Let's Talk Training #2:

Intensity

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This article is the second in a series dealing with the different aspects of strength training. For better understanding of this material you should read or review the previous article (in NSCA Journal, Volume 7, Number 6) dealing with sets and reps. This issue will look at intensity and its variations. Before we start please note the following:

a) The word “cycle” will appear often. I will discuss it in detail in a future article. For the purpose of this article the reader should keep in mind that a cycle is the duration from start to end of a particular training period. (E.g. if there are eight weeks in pre-season training, those eight weeks represent a cycle).

b) To illustrate certain concepts I will use examples giving you hypothetical weights. They are just examples, therefore do not use those numbers literally in your workouts, simply try to understand the concepts.

Intensity

Intensity is the tension or stress put on the muscle. It is dependent on the number of sets and reps, rest between sets, duration of workout but mostly on the amount of weight used. Therefore, when we speak of intensity we are mainly talking about “how much weight.” Correct technique and proper intensity make up the two most important aspects in training. If these two areas can be mastered, the athlete can have tremendous success.

How Is Intensity Determined

Intensity is relative; what is intense for one person may be easy for another. For this reason when we speak of intensity in the weight room we work in % of the individual RM (max). Using % as the guide in regulating intensity makes the workouts more accurate. Most workout %’s are based on the person’s 1RM (the most weight he can do for one repetition). When reading articles dealing with %’s, and if it is not stated otherwise, those %’s are based on the athlete’s 1RM.

Example: The athlete has a 1RM of 400 lbs. His workout demands 80%. He will work out at 320 lbs. on that day. (80% of 400 lb = 320). If the next workout demands 90%, he will be working out with 360 lbs.

Intensity can also be differentiated by labeling it heavy, medium or light. These terms are also relative. What was heavy last month is light today, and what was light at the end of a cycle might be heavy at the start of a new cycle. When correlating a % to heavy, medium or light, the following guidelines can be used.

Heavy - 90-100% or more
Medium - 80-90%
Light - 70-80%

Please note that these % are not based on the athlete’s 1RM but on the amount of weight the athlete can handle at that time of the cycle.

Example: The athlete squats twice a week. One day he will work heavy and the other day light. On his heavy day he does 200 lbs. Therefore, his last set on his light day workout will be 70-80% of 200 lbs. which is around 155 lbs. The next week he will try to do more on his heavy day, so assume he does 220 lbs. Now his last set in the light workout for that week would be 70-80% of 220 lbs., which is around 165 lbs.

The Overload Principle

For a muscle to get stronger it has to be overloaded. Overload means putting stress (amount of weight) on the muscle greater than what it is used to. As the muscle adapts to greater and greater levels of stress, the amount of weight that is required to constitute an overload must be increased. For example, let’s say an athlete can bench press 200 lbs. and that is all he can do at the time. A couple of workouts later the 200 lbs. will become easier (muscle has adapted to the 200 lb stress). Therefore, he may now be able to handle 210 lbs. When the muscle has adapted to the 210 lbs. “stress” he can increase the weight again and again.

For improvement to take place, workouts must impose a demand on the body system. It has been shown that the athlete has to train with loads greater than 80% of his maximum for strength and power to be optimally increased. Underloaded resistance (below that which is normally encountered by the muscle) will not result in increases in strength and power. A perfect example is the athlete who likes to do push-ups. At

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first he will gain strength, but later when the muscles get used to the stress (his body weight) there will be no gains. The athlete can continue to do push-ups and they will keep him in some kind of shape but there is no progress as far as strength is concerned. Now if he will increase the resistance (put a weight plate on his back) then he will increase strength. As long as he increases the resistance his strength will also increase.

Resistance should be increased throughout the course of the program as the muscle gains in strength and endurance. For this reason the overload principle has been modified to what is now called the principle of progressive resistance.

