Maximal Power Training (MPT)

Vern Gambetta is well known to many readers as a coach, writer, founder of USATF's Coaching Education, professional sports consultant, and even ex-editor of this esteemed periodical, among other things. When the call went out for articles, Vern responded immediately, and this piece is an excellent summary of the work of two Australian sports scientists, Greg Wilson and Robert Newton. In our opinion, Gambetta has always been on the cutting edge of training, and you will agree when you read this piece. For more information on what Gambetta is up to, his web site address is http://www.gambetta.com/main.html. This article has been reprinted with the kind permission of Eleanor Frankel, who edits Training and Conditioning. *You may call 607/272-0265 to get further information on this journal. Currently, it comes out six times per year, but it will be bumped up to nine times in 1999.*

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The quest for the development of power as a means to improve sports performance is never ending. Training methods to improve power have run the gamut from heavy weight training to light fast weight training to plyometrics where the acceleration and deceleration of the body is the overload.

All these methods have produced results, although the results have not always been commensurate with the training time invested. As a coach I have tried many of the methods with varying degrees of success. I have always felt that there had to be a more systematic way to approach power development.

In my continuing search to find a better way to train for power the research of Australian sport scientists Greg Wilson and Robert Newton appealed to me because of its practical application. I will attempt to summarize their research and give some practical ideas on the implementation of their concepts.

Power is the application of strength with speed. Strength is only concerned with the application of force as expressed by the formula F x D. The time of the application of force is of no consideration; force production is the main goal.

Power is expressed by the formula F x D/Time; here *speed is of the essence*. Power is the quality needed for performance in the athletic arena, where movements take place in less than .3 of a second.

The training methods to achieve this kind of power are not new. They have been used for years by jumpers and throwers and more recently by sprinters and hurdlers in track & field. Explosive ballistic work was done out of necessity because their performance arena demands the highest expression of explosive power to propel their body or an implement with maximal velocity.

To achieve maximal power the bar or the implement must accelerate throughout the movement. A major limitation of using weight training to achieve maximal power is that the bar must achieve zero velocity at the end of the concentric phase of the movement. This means that near the end of an exercise, whether it is a squat, clean or bench press, the bar must slow down in preparation for stopping.

Research has shown that in a maximal lift 23% of the movement is accounted for by deceleration of the bar. In a lift at 81% of maximum the deceleration phase accounted for

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52% of the concentric movement (Wilson 1994). This is one of the major limitations of weight training for the development of maximal power.

In addition, traditional weight training is unable to imitate specific sport movements. This is true of both machines or free weights.

That is not to say that weight training is unimportant. Much to the contrary, it is very important to have a base of absolute strength, but as with any other method, it must be used at the proper place as part of an overall program. It can't be the sole focus of the program. It is necessary to train across a broad continuum of speeds and external resistance to achieve optimum results. No one method will get the job done.

In the search to utilize weights to raise explosive power one method that has been advocated is to lift lighter weights fast. Superficially it appears that the bar is moving fast but even this approach does not solve the problem as the bar is accelerated for only a short time at the first part of the movement. The rest of the lift involves the production of very little force since the work is directed at slowing down and stopping the bar at the end of the movement.

High power production is best represented by sport activities like putting a shot put. throwing a baseball, swinging a golf club or a baseball bat. The common characteristic of all these activities is that the implement or ball is accelerated progressively throughout the movement until release or contact occurs. This results in high power production throughout the movement.

According to Wilson (1994), "Maximal explosive power training involves performance of dynamic weight training at the load which maximizes mechanical power output." This involves lifting loads in the range of 30-45% of maximum at high speed.

Based on the previous discussion it should be obvious that the exercises must not be the typical weight training exercises where the bar reaches zero velocity at the end of the movement. Therefore, to attempt Maximal Power Training (MPT) with the traditional weight training exercises on machines or with free weights would be counterproductive to the stated goal of raising explosive power.

MPT is a marriage between strength training and plyometrics. "Maximal power training could be considered a form of plyometrics training that is specifically performed at a load which maximizes the power output of the exercise" (Wilson 1994). The loading is greater than plyometrics because more resistance than body weight is used. But lighter than traditional weight training.

The danger in this method is that due to external loading the exercises have greater impact forces as well as greater contact times at a slower velocity than using plyometric training where there is no external load. This makes it imperative that the athletes using this method have a very good training base or they will be at greater risk of injury.

