RESISTANCE TRAINING TO IMPROVE PISTOL SHOOTING PERFORMANCE

Accurate marksmanship in pistol shooting is dependent on many variables. Those variables include the skill of the shooter, experience, upper extremity and core strength, and posture control (3,12). Tactical athletes in both law enforcement and the military must be very proficient in these areas if they are to become successful in marksmanship. According to research, a tremor in the lateral and vertical plane during pistol shooting is based on stability from the shoulder and the wrist (3,12). Most of the lateral oscillations produced by the body occur during aiming at a target (12). These oscillations are more apparent at the distal portions of the shooter’s arm (elbow, wrist, and hand) (12). These oscillations can be the result of inadequate isometric strength and stability from the muscles and tendons of the shooter’s arm. The anatomy of the shooter’s arm consists of the shoulder joint, biceps, triceps, elbow joint, forearm muscles, wrist joint, and muscles and joints of the hand (thumb and fingers) (3,12).

Regardless of the skill of the shooter, a postural tremor is present during aiming and firing. The amount of the tremor is dependent on the skill and upper extremity/core strength of the tactical athlete. Research shows a strong correlation between hand grip strength and being successful in pistol shooting training among police cadets (3). It is important that upper extremity strength and/or muscular endurance is adequate enough to increase shooting performance among tactical athletes in situations where it counts.

In a previous issue of the TSAC Report (Report 35), the article “Kinesiology Tape Application to Improve Pistol Shooting in Tactical Athletes” was written to illustrate the usefulness of using kinesiology tape to enhance muscular contraction and muscular endurance within the shooter’s arm. Research supports the claims that a combination of kinesiology tape application in conjunction with a resistance training program will improve muscular activation via motor and cutaneous unit recruitment (6,9). Kinesiology tape applications are useful during periods of muscular fatigue and injury (6,9). Injuries to the shooter’s upper limbs that can impede shooting. A combination of a kinesiology tape application and a progressive resistance training program for the upper extremity can potentially increase overall performance of the shooter’s arm during pistol target shooting.

THE SHOOTER’S ARM

The shooter’s arm starts at the shoulder girdle. The shoulder girdle consists of the glenohumeral joint, sternoclavicular joint, and the scapulothoracic joint. The major muscles around these joints include the deltoid, pectoralis major, pectoralis minor, trapezius, rotator cuff muscles, biceps, triceps, and to a slightly lesser degree, serratus anterior, and rhomboids. In order to stabilize the shoulder joint (glenohumeral joint), the muscles of the rotator cuff are important. The job of the rotator cuff is to stabilize the shoulder joint during aiming but will need to be significantly active during firing of the pistol so that the recoil does not disturb the arm’s position (4). When shooting, the arms will be at approximately 90 degrees of shoulder flexion. The anterior and medial deltoids are important during the aiming and firing of the pistol. As the shoulder is in approximately 90 degrees of flexion, the biceps and triceps assist with stabilization of the shoulder and elbow during pistol shooting. In addition, serratus anterior and rhomboids help with scapular control and stability. The elbow and wrist joints also play roles in pistol shooting and must have strength for optimal performance (1).

The muscles of the forearm (extensors and flexors) provide muscular tension to the long tendons in the fingers, specifically in the tendons of the second and third fingers. The second finger extensor tendon is primarily the trigger finger when the trigger of the pistol is depressed. According to research, grip strength in the form of steadiness is key to achieving excellent marksmanship (1,3,12). The muscles of the hand include the thenar eminence, hypothenar eminence, and the lumbricals, which provide muscular power for proper grip. These muscles need to be strong enough to help maintain a stable position when the trigger is depressed as well as limit postural sway (1,3). The lumbricals of the fingers must aid in the proper position of the gun handle and activate smoothly as the second finger depresses the trigger (3).

PROGRAMMING CONSIDERATIONS

The muscular strength, posture control, experience, and skill of a shooter may determine the accuracy of their shooting. The resistance training program of the upper extremities should be comprised of exercises that focus on stability, muscular endurance, and motor unit activation throughout the entire arm. The combination of kinesiology taping while shooting and a resistance training program may benefit the tactical athlete by enhancing motor unit recruitment within key muscles of the upper extremities used during training and pistol shooting (1,5,10). The exercises should be equally comprised of all actions of the muscles (i.e., concentric, isometric, and eccentric). By employing all the actions, the muscles of the shooter’s arm will be able to specifically adapt to the demands of pistol aiming and firing without causing fatigue or injury to the arm during strength training and shooting. Research has demonstrated that there is an inverse relationship between upper extremity tremor and the strength and conditioning of the shooter’s arm (12). In all
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exercises listed below, proper form is crucial; the tactical athlete should never sacrifice form for increased weight or resistance. When all repetitions and all sets suggested in this article can be performed with perfect form, it may then be appropriate to increase the weight or volume progressively. Weight progression is typically increased by five pounds or until significant challenge of the exercise is accomplished without sacrificing form of exercise technique. The tactical athlete should engage in strength training as much as three or four sessions per week to improve optimal performance in pistol shooting.

