USING THE MEDICINE BALL FOR GREATER FORCE PRODUCTION

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One of the most trusted ways of conditioning for the thrower that has stood the test of time is training with medicine balls. The old leather balls made way for the modern, colourful rubberized version, increasing the potential for new exercises and adding greater variety to the training programme. It remains a splendid way of total body conditioning, and develops many aspects paramount to the thrower, such as:

- Strength
- Strength - endurance
- Explosive strength
- Strength of ligaments, tendons and other connective tissue
- Throwing technique and functional strength
- general and specific coordination
- Dynamic flexibility
- Muscle activation through a full range of motion
- core stability (inner and outer core)
- Rotational power

Gradual progression is important, progressing from low intensity, light weight exercises to high intensity throws with heavier balls. Simple exercises involving general coordination precedes specific exercises which require more skill and nervous system involvement. Correct throwing technique remains paramount at all times.

Bone, which is very sensitive to training stimuli, ligaments, tendons and other connective tissue should always be given sufficient time to adapt to training loads. Female throwers have narrower shoulders than their male counterparts. They also have a smaller muscle mass, resulting in 40 - 60% less upper body strength. Training with medicine balls is an excellent way of addressing this problem.

As throws coaches, we are also well aware of the fact that the shoulder joint possesses a great range of motion, and make this joint, if not taken care of, very vulnerable to injury. Baechle and Earle (2000:50) report that the humeral head is capable of moving as much as 2.5cm out of the glenoid cavity during normal movement. The glenoid labrum, capsules, muscles, ligaments and tendons are equally important to ensure shoulder stability. The shoulder and chest muscles, for example, contract forcefully during the concentric action of the throw, generating kinetic energy, but also play an important role to stabilize the shoulder, and to decelerate the arm, in order to dissipate the kinetic energy.

Let's have a brief look at one of the most overlooked and sometimes undertrained muscle groups - the rotator cuff. Four small muscles comprise the rotator cuff. During throwing activities they provide dynamic stability by keeping the ball-and-socket joint together, preventing shoulder dislocation. The long head of the biceps also aids in providing dynamic stability.

Huge angular velocities are evoked during explosive throwing movements, and if these muscles are not well developed and conditioned, serious shoulder injuries might be sustained.

The first of these four muscles, the subscapularis, is located on the anterior surface of the scapula, and attaches at the top part of the humerus. Its function is to medially rotate the humerus, to stabilize the shoulder joint and to prevent the deltoid muscle pulling the humerus upward. The supraspinatus is posteriorly located above the spine of the scapula, and also attaches at the top of the humerus. It initiates

the movement of abduction of the shoulder, prior to the Deltoid muscle taking over the function. The Infraspinatus is also located on the posterior surface of the scapula, just below the spine of the scapula. It attaches at the top of the humerus and laterally rotates the humerus and prevents posterior dislocation of the shoulder joint. The fourth of the rotates cuff muscles, is the teres minor, also located on the posterior surface of the scapula. It also laterally rotates the humerus, and prevents upward dislocation of the shoulder joint.

The scapular stabilizers also play an important role, not only to stabilize, but to decelerate. The most important scapular stabilizers are the serratus anterior, trapezius and rhomboid muscles. The upper trapezius is normally well developed, as most, if not all, elite throwers do Olympic weightlifting movements. The middle and the lower parts of the trapezius are often neglected.

All explosive throwing movements are linked through the core, momentum and power from the legs are transferred through the core to the upper body. If the throwers core is weak, the throw will be weak. Remember, you are only as strong as your weakest link. The throwing movement should be strong through the whole kinetic chain. Medicine ball training provides excellent opportunities to develop dynamic core stability.

Medicine ball throws can be executed from a great variety of body positions. Single, as well as double handed throws can be performed. Throwing can be done from stable, as well as unstable surfaces.
Throwing can be done against a stable wall, indoor and outdoors. Certain exercises are better suited when athlete's work in pairs. Medicine balls can also, like ballistic weight training, be explosively projected into free space.

Throwing should always be performed explosively, maximally recruiting fast twitch muscle fibres and intensely involving the nervous system.

Speaking of explosive efforts, let's have a brief look at two important entities, power and acceleration.

Power is also referred to as explosive strength, and can be defined as the ability to overcome resistance very quickly.

$$\text{Power} = \frac{\text{work}}{\text{time}} = \frac{\text{force x distance}}{\text{time}} = \text{force x velocity}$$

As can be clearly seen, speed is paramount, and that is exactly what we need in the throwing events, and also when training with medicine balls. Forces need to be developed very quickly (force x time = impulse). The use of specialized throwing exercises, performed at maximum velocities, is necessary to obtain maximum power output, and the increased power output must still be transferred to the actual throw (functional power). O'Shea (1996:11) states that if the demands are not specific to the performance demands of the actual throw, functional (transferable) adaptation will not take place. That is why the manner in which you perform the throwing exercises is to important. Remember, throwers need to generate maximum force very fast, and to be able to accelerate the implement with great velocity. An increase in power is thus very specific to the resistance and the velocity of the movement (Newton & Kraemer 1994:23). Velocity specific training is thus paramount.

