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Periodization of Strength Part 2: The Hypertrophy Phase

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Every sport training program must begin with an Anatomical Adaptation (AA) phase. Depending on the biomotor abilities of the sport, the AA phase may be followed by a hypertrophy or maximum strength (MxS) phase of training. Athletic training programs that involve physical contact and a high level of lean muscle mass are generally planned to include one or two hypertrophy phases of training. The following discussion will focus on the methodological and practical aspects in hypertrophy training.

Hypertrophy training, an enlargement in muscle size is generally achieved by applying a vast number of principles inherent in bodybuilding. The main goals of the hypertrophy phase include an increase in the cross sectional area of muscle and an increase in the storage capacity of high energy substrates and enzymes. Hypertrophic changes occur in both the fast twitch and slow twitch muscle fibers. However, it occurs to a larger extent in fast twitch muscle fibers. Unlike the sport of bodybuilding, hypertrophy training for selected sports focuses mainly on increasing the size of the prime movers and is best suited to meet the needs of athletes such as shot putters, heavy wrestlers and football linemen.

Although the application of bodybuilding does produce an important increase in hypertrophy, it does not result in excessive nervous system adaptation such as the stimulation and recruitment of the high powered fast twitch muscle fibers. This can be a handicap for most athletes, so bodybuilding methods are used only in a certain phase of strength development. Some novice athletes can use bodybuilding since it is relatively safe and employs moderately heavy loads. Caution should be taken to ensure that the novice athlete does not train to exhaustion in each set.

Strength trainers and bodybuilders will experience short term and chronic hypertrophy. Short term hypertrophy as the name implies, lasts only a few hours and is a result of the pump experienced during heavy training. This “pump” is largely the result of fluid accumulation in the muscle. Heavy lifting results in an increased amount of water being held in the intracellular spaces of the muscle, making it look larger. When the water returns to the blood a few hours after training, the pump disappears. This is one reason why strength is not always proportional to muscle size. On the other hand, chronic hypertrophy is the result of structural changes at the muscle level. Since this is caused by an increase in the number or size of muscle filaments, its effects are more enduring than those of short term hypertrophy. The process of chronic hypertrophy is initiated during this particular phase of training. However, it is extremely exemplified during the MxS phase. More information pertaining to MxS training will be provided in the subsequent article.

Numerous theories attempt to account for the cellular adaptations in muscle that leads to chronic hypertrophy. Two popular theories include the *ATP deficiency theory* and the *muscle tension theory*. According to the ATP deficiency theory, muscle growth is initiated by a disturbance in the balance between the consumption and manufacturing of ATP. Intense hypertrophy training to exhaustion leads to ATP deficiency that depletes the endogenous proteins such the myofibrils (structural proteins) and enzymes/hormones (functional proteins) both of which rely on ATP for their synthesis. Proper recovery coupled with a high protein diet is believed to increase the quantity of these proteins and further the laying down of muscle tissue.

The muscle tension theory is more functional in nature. This theory states that slow repetitions or movements throughout the entire range of motion will keep the cross-bridges in contact much longer and thus elicit greater structural damage. Once again recovery and overcompensation leads to muscle hypertrophy. It is important to note that both of the above mentioned hypotheses are theoretical in nature. Further research in the area of muscle hypertrophy and the underlying mechanism(s) stimulating muscle growth is warranted.

As in any other new training phase, hypertrophy training should begin with a test for 1RM. The athlete then starts with a 70 to 80 percent load, or one that allows the performance of six repetitions. As they adapt to the load, they will progressively be capable of performing more repetitions. When 12 repetitions are reached, the load is then increased to a level where again only six repetitions are possible. See Table 1 for the training parameters of the hypertrophy phase.

To achieve maximum training benefits, it is important for athletes to reach the highest number of repetitions possible in each set. This means that they should always reach a degree of exhaustion that prevents them from doing the last repetition even when maximum contraction is applied. Without performing each individual set to exhaustion, muscle hypertrophy will not reach the expected level since the first repetitions do not produce the stimulus necessary to increase muscle mass. The key element in hypertrophy training is the cumulative effect of exhaustion in the total number of sets and not just exhaustion per set.

