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Medicine Ball Training Implications for Rotational Power Sports

Jacob E. Earp, MA, CSCS[1] and William J. Kraemer, PhD, CSCS*D, FNSCA[2]
[1]School of Exercise, Biomedical and Health Sciences, Edith Cowan University, Western Australia; and [2]Human Performance Laboratory, Department of Kinesiology, University of Connecticut, Storrs, Connecticut

SUMMARY

MEDICINE BALL EXERCISES CAN BE AN IMPORTANT TOOL IN THE DEVELOPMENT OF MUSCULATURE THAT IS IMPORTANT FOR SPORTS PERFORMANCE. MEDICINE BALL EXERCISES CAN ACHIEVE ANGULAR SPECIFICITY AND STIMULATE TISSUES THAT MAY NOT BE ACTIVATED IN EXERCISE MOVEMENTS USED IN A TYPICAL STRENGTH AND CONDITIONING PROGRAM. MEDICINE BALL TRAINING ALLOWS COMPLEX SPORT-SPECIFIC MOVEMENTS TO BE PERFORMED EXPLOSIVELY WITH GREATER RESISTANCE THAN THAT SEEN DURING REGULAR SPORTS COMPETITION. SPORTS-SPECIFIC DEVELOPMENT OF HIGH-VELOCITY POWER MOVEMENTS CAN BE ACHIEVED TO HELP TRAIN THE SPORT-SPECIFIC MOVEMENTS AT HIGHER POWER OUTPUTS ON THE FORCE-VELOCITY CONTINUUM.

Medicine ball training has long been an accepted modality for resistance and power training (7). This mode of training is beneficial for those sports that require a great deal of rotational power to be developed for performance. Athletes in rotational power sports can use medicine ball training as a supplemental element of a periodized training program for a variety of reasons. Medicine ball training can allow a higher degree of sport specificity to be attained because exercises can be performed that can more closely mimic the range of motion (15) and velocities encountered in sport (3). Thus, such exercises can help build on the sport-generic exercises needed in every program (e.g., squats, bench press, power cleans, etc). Supplemental medicine ball exercises should complement the generic component, and exercises should be chosen to emphasize sport-specific demands such as velocity, plane of movement, and body positioning during the movement.

ROTATIONAL POWER SPORTS

For the purposes of this article, rotational power sports are defined as those sports that require explosive movements in either the transverse or oblique planes. All swinging sports, such as baseball, softball, hockey, lacrosse, tennis, and golf, can be considered rotational power sports. In these sports, it is vital for athletes to be able to create maximal angular velocity of their sport implement so that they can successfully strike a ball. Speed of movement and ability to react to ball position through a variety of planes are vital elements in many of these sports. Throwing sports, such as baseball, softball, javelin, shot put and discus throwing, and handball, or sports that involve throwing movements such as a quarterback in football or a goalie in soccer can also be considered rotational power sports. In these sports, the athlete positions their body so that the greatest angular velocity is transferred to a ball directly while maintaining a high degree of precision (1,6,14,16,18). Whether the movement is throwing or swinging the focus of the movement can be considered ball (or implement centered), as opposed to body-centered movements such as running or jumping, because the focus of the movement is to move the body around the ball for optimal performance. Medicine ball training, using muscle patterns similar to these sport movements, can be beneficial to baseball players and other rotational power athletes (17,16).

Movement patterns that are ball centered are vital to rotational power sports. In these movements, the body is manipulated to allow for greatest instantaneous velocity of ball or implement. These movements are optimally performed in a closed chain environment through a kinetic chain of movements (11,19). When the feet are in contact with the ground, movement can be initiated through the larger and stronger muscles of the lower body and then transferred toward the ball or implement through other muscle and tendon structures to allow for maximal velocity toward the target (1,2,14,15). During throwing and swinging movements, muscles fire primarily in

KEY WORDS:
sports specific; supplemental exercises; power; force-velocity curve; baseball; tennis; golf

a proximal to distal sequence. This sequence of activation allows a peak velocity of more proximal muscles, such as the calves, quadriceps, and glutei, to serve as prime movers and movement initiators (1,2,14). Further rotational acceleration and maintenance of the angular velocity already developed by the hips is then transferred to the torso. The muscles of the torso are oriented in a continuous chain that runs through a multitude of planes from the hips to the upper back and arms. These muscles include, but are not limited to, the external obliques, internal obliques, teres major, rhomboids major, and latissimus dorsi (2,13). Finally, the angular velocity is transferred to the extremity muscles, which serve to not only maintain the high degree of rotational forces already developed but also fine tune the precision of movement that is used. These muscles include the deltoids, triceps brachii, the internal and external rotators of the arm, and the flexors and extensors of the hand (14). Because of this complex system of order of activation and action of muscles, resistance training movements, such as medicine ball throws, should be used for training for rotational power sports.