Acceleration refers to the rate of change in velocity. Newton's second law of motion states that acceleration is proportional to the force causing the acceleration, and takes place in the direction of the applied force.

Force = mass x acceleration (F = ma)

Forces are necessary to accelerate throwing implements. The bigger the force and the lighter the implement, the greater the acceleration. Throws should always be performed through a full range of motion. This will give the thrower the added advantage of a longer path in which to accelerate the implement.

Throwers need explosive-reactive power.

The faster a muscle is lengthened, the greater the concentric force developed. If the switch from muscle lengthening to shortening is done as rapidly as possible, then the maximum advantage of the release of stored kinetic energy to produce explosive forceful movement can be taken (O'Shea - 1995:86).

How do throwers develop this neuromuscular system? One example is the use of plyometrics.

Plyometrics is characterised by impulsive action of minimal duration between the end of the eccentric braking phase and initiation of the concentric acceleration phase (Siff & Verkhoshansky 1996:277). Siff and Verkhoshansky also state that the transition phase should not exceed 0.15 of a second.
Plyometric exercises are used to increase speed, power and movement speed. The reactive power capabilities of the body is improved. It involves rapid deceleration of a mass (implement or body weight), followed almost immediately by a rapid acceleration of the mass in the opposite direction. Plyometric exercises increases the potential of the stretch-shortening cycle, opening new avenues to achieve longer throwing distances.

O'Shea (1995:84) notes that tendon strength is a critical component of explosive movement, as encountered in the various throwing events. The tendons have the ability to store elastic energy during the eccentric contraction phase, which is then released to enhance the following forceful concentric contraction.

The pre-stretch principle is used at various stages during the execution of the throw, and is what plyometrics rely upon.

When executing medicine ball throws, the thrower (coach or partner) has to throw the ball really hard at the receiver (athlete) in order to get a good stretch, and to ensure that the tendons absorb as much energy as possible, which then will enhance the quality of the concentric contraction (the throw). For example - when the thrower's lower body rotates ahead of the upper body, with the throwing arm left behind, the chest and shoulder muscles are pre-stretched absorbing a lot of energy which is then utilized during the release of the javelin.

Throwers rely heavily on this pre-stretching of the muscle. If not executed properly, the thrower diminishes the force applied to the implement.

How much energy can a tendon store?

This depends on the magnitude of the applied force, and the length of the tendons when stretched.

"The larger the force applied to the tendon, the greater the stretch of the tendon. And the greater the stretch, the greater the amount of potential energy stored and available for generating maximum concentric force." (O'Shea - 1995:84)

Plyometrics, when applied correctly will most certainly lead to great improvement in the athlete's explosive-reactive values, and develop the athlete's ability to utilize the elastic and neural benefits of the stretch-shortening cycle.

High velocity concentric and eccentric training conditions the nervous system and stimulates muscle adaptation.

Circuit training with medicine balls

The usage of medicine balls is very versatile, and can easily be adapted to suit the needs of the athlete during any particular phase of the macrocycle.
During the phase of general training, circuit training can be utilized very effectively. Its effect can be increased by training in an indoor hall.
Apart from a great training atmosphere when several throwers are training together, providing a great motivation stimulus, a large variety of throws can be executed in a short space of time. The activity level is also very high.
The great British throws coach, Wilf Paish, first introduced me to this form of training, and showed that exercises can be easily structured to accommodate all the throwing disciplines in the same training session. A circuit comprises 8-12 exercise stations. The number of circuits depends on the athlete's fitness level. At each exercise station 1-3 sets of 8-12 repetitions are performed, with little rest between sets and exercises. Athlete's normally work in pairs. When the one athlete is training, his partner either throws the ball at the receiver, or keeps a watchful eye on his partner's technique. As soon as both have completed an exercise, they will immediately advance to the next exercise station, with of without rest.

Circuit training with medicine balls is very taxing, and training loads should always be adapted to the level of physical conditioning of the athlete. Sufficient time should be allowed for recovery between sets, exercises and training sessions.

REFERENCES

- Baechle, T.R & Earle, R.W. 2000. Essentials of Strength Training and Conditioning. Champaign, IL : Human Kinetics.
- DINTIMAN, G., WARD, B. & TELLES, T. 1988. Sports speed. Champaign, IL : Human Kinetics.
- HATFIELD, F. 1989. Power - A scientific Approach.. Chicago : Contemporary
- Jarmey, C. 2008. The Concise book of muscles. Chichester : Lotus publishing.
- NEWTON, R.E & KRAEMER, W.J. 1994. Developing explosive muscular power: Implications for a mixed methods training strategy. [In strength and conditioning].
- O'SHEA, P. 1995. Quantum Strength & Power Training. Corvallis, Oregon : Patrick's Books.
- PAISH, W. 1998. The complete manual of sports science. London ; A&C Black.
- RADCLIFFE, J.C. & FARENTINOS, R.C. 1999. High powered plyometrics. Champaign, IL : Human Kinetics.
- SIFF, M.C. & VERKHOSHANSKY, Y.V. 1996. Supertraining. Pennsylvania, USA : Sports Support Syndicate.
- TROWER, J. 2000. Javelin throwing. Birmingham : UK Athletics.

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