Progressive Resistance

Progressive resistance means to increase the weight gradually as the body gets used to the new stress. When the muscle is stressed progressively beyond its normal demand, the muscle responds positively and becomes stronger. On the other hand, if the stress is too great the muscle will react negatively with injury or overtraining. Large increases in resistance should be avoided. Many young athletes want to see “how much” on every workout. They want to out-do their training partners and forget the true purpose of strength training. The athlete should make realistic increments when increasing the workload.

Example: The athlete does 200 lbs. for his last set of five reps. It was hard but all reps were done. On his next heavy workout he might jump to 205 lbs. If the 200 lbs. was easy then he can jump to 210 lbs. instead of 205 lbs. on his next heavy workout. Use common sense and work each athlete to his potential.

Starting Out

One of the most frequently asked questions by high school coaches during our annual strength and conditioning seminar is, “how much weight should we start with?” There are two factors that affect how much weight is used.

The % (or intensity) used at the start of a cycle depends greatly on when the last cycle ended. If the athlete is doing two cycles back-to-back, then when starting the second cycle the athlete should be able to handle 70-80% of RM on his first workout. If there are several weeks of “rest” between cycles (Christmas break, spring ball) then the athlete should handle a lower intensity. The better shape (strength-wise) he is in at the start of the cycle, the more weight he can handle.

A safe bet as to how much weight should be used at the start of a cycle is 60-70% of RM. (Note: RM not 1RM). If he starts off doing sets of 10 then he should do 60-70% of his 10RM. If he starts off with sets of 5 he should use 60-70% of his 5RM.

Example: The athlete has a bench press 1RM of 300 lbs. which is equivalent to about 200 lbs. for 10RM. The cycle starts off with sets of 10; therefore, he will do 130 lb. x 10 on his first workout (60-70% of 200 lb.) If the cycle started off with sets of 5 and his 5RM is 250 lbs., then his first workout would be with 170 lbs. for 5 reps (60-70% of 250 lbs.)

As a coach you must make sure that the athlete will not use too much weight early. It is better to be a little conservative when getting started. Later, when the athlete is back in better shape, more and more weight can be used.

For the athlete who has never lifted weights before I would use the bar with no weights. Using only the bar he can work on technique, plus the intensity is very light. As the technique improves so can the intensity.

For More Advanced Programs

Basing workouts on 1RM is somewhat accurate. Basing workouts on 3RM when doing sets of 3 reps or 5RM when doing sets of 5 reps might be more accurate. Some athletes are best at doing reps while others do best with singles. I have seen players triple 375 lbs. and miss 400 lbs. for a single while others can do a 400 lb. single with only a 360 lb. 3RM. At the University of Tennessee we use an athlete’s 10RM, 5RM, 3RM and 1RM in making his workouts. We saw that basing all workouts on what the athlete can do for a single (1RM) did not produce as good results as using various RM.

If you do not have the various RM’s on each athlete, you can use this easy general guideline to get things started and then later you can record more accurate RM’s. In general, each extra rep takes away 10 lbs. from the athlete’s 1RM. If his 1RM is 300 lb. his 3RM would be around 270 lbs. and his 5RM around 250 lb. If the athlete is doing lifts in excess of 400 lbs., take away 15-20 lbs. from his 1RM.

Planning The Cycle

Now that we know how much weight should be used in starting a cycle, let’s look at how the intensity should increase so as to get a new personal best (new RM) at the end of the cycle.

For the first couple of weeks the athlete should train at 60-70% of RM. This intensity might seem too low, but early in the cycle it might be all the weight the athlete can handle. As the weeks go by you will increase “progressively” to 100% or more. The athlete’s new RM should occur in the last weeks of the cycle.

Example: The cycle is 6 weeks long.

Week 1 - 60%  Week 2 - 70%  Week 3 - 80%
Week 4 - 90%  Week 5 - 100%  Week 6 - 110%

This is a very rough guideline to show you how you can “theoretically” plan out the cycle. Adjustments might have to be made during the cycle because so much can happen (injury, exams, personal problems, illness, etc). What was “theoretically” planned before the cycle started must be slightly changed.