Medicine ball training is a unique form of power training that has been used for athlete development for many years (7). Similar to the movements in rotational power sports, the goal of medicine ball movements is to transfer the greatest amount of angular velocity to an external object through gross and finite body movements. Performing medicine ball throws is an excellent form of resistance training in that it allows exercises to be performed at relatively high speeds but with greater force than those performed during normal sport competition (5,7,17,16). This increased force allows for greater power development at that part of the force-velocity curve, which can potentially be beneficial to athletes because forceful high-velocity movements are often neglected during sport and resistance training exercises. In addition, throwing exercises can be performed with minimal end of movement deceleration, which is a downfall of many optimal power weight training exercises (9,10). Also increases in strength and coordination within the ranges of motion encountered in sport may also be beneficial to injury prevention. Traditional weight training exercises performed in frontal or sagittal planes only may not achieve the range of motion that a medicine ball exercise functionally can.

MOVEMENT-SPECIFIC CONSIDERATIONS

When performing medicine ball exercises, different training considerations need to be taken into account during program design. The plane of movement, body position during movement, speed of movement, and the amount of countermovement are all variables that can be manipulated to emphasis those aspects that are most vital to an athlete's individual sport needs.

Throwing movements are often in the oblique plane progressing forward and downward across the body. For throwing athletes, movements that focus on this direction of movement, such as an overhead diagonal throw, are beneficial (Figure 1). Movements focusing on individual parts of the entire chain of movements, such as kneeling wood chops (Figure 2) and internal rotation throw, can help to isolate small and often neglected muscle groups (12).

In contrast, swinging movements vary based on the sport and the task being performed. For example, a baseball swing is performed mostly in the transverse plane with a quick reactive countermovement triggered by a step (14), whereas a golf drive is performed in the oblique plane moving downward then upward with a slower controlled countermovement of the torso and arms (8). Sport specific exercises for a baseball player can include a medicine ball baseball throw (Figure 3) or lateral medicine ball bounces (Figure 6). In contrast, the golfer would be better suited performing a golf static stance downward toss instead (Figure 4).

With sports such as tennis, differences can be seen not only in comparison to other sports but also between different tasks within the sport itself (1,2). For example, 2-handed backhand volley

Figure 1. Overhead diagonal medicine ball throw.

Figure 2. Wood chop throws.

Figure 3. Medicine ball baseball throw.

Figure 4. Static stance downward toss.

differs compared with a serve in direction of rotation, plane of movement, the countermovement (single plane versus circular), and the number of limbs involved. Furthermore, this same tennis player should work to develop a strong forehand swing with the body in a variety of positions (1). For this athlete, a variety of throws can be used to help the athlete better produce power in a variety of angles, directions, and from a variety of stances. These types of throws include throws from a forehand side and backhand side, which can be performed with an open, closed, or mixed stance (Figure 5).

In addition to the form of the movement differing within a sport, the speed of the movement can also change based on the time to react to a given stimuli within a sporting movement. Because of this training, a variety of speeds are important for rotational power sports that have a large reactive component. In addition, often times in sport, it is favorable to sacrifice power for reactive speed. In such cases, a spectrum of speeds of movement and preload conditions should be implemented with medicine ball training exercises. For example, that same tennis player can perform quick reactive lateral bounces with a light ball against a wall (Figure 6), a more powerful "power throw" that moves through a full range of motion throw from the same position (Figure 7), or a power throw in a preloaded condition after catching the ball thrown by a partner (Figure 8). Although all 3 types of throws should always be thrown with as much power as possible, in the reactive throw to accomplish the same movement in the time allotted, the weight of the ball and the amount of countermovement can be sacrificed to allow for a quicker movement. A summary of sport specific consideration for throwing (Table 1) and swinging sports (Table 2) can be found in the Table 1 and 2.

PRESCRIPTION CONSIDERATIONS

With rotational exercises, care must be taken in the general preparation phase to prepare the range of motion for subsequent higher stress exercise movements. Strengthening, flexibility, and then progression in the loading of the medicine ball exercises is vital in

Figure 5. Power throws from a variety of stances.

Figure 6. Rapid lateral medicine ball bounces.