The sample resistance training program and exercises can be used as a basis from which tactical athletes may design and implement their training program to help improve pistol shooting performance.

SAMPLE RESISTANCE TRAINING EXERCISES

SHOULDER INTERNAL/EXTERNAL ROTATIONS
An exercise that can be recommended is internal and external shoulder rotations. This exercise can be beneficial to strengthening the rotator cuff musculature (supraspinatus, infraspinatus, teres minor, and subscapularis) (11). However, it can also be potentially detrimental if prescribed to tactical athletes that are asymptomatic (not displaying a need for strengthening in that area). A main concern with the implementation of this exercise in asymptomatic populations is a greater risk of impingements or injuries due to increased thickness of the musculature, which may limit subacromial space (5,7).

However, this exercise can be utilized by tactical athletes to address specific deficiencies or imbalances in shoulder strength, specifically in the rotator cuff (8). In terms of general injury patterns, injuries in the shoulder complex comprise a large portion of all reported injuries from several studies, with prevalence rates ranging from 22% to 36% (7). However, oftentimes these injuries are the result of improper exercise technique (7,11). If internal and external shoulder rotations are utilized, it is recommended that tactical athletes lie on their side on a table with a small towel under their top arm with their elbow at 90 degrees of flexion and the shoulder abducted at 30 degrees (9). Keeping the elbow fixed to the side of the body, the forearm should be raised towards the ceiling using a small degree of motion, about a 30-degree arc, before returning to the starting position (9). Using a towel will help maintain the proper position for the movement (about 30 degrees of abduction in the starting position) as well as allow for adequate blood supply to the shoulder complex (9).

PUSH-UPS
This common exercise incorporates the majority of the muscles of the upper extremities and the trunk. The tactical athlete should start in a prone position lying on the ground with the elbows to the sides of body and hands alongside the shoulders/head. Then, the tactical athlete should use a powerful push against the ground, keeping the trunk stable, to raise the entire body off the ground until the arms are fully extended with the elbows maintaining a very slight flexion. The body should be aligned in a straight line without allowing the anterior torso or hips to sag toward the ground. Hold this position for two seconds then slowly lower the whole body toward the ground until the chest is approximately three inches from the ground. Repeat this movement to complete three sets of 12 – 15 repetitions.

SHOULDER PRESSES (FIGURES 1 AND 2)
The tactical athlete should sit erect on an exercise ball. The exercise ball will challenge the posture control of the tactical athlete’s trunk. Since the exercise ball will challenge stability, performing shoulder presses on an exercise ball may aid in body and extremity stability during aiming and firing. Holding dumbbells with a pronated grip, the tactical athlete should start with the elbows bent to 90 degrees with the forearms vertical and perpendicular to the ground. The tactical athlete should push both dumbbells over the head until the elbows are fully extended. Then, slowly lower the dumbbells to the starting position and repeat the motion. The tactical athlete should maintain an erect posture and keep the traps relaxed during the exercise. Complete three sets of 10 repetitions each.
SHOULDER FRONT RAISES (FIGURE 3)
The tactical athlete should sit on an exercise ball and keep the back straight without slouching. This exercise can be performed either with a single arm being raised while switching back and forth, or with both arms raised at the same time. The exercise that is demonstrated in Figure 3 is a single-arm raise. The tactical athlete should start with the dumbbell at their side and then raise the dumbbell with the arm straight at the elbow until approximately 90 degrees of flexion is reached at the shoulder. The hand should be slightly below the shoulder/trap line. The tactical athlete should hold this position for 1 – 2 s and slowly return the dumbbell to the starting position. It is important to remain in an erect position while sitting on the exercise ball without slouching or moving the back into extension. Complete three sets of 10 repetitions each.

PRONE LATERAL RAISES (FIGURES 4 AND 5)
The tactical athlete should lie prone on an exercise ball with the chest off the ball. With a dumbbell in each hand, start the exercise with the arms in front of the body. Raise the arms until they are parallel to the ground with the palms facing down; the tactical athlete should make sure not to bend the elbows. The tactical athlete should squeeze the shoulder blades together when the arms are parallel to the ground. Complete three sets of 10 repetitions.

