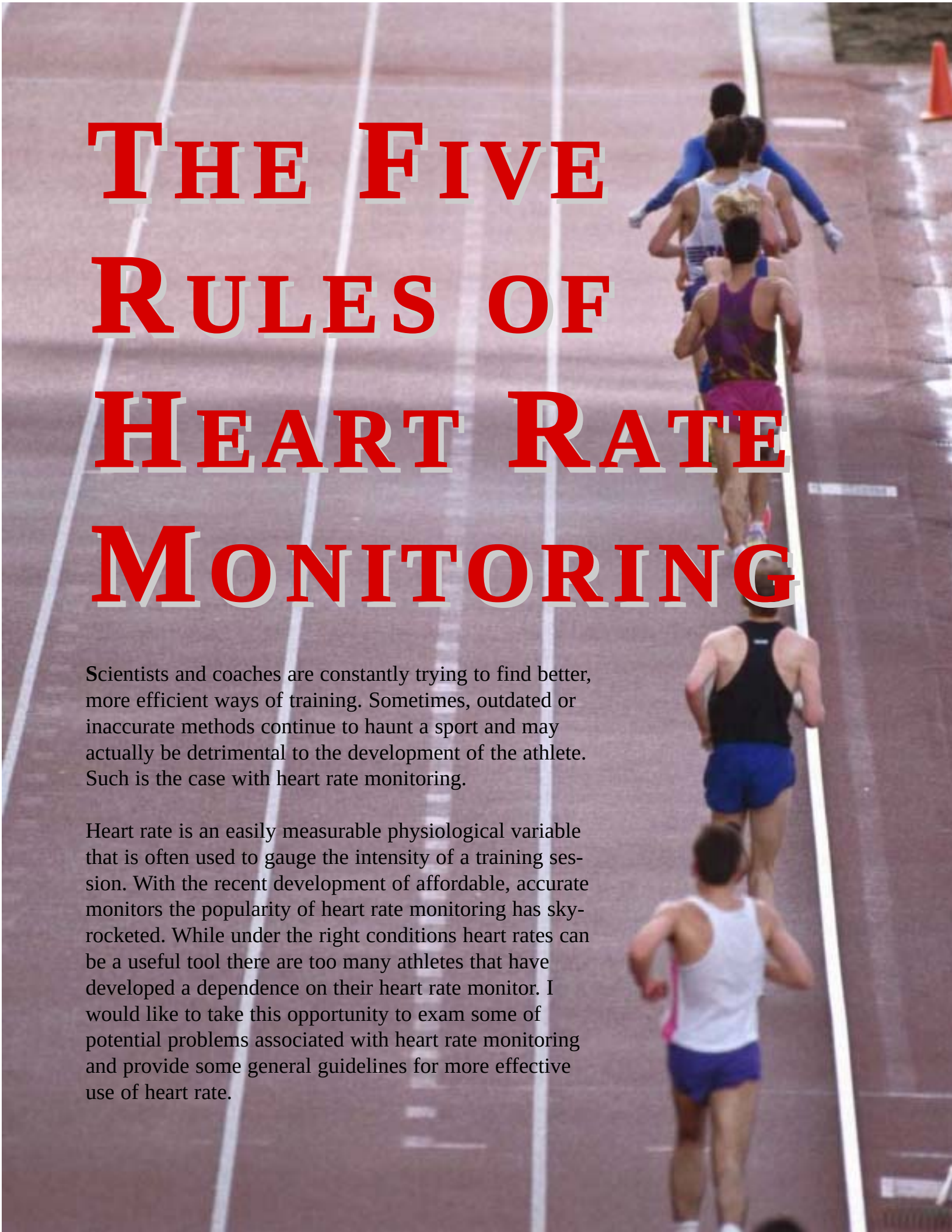
This lecture session provides the program variables and theoretical framework for designing specific power programs. The 5 step model provides participants with a simple, effective means of ensuring that they are covering ever aspect of power development. Topics covered include:

- Training muscles vs. training movements
- Replication and skill transfer
- The weight training paradox
- Power periodization cycling
- Antagonistic power combinations
- Volume-intensity relationships
- Overload
- Acceleration and deceleration

Session 4: Power Techniques

Building on the previous session, this hands on session features the drills, exercises and training methods discussed in the previous lecture. The group will be broken into smaller groups and cycle through four different stations where participants will learn and learn to teach ten different exercises and drills for a total of 40 new exercises ranging from releases and throws to plyometrics and Olympic lifts.