The exercises should be performed at a low to moderate speed, however, athletes in sports where speed-power is dominant are strongly advised against slow speed of execution especially if the hypertrophy phase is longer then four to six weeks. Adaptation of the neuromuscular system to a slow speed of execution will inhibit the recruitment of fast twitch muscle fibers and negatively affect athletes in speed-power dominant sports.

The duration of the hypertrophy phase is generally four to six weeks, with a frequency of two to four workouts per week. Unlike bodybuilding, hypertrophy training for athletes involves a lower number of exercises targeted to improve the size of the prime movers and not all muscle groups. The benefit of such an approach is that more sets are performed per exercise (four to six or as many as eight) and thus better muscle hypertrophy is stimulated for the prime movers.

During the rest interval of three to five minutes (which is longer than in bodybuilding) and at the end of the training session, athletes should stretch the muscles worked. The large number of repetitions performed in training causes the muscles to shorten and subsequently produces premature inhibition of contraction of the antagonistic muscles. This results in reduced muscle range of motion and decreased quickness of contraction affecting the overall performance ability of the muscles involved. To overcome this effect, athletes should constantly stretch their muscles to artificially adjust them to their biological length. In addition, a shortened muscle has a slower rate of regeneration as only the normal biological length facilitates active biochemical exchanges. These exchanges provide nutrients to the muscles and remove the metabolic wastes, facilitating better recovery between sets and after training sessions.

Table 1 - Training Parameters for the Hypertrophy Phase

Training Parameters Work

- Duration of hypertrophy phase: 4-6 weeks
- Load: 70-80%
- Number of exercises: 6-9
- Number of reps per set: 6-12
- Number of sets per session: 4-6 (8)
- Rest interval: 3-5 minutes
- Speed of execution: slow to medium
- Frequency per week: 2-4

As with every training phase, the hypertrophy phase should be viewed as a step to anatomically and physiologically prepare the body for the upcoming phase(s) of training. The AA phase serves as a structural foundation builder and the hypertrophy phase further adds to the strength and effectiveness of the foundation. Coaches and athletes should take note on the size, strength and other functional characteristics of their chosen sport and decide whether or not hypertrophy training serves a vital role. Figure 1 illustrates a sample six week hypertrophy program for a wrestler (heavyweight category).

Figure 1 - Sample Six Week Program for a Heavyweight Wrestler

Loading Pattern	low		medium		high		low		medium		high	
	Week 1		Week 2		Week 3		Week 4		Week 5		Week 6	
	% max	sets/reps	% max	sets/reps	% max	sets/reps	% max	sets/reps	% max	sets/reps	% max	sets/reps
Exercise Name												
Half Squats	60	3, 12	60	4, 12	70	4, 10	60	3, 12	75	4, 10	80	4, 8
Seated Rows	60	3, 12	60	4, 12	70	4, 10	60	3, 12	75	4, 10	80	4, 8
Twisted Abdominals		3, 15		3, 18		4, 12		4, 12		4, 15		4, 18
Leg Curls	60	3, 10	60	4, 8	70	3, 8	60	3, 8	60	4, 8	70	4, 8
Deadlifts	60	3, 10	60	4, 8	70	3, 8	60	3, 8	60	4, 8	70	4, 8
Bench Press	60	3, 12	60	4, 12	70	4, 10	60	3, 10	75	4, 10	80	4, 8
Lateral Deltoid Raises	60	3, 10	60	4, 8	70	3, 8	60	3, 8	60	4, 8	70	4, 8
Shoulder Shrugs	60	3, 12	60	4, 12	70	4, 10	60	3, 12	75	4, 10	80	4, 10
Toe Raises	60	3, 15	60	4, 15	70	4, 12	70	3, 10	75	4, 12	80	4, 10
Lat Pulldowns	60	3, 12	60	4, 12	70	4, 10	60	3, 12	75	4, 10	80	4, 10
Cleans	60	3, 12	60	4, 12	70	4, 12	60	3, 12	75	4, 12	80	4, 10