BICEPS CURLS (FIGURES 6 AND 7)
The tactical athlete should sit on an exercise ball with a dumbbell in each hand. The hands should be in a neutral position (thumb pointed toward the ceiling). Begin by raising each dumbbell toward the head by bending the elbows until full elbow flexion is reached. Slowly lower the dumbbells down toward the ground by extending at the elbows. The shoulders should remain relaxed and in a neutral position. The tactical athlete should keep the dumbbells in front of the body by keeping the elbows in front of the trunk. It is also important to keep the back straight and not to allow any motion to be generated by the back muscles. Complete three sets of 10 repetitions.
PRONATION AND SUPINATION–FOREARM ROLL
(FIGURES 8 – 10)
The tactical athlete should sit on an exercise ball with the forearm resting on a table. The tactical athlete should grab a light dumbbell (2 – 8 lb) at the end of the dumbbell as shown in Figures 8 – 10. The start of the exercise can be either the palm facing down to the ground or up toward the ceiling. The tactical athlete will slowly rotate the dumbbell using the supinator or pronator muscles so that the dumbbell finishes in the position opposite of where it started. The motion strictly originates from the forearm. Pause for 1 – 3 s between each set. Complete three sets of 10 repetitions then repeat with the other arm.
Wrist Extensions (Figures 11 and 12)
The tactical athlete should sit on an exercise ball with the forearm resting on a table holding a dumbbell. The wrist should rest on the table while the hand hangs off the table in passive wrist flexion (due to gravity). The tactical athlete should bring the wrist up towards the ceiling and hold this position for 1 – 2 s, then slowly move the wrist towards the ground. The importance in this exercise is the lowering of the dumbbell back toward the ground. This is known as an eccentric contraction of the wrist extensors. The rate of lowering the wrist back towards the ground can be measured by counting backwards from four to zero. At the count of zero the wrist should be back in the hanging position. The tactical athlete should be careful not to allow the wrist to rotate in any direction during this exercise, or to fall uncontrollably. Complete three sets of 10 repetitions with each arm.

Wrist Flexion (Figures 13 and 14)
The tactical athlete should sit on an exercise ball with the forearm resting on a table holding a dumbbell. The back of the wrist should rest firmly on the table while the hand hangs off the table with the palm facing the ceiling in passive wrist extension (due to gravity). The tactical athlete should activate the wrist flexors and flex the wrist so that the hand is moved towards the head of the tactical athlete. They should hold this position for 1 – 2 s and then slowly return the wrist back to the starting position. Eccentric contraction of the wrist flexors is important for the tactical athlete when returning the wrist back to the starting position. Do not allow the wrist to rotate or fall uncontrollably. Complete three sets of 10 repetitions with each arm.
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RADIAL DEVIATION (FIGURE 15)
The tactical athlete should sit on an exercise ball with the forearm resting on a table and the hand off the table holding a dumbbell. The wrist should be placed in a neutral position so that the thumb is pointed towards the ceiling and the fingers are pointed to the side. Flex at the wrist so the thumb is moved towards the head of the tactical athlete. They should hold this position for 1 – 2 s, and then slowly return the hand to the resting position. The tactical athlete should maintain control during the eccentric contraction of the wrist when lowering the dumbbell. Complete three sets of 10 repetitions with each arm.

LUMBRICAL SQUEEZE (FIGURES 16 AND 17)
The tactical athlete will start by placing their hand on the edge of a table with the fingers off the edge pointing down towards the ground. Keeping the palm flat against the table, the tactical athlete should squeeze the side of the table with the fingers and pull the knuckles up towards the ceiling without bending the fingers. The palm of the hand should move superiorly towards the ceiling without the fingers bending. This exercise may be used to help improve grip strength. Complete three sets of 10 repetitions with each hand.
REFERENCES


ABOUT THE AUTHOR

Keith Chittenden is a Certified Strength and Conditioning Specialist® with Distinction (CSCS,*D®) and Tactical Strength and Conditioning Facilitator® with Distinction (TSAC-F,*D®) through the National Strength and Conditioning Association (NSCA). He holds a Master’s degree in Exercise Science from California University of Pennsylvania and is a doctoral candidate at the University of Hartford. He was a columnist for the NSCA’s TSAC Report and continues to be a regular contributor to NSCA Associate Publications. Chittenden has over 13 years working with athletes, police officers, and military personal in areas such as fitness, performance enhancement, and post-rehabilitation.

TABLE 1. SAMPLE PISTOL SHOOTING RESISTANCE TRAINING PROGRAM

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<tr>
<th>EXERCISE</th>
<th>REPETITIONS</th>
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<th>RESISTANCE</th>
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<tr>
<td>Push-up</td>
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<td>Bodyweight</td>
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<td>3</td>
<td>10 – 30 lb</td>
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<td>3</td>
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