It is important to keep an eye on the athlete’s progression weekly to make the small changes needed. At the end of the cycle you will probably see various degrees of improvements from 0% to maybe 20%. No matter what may happen during the cycle it is very important to set goals and to have a plan to achieve those goals. The more times you do this kind of “planning” the better you will get at matching the “theoretical” with the actual results.
The Pyramid System

The pyramid system is one of the most widely used training methods today. It is believed by some to be the best for increasing strength in the weight room. There are many variations to the pyramid system but all have one or both of these basic characteristics:

A) Increase in intensity
B) Decrease in the number of repetitions

The total number of repetitions may be a secondary consideration in terms of strength development. The most important factor seems to be the use of relatively heavy resistance and near-maximum effort. This system is designed to overload the muscles as much as possible while doing fewer repetitions.

We have seen how to plan a cycle and what intensity is to be used during the cycle. All the intensities which we have talked about represent the last set of the daily workout. Example: The workout asks for 5X at 90%. This means that the last set of 5 reps is done at 90% intensity and that the other sets were done at a lower intensity.

What about the intensity of the other sets? Here again we have to use the progressive resistance principle which is exactly what the pyramid system is all about.

Example: The workout asks for 1x10, 1x8, 2x5, 2x3. The intensity is 90% and the 3RM is 300 lb. The total workout should look something like this: 135x10, 185x8, 225x5, 245x5, 265x3, 275x3.

As you see, the weight started very low and it increased as the reps decreased. The actual weight increased: 50, 40, 20, 20, & 10 lbs. Early bigger weight jumps were taken compared to smaller jumps taken as the athlete approaches his daily goal. This is quite important so as to get the most work in the later sets.

The following are basic pyramid system workouts:
- 1x8, 5x5
- 1x8, 2x5, 3x3
- 1x10, 1x8, 1x5, 1x3, 1x1
- 2x10, 2x8

There is no set formula in setting up the pyramid system. You can use these or make one of your own. As long as you increase the weight progressively, decrease the reps, and end at the desired work load, you are in the right ball park. Even if the reps stay the same (e.g. 5x5) but the weight increases, it is still a pyramid system. The sets and reps do not necessarily need to end with a single to be a pyramid system.

Varying The Intensity

The athlete makes faster progress if he does not handle maximum poundage at every workout session. If the same lift is done twice during the week, then one day it should be done at a heavy intensity and the other day lighter. Constant loads are not as effective as occasional sharp increases in training stress. You may think this is against the progressive principle just reviewed. On the contrary, what this means is lifting heavy one day and lighter the next time. What you do not want to do is lift the same intensity on each workout.

Remember that the intensity or actual weight used is related to the time of the cycle. The key words are "time of the cycle." The athlete may have a 400 lb. 5RM in his squat. Obviously, when he starts a new cycle he can not handle that kind of weight. Let's assume all he can handle on his first week is 250 lb. x5. This automatically becomes his 100% or heavy workout because that is all he is able to do at the time. Next workout he will work at 90% or medium intensity; therefore, he will handle 225 x5 (90% of 250) for his last set. On his next heavy workout he might do 270 lbs. which is now his new 100% effort, therefore, his next lighter workout will be based on the 270 lbs. Obviously, his goal will be to beat his 400 lb. 5RM in his last workout.

The above shows varying the intensity by lift. Another way it can be done is by varying the intensity by day. If the athlete lifts 3 times per week he will do all his lifts heavy one day, all his lifts medium the next day, and all his lifts light the next day. This method is not used as widely as the first and I personally do not like it as much. My observations have shown better results when varying the intensity by lifts.

By now you can see that a heavy workout does not necessarily mean doing singles with maximum weights. Doing a set of 10 reps with as much weight as possible is a heavy workout. Doing a single at 80% of RM is considered medium, even if it is a single rep. As you can see, the weight % to the RM, not the number of repetitions, determines the intensity of the workout.

At Tennessee we do max singles only twice in the whole year. Most of the time we train with sets of 10, 5 or 3 reps at different intensities. Singles are the result of strength gained by doing those 10's, 5's and 3's.

