Manipulating Reps for Gains in Size and Strength

by Charles Poliquin

Perhaps the most important loading parameter in designing exercise programs is not the number of sets, the tempo used, or even the specific exercises employed, *but the number of repetitions selected*.

It is clear that the most important variable to strength training is the amount of resistance used. The amount of weight determines the tension put on a muscle, and how long this tension is maintained determines the muscle's response. In fact, subtle manipulations can make the difference between increases in strength, increases in size and increases in endurance.

And the wrong manipulation can make the set, and indeed, the whole exercise session, worthless.

Obviously, the number of repetitions performed determines how much the athlete can lift, and given this fact, I have come up with 24 principles that can influence your decision, approximately half of which are presented in this article.

Whether you design programs for others or just yourself, many of these principles should help you in attaining your physique goals.

1. The number of reps done for a given time under tension dictates the training effect.

Training intensities can be altered in one of two ways: by having the athlete work at a higher percentage of his max (heavier weights), or moving the weight *faster* during the lifting, or concentric part of the lift.

While the number of reps an athlete performs also influences the training effect, it's mandatory that the speed used to execute the movement also be considered. It's too bad that very few researchers take into consideration the effects of different repetition speeds, and even worse that few coaches take tempo into consideration.

This is where the whole "super slow" theory of training falls flat. As far as sport is concerned, whoever produces the most amount of force in the shortest amount of time wins. By purposely training slow, you learn to become slow. Reducing the speed of movement just increases the time a muscle is under tension, not the intensity. As far as bodybuilding, however, it does not matter so much because functionality of the muscles is not crucial. In that regard, training slow for a brief period can lead to hypertrophy, especially if the trainee has been lifting explosively for a while.

Generally speaking, however, sets that subject the muscles to less than 20 seconds of time under tension build strength, while those that take from 40 to 60 seconds to complete cause hypertrophy.

2. MVC's (Maximal Voluntary Contractions) are essential to the strength building process.

To build size and strength, it is essential to incorporate maximal voluntary contractions. In short, this means recruiting as many motor units as possible to develop force.

Contrary to what you might assume, an MVC does not always equate to a 1RM load. Rather, an MVC could be the last rep of a 5 or 6RM load, where performing another rep is impossible.

Working with 1RM loads, though, enables an athlete to achieve maximal motor unit activation (MUA). Do this enough times, and neural adaptations and increased strength occur.

This is why the rest-pause training methodology is so valuable. For those of you unfamiliar with it, it involves using a 1RM load, which activates the maximal number of motor units. The athlete then racks the bar, removes 2-5% of the load, and then repeats the lift. The process is then repeated, for usually no more than 8 reps.

3. An athlete should use between 70 and 100% of maximum capacity to develop maximal strength.

While there is still some controversy as to the exact range of percentages, many leading experts in strength training believe that the best way to develop maximal strength is to use weights that allow the athlete to perform between 1 and 12 reps at 70 to 100% of the athlete's 1RM.

Some say, however, that anything below 75% is best suited for developing muscular endurance, while others put the number at 60%.

It is my experience, however, that the lower threshold is 70%, but beginners, and especially women, can often make progress using loads that are approximately 60% of 1RM.

4. The range in repetitions needed to develop strength and/or hypertrophy decreases with training ag**e.**

Training age, or the number of years the athlete has been training, influences the 1RM continuum.

While the average beginning weight trainee can often do 20 reps at 75% of maximum, that same trainee may do 10 reps at 75% of maximum after a year. If that same trainee is examined five years later, he may only do 4 reps at 75% of maximum.

Why is this important? Consider the athlete with a training age of one year who can bench press 12 reps at 140 pounds, which is 70% of his 1RM. Perhaps when this trainee has been training for four years, his new 1RM is 400 pounds. However, he may now only be able to complete 6 reps using 70% of his 1RM, which is 280 pounds.

Given that it is generally agreed upon by the strength training community that that 70% is the minimum threshold for strength development, it would not be a good idea to prescribe weights lower than 70%, or

repetitions higher than 6, as the weight would be too light to promote gains in strength.

5. The 1RM continuum varies greatly among muscle groups.

If an athlete performs his 12RM (the amount of weight he can lift 12 times) in the bench press, he may only be working at 70% of maximum, but at 12RM in the leg curl, he may only be working at 57% of maximum.

The extreme is even more remarkable when you consider certain lower body movements that employ a high stretch-shortening cycle component, such as leg presses. Many athletes can do 65 reps on the leg press while using a weight that is 70% of their maximum!

6. The number of repetitions is the loading parameter that athletes adapt to the most quickly.

It's best to vary rep range prescriptions often because the body adapts very quickly to given rep ranges. In fact, the average athlete adapts to a given number of reps in six workouts. When this adaptation occurs, it's virtually pointless to continue the same program.