To effectively use MPT, exercises should be selected that allow for the production of the highest forces possible throughout the whole range of movement. One of the best examples of this type of movement is the weighted squat jump. The power potential for this exercise is very high. According to Baker, "The multiple repetition jump squats are associated with power outputs usually only generated by elite weightlifting during the second pull of jerk thrust." He goes on to conclude. . . " Multiple repetition jump squats may provide an excellent alternative or supplement to the traditional Olympic weightlifting style movements for the development of speed-strength."

Incorporating these methods will involve a paradigm shift for many people who have relied almost exclusively on heavy external loading through weight training. It will demand more imagination as well as creativity on the part of the user to develop programs that serve the needs of the individual athletes relative to the power demands of their sport.

MAXIMAL POWER TRAINING EXERCISES

Plyo Power System—This is a machine that Wilson and Newton used for their research. It is essentially a modified Smith machine with a computer-controlled braking device to catch the bar after it is released. It is the safest way to utilize maximal power training with weight training because of the brake to catch the weight upon release. It is also very effective because of the computer interface that gives instant feedback on the power generated by the athlete.

The caveat to this method is that it is still guided resistance so that the proprioceptive and stabilization demand is not as high and it is limited to exercises in the vertical plane. The system is expensive and currently unavailable for sale in the USA. With some ingenuity it is possible to modify a regular Smith to be able to catch the bar upon release.

Jump Squat—In this exercise the athlete rapidly squats down and explodes back up as fast as possible aiming to achieve maximal height. To achieve the goal of maximal power production it is best done with external load.

To determine the appropriate load it is necessary to first determine the Total System Mass = Body Weight + Barbell Weight (Baker pp. 12). For example if the athlete weighs 200 lbs. and has a maximum squat of 375 lbs. the total of 575 lbs. is the total system mass.

To determine the optimal training load take 40% of 575 lbs. which would be 230 lbs. Then subtract the athlete's body weight from that, which results in a training load of 30 lbs.

It is imperative that special care must be taken so that loads that are too heavy are not selected. That is why it is so important to take into account total system mass. This workout is best performed in rep ranges from 8 to 15 reps for 3 to 5 sets. Two times in a

seven-day microcycle is sufficient.

Elastic Equivalent—These workouts consist of pairing of exercises consisting of one heavy exercise in the traditional weight training mode followed by an MPT exercise that allows acceleration over the entire range of the movement. Use no more than three pairs of exercises in a session and only two sessions a week for a maximum of three weeks. This is very intense work of high nervous system demand that has the potential to raise explosive power to higher levels, but if overused it can dull the nervous system.

Examples would be:

- Squat (4 - 6 @ 75 to 80%) & Jump Squat (10 to 12 reps)
- Bench Press (4 - 6 @ 75 to 80%) & Medicine Ball Chest Pass (10 to 12 reps)
- Hang Power Clean (4 - 6 @ 75 to 80%) & Stair Jumps with a weighted vest (10 to 12 reps)

Use 4 to 6 reps on the weight exercises at about an intensity of 75 - 80% of max. Use 8 to 12 reps on the elastic equivalent exercise.

Medicine Ball—To achieve the MPT training effect it is necessary to use heavier medicine balls. If heavier balls are not available it is possible to use weight plates thrown into a sand or a foam pit.

- Triple Extension Throws Backward
- Triple Extension Throws Forward

Use 3 to 5 sets of 6 to 8 repetitions.

Pendulum swings—This is an exercise that technically does not fit into the MPT mode of training but it can achieve many of the same effects. Hang a heavy medicine ball on a rope suspended from above. Swing the ball out creating a pendulum swing. As the ball swings toward you catch the ball with either one or two hands and immediately accelerate the ball back out.

Kettle Bells (Powerballs)—This is a favorite of the Eastern European throwers. Kettle bells are essentially a large heavy metal ball with handles for gripping that enable the athlete to throw them. They are not currently available in the USA except in the form of throwing weights for track and filed.

Instead I use a powerball which is a plastic ball with a handle for throwing that can be thrown on any surface without damaging the surface. The powerball varies in weight from two pounds up to 40 pounds. With these balls it is possible to execute a clean or a snatch movement and release the ball to achieve maximal power production. It is best to perform these exercises in the range of 6 to 8 repetitions for 3 to 5 sets.

To achieve optimum results from this method of training it is necessary to have a good overall general fitness base and an extensive weight training background in explosive movements in order to be able to handle the intensity of the work necessary to insure improvement. It is probably best utilized during the times of the training year when you want to raise power to new levels.

The traditional approach would be to put it at the end of a training program just before the most important competitions. That is acceptable. But it would probably be better to use it several times throughout the year in two- or three-week blocks to raise explosive power.

Remember, this method is not a method that should be used with beginners; you must have a good base of training and good proficiency in your sport before beginning this type of training.

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