For information on a certification course in your area call 1-800-255-1017
www.strengthpro.com



The Five Rules of Heart Rate Monitoring

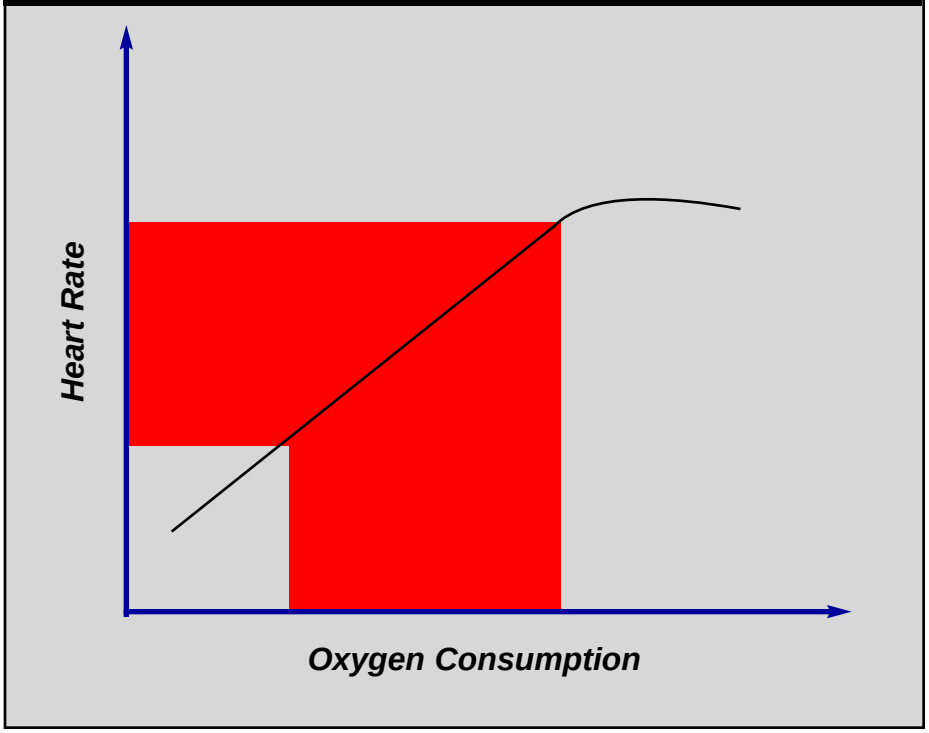
Scientists and coaches are constantly trying to find better, more efficient ways of training. Sometimes, outdated or inaccurate methods continue to haunt a sport and may actually be detrimental to the development of the athlete. Such is the case with heart rate monitoring.

Heart rate is an easily measurable physiological variable that is often used to gauge the intensity of a training session. With the recent development of affordable, accurate monitors the popularity of heart rate monitoring has skyrocketed. While under the right conditions heart rates can be a useful tool there are too many athletes that have developed a dependence on their heart rate monitor. I would like to take this opportunity to exam some of potential problems associated with heart rate monitoring and provide some general guidelines for more effective use of heart rate.

The ability to use heart rate to monitor the intensity of a training session developed from the fact that there is a linear relationship between oxygen consumption and heart rate (figure 1). While this is valuable information it has also lead to two problem areas. First, the relationship starts to break down at around 85% of VO2 max. Since many types of intervals and most speed work are done at or above this intensity heart rate alone cannot be used to monitor this type of work. Second, even though there is a relationship between exercise intensity and heart rate this relationship is different for different exercises i.e. heart rates for running will not be the same as heart rates for rowing for any given intensity. In fact, in cycling heart rates change with different body position on the bike. Some research indicates that heart rates on the road can be as much as 10 beats higher than riding indoors on a trainer for the same oxygen consumption. This brings us to our ***first rule of heart rate monitoring. Heart rates are specific to the activity you are doing.***

Heart rate is influenced by many variables. Duration of training, emotional stress, clothing, heat, dehydration, overtraining, loss of sleep, decreased blood volume, altitude, and detraining. During long duration steady state training sessions (60 minutes or more) the heat produced by the body has been shown to increase heart rate by as much as 20 beats/ minute. If you were to slow down to try to keep your heart rate the same you would change the training effect for the muscles. This leads us to **heart rate rule number two: During steady state training speed or power output should remain constant throughout the session regardless of increases in heart rate.** Training in a hot environment can increase heart rate by up to 13 beats/min. This can make the accurate use of heart rate very difficult. Late in a training cycle heart rates can be very than what they were a week earlier for the same power output. Whether this is higher or lower is difficult to predict. Emotional stress at work or the stress of exams at schools tends to increase heart rate during training. In addition, these types of stress decrease quality of sleep which further increases heart rate. **Rule number three: When training in hot weather or during periods of high stress use feelings of fatigue and comfort as a training guide rather than heart rate.**

Figure 1. Relationship Between Heart Rate and Oxygen Consumption



Heart rate is an individual response as is maximum heart rate. I have known people who regularly train together doing the exact same workout who have had 20-30 beat differences in heart rates during the same training session. This isn't necessarily due to differences in fitness rather it is something inherent to those people. Comparing heart rates to other

people is unnecessary and often unwise. Training programs should not be based on general heart rate guidelines rather they should be based on individual responses. A training heart rate of 150 bpm may elicit very different adaptations for different people. **Rule four: Don't compare heart rates to others.**

Because heart rate is an individual response and because it can be dependent on fitness level heart rate values need to be determined in relation to other physiological variables. There are three common physiological markers for aerobic training: Aerobic threshold, anaerobic threshold and VO2 max. Training programs are normally designed with the idea of changing these physiological points. In order to prescribe meaningful heart rate ranges these points have to be identified. This can be done through lactate testing or through an oxygen consumption test. The data is then plotted (figure 2) and meaningful heart rate ranges can be developed. If these points are not determined the heart rate prescriptions are purely guess work. **Rule five: Heart rate ranges should be determined from other physiological data.**