One method with which I have had great success it to prescribe a given rep bracket for 2 workouts, lower it by 1 rep for the next two workouts, and then lower it by 1 rep yet again for one or two workouts.

Here is an example of such a progression:

Workouts 1-2: 4 sets x 6-8
Workouts 3-4: 5 sets x 5-7
Workouts 5-6: 5 sets x 4-6

7. Elite athletes must pay attention to the specificity of contraction force.

Generally speaking, reps in the 1RM to 5RM range increase maximal strength with minimal gains in mass. Reps in the 8RM to 15RM range produce greater gains in hypertrophy, while reps between 6RM and 7RM produce equal changes in hypertrophy *and* strength.

However, when considering athletes who have several years of training experience, low repetitions (1-5) must be used with high loads (85% or higher) for both relative and absolute strength, while mid-repetitions (6-12) must be used with sub maximal loads (70-84%) for absolute strength gains. High repetitions should be combined with light loads for strength-endurance (less than 70%).

In other words, athletes with more years of experience can train with a broader range of repetitions.

Along the same lines, periodically "straying" into unfamiliar rep ranges can have positive training effects that are not consistent with the norm. For instance, in athletes seeking hypertrophy, periodically employing programs that use 1RM to 5RM ranges can lead to increases in muscle *size* in addition to strength.

8. Don’t perform low reps too frequently.

Sport scientist Robert Roman has written extensively on the training of competitive lifters and he concluded that the most successful weightlifters tend to do most of their sets in the 3RM to 4RM range.

This observation was echoed by Canadian weightlifting coach Pierre Roy, who believes that the average rep range for athletes should be 3.

The take home point is that if an athlete does singles or doubles for too long, he will stagnate. This, of course, is especially true for athletes who seek hypertrophy.

9. Each muscle group or lift responds best to a specific average rep range.

Throughout my career, I have had the opportunity to analyze the training logs of the hundreds of athletes that I’ve coached. As such, it has become apparent that the optimal rep range should be specific to the muscle group or exercise chosen.

For instance, in the case of the elbow flexors, the best strength gains were obtained when no less than an average of 2.5 reps per set were performed, with a minimum total of 15 reps per workout.

Along the same lines, for hypertrophy purposes, triceps generally respond better to fewer reps than the biceps (because the triceps are generally more fast-twitch). Another example regards the hamstrings, which generally require fewer reps than quadriceps, or the gastrocs, which require fewer reps than the soleus.

10. The function of the muscle dictates the number of reps.

You have no doubt heard your physiology professor say, "Form dictates function." It is also my experience there are specific rep ranges that are more appropriate for certain muscle functions.

As an example, training the knee flexors (hamstrings) with sets of 12 results in little hypertrophy. However, when training the knee extensors, sets of up to 50 reps (leg press) can induce hypertrophy. This probably has to do with the fact that the knee flexors are used for explosive tasks, while the knee extensors are used primarily for maintaining posture and in the execution of certain stretch-shortening tasks.

11. Vary reps for the upper body more than the lower body.

Recent studies confirm that using programs that employ variation in rep ranges was more beneficial for the upper body than the lower body.

For example, if designing a program for the bench press, it’s more important to vary the reps often than it is for movements like the squat and deadlift.

12. High-rep training can increase capillary density.

Studies have shown that sets of more than 20 reps can increase capillary density, and capillary dense muscle can eventually lead to hypertrophy when one resumes more traditional rep schemes.

One such study, performed in 1973, showed that as little as one high-rep workout was enough to double the amount of mitochondria in muscle cells.

I think this is one reason why cyclists and speed skaters have such large quadriceps – they expose the muscles to an extreme amount of time under tension, thus facilitating capillary growth and hypertrophy of lower threshold motor units.

However, from personal experience, it seems that the quads, deltoids and lats would benefit from this type of training more than other muscle groups.

13. Reps performed in one exercise may have a different effect than reps performed for another exercise, even though both movements are for the same body part.

When comparing squats against leg press, squats are far more effective in increasing leg strength and overall strength. However, there is some evidence to suggest that the leg press might result in more hypertrophy of the quadriceps. One study, at least, showed that for the same number of reps, the leg press resulted in a higher amount of Growth Hormone being produced than squats.

As possible evidence, the leg press is the exercise of choice when it comes to speed skating, and I have personally worked with speed skaters whose legs made Tom Platz's look like Woody Allen's.

While I am loathe to recommend leg presses instead of squats, I merely present it as an interesting discussion point.

There are many more principles regarding the manipulation of reps that I use in designing programs, but the ones I have presented here should put you light years ahead of the average weight training pack.

Editor's note: This article is a brief extract of some the material presented in the Poliquin International Certification Program Level Theory 1 Manual that can be purchased at www.CharlesPoliquin.net.