Now let's look at a few training variations which, when used properly, can improve strength. The intensity of these variations is "very high" and should be used when the lift is to be performed at a "heavy" intensity. Forced reps should be used once in a while to add "spice" to the workouts. They definitely should not be used on a regular basis since they can lead to overtraining and injury. If your workouts are well set up and the sets, reps and intensity are appropriate, there is little need for one or several of these variations of training.

Forced Reps To Failure

Training to failure is done when the athlete pushes himself so hard that he cannot do one more rep. Usually at this time his partner helps him do a few more reps by assisting him in the lift (e.g., bench, pulling the bar upward). This method pushes the muscles past the physiological threshold that limited him in the first place. This is a good training practice, but not to be used on a regular basis. It can be used to get out of a plateau or just as a change of pace. During the course of the cycle, there might be occasions, especially with single joint exercises (triceps, leg curls, etc.), where "burn outs" (forced reps) can be used. One thing for sure, training to failure every day will not lead to maximum strength gains.

Negative Work

In training with weights, when the bar is lowered the athlete is performing negative work and when the bar is raised he is doing positive work. In both situations the muscle
is contracting. Therefore, both are important in the development of strength. It is important to control the downward and upward motion in all lifts.

Just doing negative work is not recommended. Always work both the positive and negative part of the lift. On occasion some extra negative resistance can be performed as a variation. To perform negative resistance training the athlete should handle weights heavier than he can do in a maximum lift. These repetitions should be performed after the athlete has completed his regular lift.

**Supersetting**

Typically, two different exercises are combined to produce a superset. This kind of training will increase muscle size but not maximal strength. If time is a factor, supersetting might be your answer. When performing a superset the athlete completes one lift and then does another with no rest (or recuperation) in between. Another variation is to do a set of one exercise, do a set of another exercise, back to the first exercise, then back to the second exercise. The following are a few of the variations in supersetting.

A) Same muscle. The athlete will train the same muscle in both lifts. (e.g., train the biceps by doing arm curls with a bar followed by arm curls with dumbbells).

B) Opposing muscles. Working both the agonist and the antagonist sides. (e.g., train the biceps with one exercise then train the triceps with the other).

C) Push-Pull. One exercise is a pushing motion while the other is a pulling motion. (e.g., do the bench press and then do a lat pull down).

D) Upper-Lower. One lift works the upper body while the other lift works the lower body (e.g., arm curls with leg extensions).

**Extra Training**

Once the player starts making gains in the weight room (and consequently on the field) he will be eager to lift as much as he can. At this time, players assume that more work is the answer to more gains. This does not always apply to strength training and in some cases it is detrimental to progress. If you have cycled the workouts with the right intensity and recuperation time for the muscles to grow and get stronger, the extra training can offset all your preparation.

To get optimal improvement in the main lifts, the athlete should not do a lot of bodybuilding work at the end of each workout. At first it may seem harmless, but soon you will see it taking away recovery time for the next workout. Unless the player has a special need, restrict him to the designated workout.

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**Intensity Charts and How To Use Them**

Close to every station the coach should post the four charts on mini-posters to be used by the athlete. Since most schools do not have computers and the coach does not have the time to make each individual workout, these posters will come in very handy. The first poster should show the lifts to be performed, the number of sets and reps and the intensity. The second chart should have the athlete's personal bests for all lifts. The third chart shows the different %'s. The last chart shows what weight increments are to be used for each set.

Example: The 3rd week workouts ask for Bench Press 1x10, 2x8, 3x5 at 90%. First, athlete A looks up what his personal best is in the bench press which is 270 lbs. He then subtracts approximately 10 lbs. for each rep he is to do on his last set (5) which gives him a 5RM of 220 lbs. Then he looks at the % chart to find out what 90% of 220 would be. The chart shows 200 lbs. Now the athlete knows the last set of 5 reps should be done with 200 lbs. To find out how much weight should be used in his other sets he looks at the weight progression chart. The chart shows, 135-140-155-170-185-200, therefore, his bench press workout for the day should be 135x10, 140x8, 155x5, 170x5, 185x5, 200x5. The weight progression chart can be used with any rep and set combination (e.g., 1x8, 5x5 or 3x8, 3x6 etc.) As a coach you might want to make your own weight progression chart to suit your own needs. What is important is for the athlete to have access to the four charts. I think this is a very good system for it saves a lot of time, plus the athlete does not have to “guess” what weights to use.