Figure 7. Lateral power throws.

the first several workouts to minimize the potential for muscle strains and pulls, especially in novel movements to the athletes. Medicine ball training is a supplemental component of a training program and should be integrated as part of a periodized progressive resistance training program to optimize strength and power gains (7,11,17,16). When prescribing medicine ball exercises, the acute program variables (4) should all be controlled to best accomplish the desired results of increased performance. The goal of medicine ball training is to achieve the greatest amount of speed and power possible within a given movement while maintaining proper form. Because of this, consideration should be given into how to best incorporate medicine ball training with other forms of training. The easiest way to incorporate medicine ball training is by performing these explosive moves during a separate power or light workout. During these workouts, medicine ball exercises can be incorporated with other high-velocity or ballistic movements, such as squat jumps, bounding, and bench throws. However, medicine ball training can also be added to other workouts by performing them at the beginning of a workout. Performing these movements at the beginning of a workout will help to ensure that fatigue from other exercises does not deteriorate technique or diminish power development. Medicine ball training can also be incorporated on a heavy workout by using complex training; by performing a nonfatiguing high-resistance movement before an explosive movement with similar mechanics, a potentiation of performance in the explosive movement may be obtained (4,5).

When peak power and velocity with a high degree of precision are the main goals of training, repetitions should be kept below fatiguing levels for maintenance of power and proper technique carefully monitored. For most rotational power exercises, only 3–6 repetitions should be performed at a time, with fewer repetitions in a set as ball weight increases. In addition, at least 3 minutes of rest will ensure that fatigue does not become a major factor between sets. The weight of the ball should be selected based on the


Figure 8. Lateral power throw starting from catch.

Table 1
Throwing sports

	Mass	Reactive	Stationary
Baseball pitch	0.3 lbs	No	Yes
Baseball throw	0.3 lbs	No	Yes/no
Javelin throw	1.3–1.8 lbs	No	Yes
Shot put throw	8.8–16 lbs	No	Yes
Discus throw	2.2–4.4 lbs	No	Yes
Handball shot	1.0–1.2 lbs	Yes	Yes/no
Cricket bowl	0.3 lbs	No	Yes
Football pass	0.9 lbs	Yes	Yes/no

Mass refers to the mass of the ball or implement thrown. Reactive movements are those that have movements that may need to be adjusted after initiation of the movement has already begun. Stationary refers to if the movement originates from a standing position or a moving position.

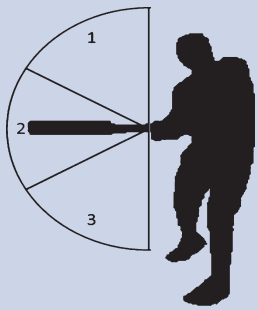
individual's ability to maintain speed and form (3,10). Weights should start out relatively light and progress as the athlete becomes stronger and more proficient in the movements. Furthermore, training across a spectrum of weights will allow the athlete to focus both on velocity and power development and may have further potential benefits. When excessive repetitions or weight are used for highly coordinated medicine ball exercises, the likelihood of loss of finite motor skills increases and these repetitions can then enforce poor motor patterns, so care must always be taken when performing movements, which mimic those encountered in sport. Medicine ball exercises will typically train the higher velocity component with some loading to stimulate tissue growth, resistance to fatigue, and improvement of function on that phase of the force-velocity curve, which is associated with higher absolute power (11). In addition, the use of medicine balls allows loading of tissues that typically will not be loaded in the same plane or angle of movement allowing for a great supplemental utility for the modality.

CONCLUSION

In conclusion, medicine ball training is an effective way of increasing performance for athletes involved in rotational power sports. Medicine ball training allows complex sport-specific

Table 2
Swinging sports

	Zone	Reactive	Stationary
Lacrosse	1, 2	Yes/no	Yes/no
Tennis serve	1	No	Yes
Tennis groundstroke	1, 2, 3	Yes	Yes/no
Baseball swing	2	Yes	Yes
Cricket	3	Yes	Yes
Hockey slap shot	3	Yes/no	Yes/no
Golf	3	No	Yes



Zone refers to the height of movement: high (1), middle (2), or low (3) movements (see associated image). Reactive movements are those that have movements that may need to be adjusted after initiation of the movement has already begun. Stationary refers to if the movement originates from a standing position or a moving position.

movements to be performed explosively with greater resistance than that seen during regular sports competition. The medicine ball exercises should be adapted to fit the requirements of the athlete's individual sport (see Table 1 and Table 2). Proper attention should be given to the plane of movement and body positioning mechanics of the throwing or swinging movements, as well as the speed of movement and the amount of countermovement. When these factors are taken into account and implemented as part of a progressive resistance training program, an athlete will be better equipped for their sport and performance will increase.

Jacob E. Earp *is a PhD candidate in the School of Exercise, Biomedical and Health Sciences at Edith Cowan University in Western Australia.*

William J. Kraemer *is a full professor in the Human Performance Laboratory in the Department of Kinesiology, the Department of Physiology and Neurobiology, and the School of Medicine, at the University of Connecticut.*

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