As mentioned earlier heart rate is not a good tool for monitoring intensity during speed work or interval training. Some coaches believe that heart rate should be used to monitor recovery between intervals so that fatigue levels can be controlled. While it is true that fatigue levels need to be controlled heart rate is not the way to do it. The fatigue during high intensity aerobic training is caused primarily by lactic acid accumulation. The time between intervals should be based on the time needed to reduce lactate levels. The relationship between heart rate recovery and lactate recovery is not very strong. In other words heart rate may have recovered but the lactate levels may still be too high to do the interval the way it should be done.

Heart rate is a tool for training. Like all tools it has limitation and should be used for a specific job at a specific time. Speed, pace or power output are influenced by fewer factors than heart rate and may prove to be better indicators of training intensity. If you are going to use heart rate to monitor your intensity follow the guidelines outlined here and remember that heart rate is just a response to internal and external stimuli it should not be the main controlling factor for your training.

Super sets and Compound Sets

Marlon Gomez

Tired of the same old three sets of ten routine over and over again? Can't seem to grow anymore? What if I let you in on a little secret that would have you growing faster than ever before? Interested? Okay, so it's not really a secret but it is one of the most powerful methods to spark your gains in muscle size once again. So sit back, grab your cup of lactic acid and be prepared for a pump of gargantuan proportions with your new training partners, Supersets and Compound Sets.

Before I explain how to apply these techniques, it is important to understand a little science behind the madness. Growth hormone is released by the pituitary gland, primarily at night when the body is undergoing recovery and regeneration. Growth hormone plays various roles in the human body including growth of muscle, bone and connective tissue as well as the breakdown of fat stores for energy. While sleep is the most potent stimulus for growth hormone release exercise can also cause significant increases in growth hormone levels. Research has shown that strength training exercise that results in failure at around 10 reps and causes high levels of lactate increases circulating levels of growth hormone. The theory behind supersets and compound sets is that the lactate accumulation and subsequent growth hormone release will increase muscle size and decrease body fat.

O.k. so now lets take some of that science and apply it to the real world lab. A Superset involves two exercises that stress opposing muscles or muscle areas. Next time you train your arms, I want you to pair up your biceps and triceps exercises in alternating fashion. For example, curls and pushdowns would be the first pairing before moving on to the next two combinations of movements. Begin your arm work with curls. Make sure to perform this set next to the push down stack, as your biceps reach muscular failure during the curls put the weights down and immediately, taking no rest, grab the push down handles, keeping transition time to a minimum, and hit those triceps hard with some quality reps. After the end of the superset, your arms should be screaming for rest but since you want to don't want to fully

recover between sets, sixty to ninety seconds is all they will get before repeating a second and possibly third superset.

Supersetting works best when alternating major muscle groups such as chest and back, quads and hamstrings, biceps and triceps. However, compound movements such as squats, bench presses and rows stimulate more growth hormone release and greater muscle growth. Supersets should be used for 2-3 weeks before moving into more intense Compound Sets.

If you feel you're up to a bigger challenge, then prepare yourself for the pain and agony Compound Sets will provide. A Compound Set entails sequentially performing two different exercises for the same muscle group, for instance bench press immediately followed by dumbbell flys. Compound sets are a more physically demanding form of training for a specific muscle area than any other. During strength training exercises the energy for muscle contraction comes from the ATP stored in the muscles and then from the breakdown of glycogen through anaerobic glycolysis, resulting in the production of lactic acid. The ATP stored in the muscles provides energy for about 10 seconds of work as the set progresses beyond this time there is an increase in lactate that is proportionate to the length of the set so the longer the set the more lactate. Compound sets are used to do precisely this; increase lactate levels and subsequently growth hormone. Compound Sets can be applied to any muscle group being trained at any point in the training session. It can be done for an entire work out, a few sets or adjusted to only targeting specific muscle groups. A compound set should take at least 60 seconds to complete so focus on slow controlled movements and do at least ten reps per exercise.

Multi station machines make it easy to perform Supersets and Compound sets

Supersets and Compound Sets are two of the most demanding techniques used in resistance training; they are no walk in the park. The combinations of these two techniques are probably the most growth producing methods around and could possibly be the answer to brining up individual lagging muscle groups. These are very intense training methods that should only be used sparingly for a couple of weeks at a time as a shock to break the monotony of training. It's time to go out and get the blood pumping now that you have learned two of the most growth producing methods in resistance training. So, whether you choose Supersets, Compound Sets or both, be assured you will experience a super-sized increase in muscle growth within no time!

A few tips to keep in mind when utilizing Supersets and Compound Sets:

1. Always warm up the area with a few light sets before the first major set
2. Move quickly with no rest from one exercise to another
3. Use short rest intervals of sixty to ninety seconds between sets
4. Maintain proper from at all times to ensure the targeted muscle is being worked
5. Utilize ten to twelve repetition maximums
6. Incorporate a variety of movements