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**Chart 1: Sample Workout**

<table>
<thead>
<tr>
<th>Offensive Line</th>
<th>Power clean1x8, 2x5, 95% Power clean1x8, 2x5, 75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day I</td>
<td>2x3, 1x1</td>
</tr>
<tr>
<td>Day II</td>
<td>3x3</td>
</tr>
<tr>
<td>Bench</td>
<td>1x8, 5x5 75% Incline</td>
</tr>
<tr>
<td>Squat</td>
<td>1x8, 2x5 80% Squat</td>
</tr>
<tr>
<td></td>
<td>3x3</td>
</tr>
</tbody>
</table>

**Chart 2: Athletes Personal Best**

<table>
<thead>
<tr>
<th>Name</th>
<th>Bench</th>
<th>Clean</th>
<th>Squat</th>
<th>Incline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark Strong</td>
<td>300</td>
<td>270</td>
<td>430</td>
<td>260</td>
</tr>
<tr>
<td>Bill Huge</td>
<td>350</td>
<td>300</td>
<td>570</td>
<td>280</td>
</tr>
</tbody>
</table>

Let's look at a couple of examples assuming both Mark and Bill are offensive linemen.

Example One: Mark Strong - Power Clean, Day I. The workout asks for 1x8, 2x5, 2x3, 1x1 at 95%. First Mark looks up what is his personal best in the power clean. The chart shows 270. Then he looks at the % chart to find out what 95% of 270 would be. The chart shows 255 lb. Now Mark knows that his last set (single rep) should be done with 255 lbs. To find out how much weight should be used in his other sets he looks at the weight progression chart. The chart shows 135-155-185-215-235-255, therefore, his power clean workout.

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for the day should be 135x8, 155x5, 185x5, 215x3, 235x3, 255x1.

Example Two: Bill Hug - Bench Press - Day I. The workout asks for 1x8, 5x5 at 75%. First Bill looks up what is his personal best in the bench press. The chart shows 350 lbs. Then he looks at the % chart to find out what 75% of 350 would be. The chart shows 265 lbs. Now Bill knows that his last set of 5 should be done with 265 lbs. To find out how much weight should be used in his other sets he looks at the weight progression chart. The chart shows 135-155-185-225-245-265, therefore, his bench workout for the day should be 135x8, 155x5, 185x5, 225x5, 245x5, 265x5. Using this method the complete workout for both athletes would be as follows.

Mark Strong

Day I  Power Clean: 135x8, 155x5, 185x5, 215x3, 235x3, 255x1
Bench Press: 135x8, 155x5, 185x5, 195x5, 210x5, 225x5
Squat: 135x8, 225x5, 255x5, 305x3, 325x3, 345x3

Day II  Power Clean: 135x8, 145x5, 160x5, 175x3, 190x3, 200x3
Incline: 95x8, 135x5, 150x5, 165x5, 180x5, 195x5
Squat: 135x8, 185x5, 225x5, 265x3, 285x3, 305x3

Bill Hug

Day I  Power Clean: 135x8, 185x5, 225x5, 245x3, 265x3, 285x1
Bench Press: 135x8, 155x5, 185x5, 225x5, 245x5, 265x5
Squat: 135x8, 225x5, 315x5, 405x3, 435x3, 460x3

Day II  Power Clean: 135x8, 155x5, 180x5, 195x3, 210x3, 225x3
Incline: 135x8, 155x5, 170x5, 185x5, 200x5, 210x5
Squat: 135x8, 225x5, 315x5, 355x3, 385x3, 400x3

As you can see the weight progression chart can be used with any set and rep combination up to 6 sets. As a coach you might want to make your own weight progression chart to suit your own needs. What is important is for the athlete to have access to the four charts.