

Shoulder and Elbow Training for Baseball

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PREPARATION IS THE KEY TO athletic success and injury prevention. In the throwing athlete, the training of the major muscle groups is very important. But commonly overlooked in the development of training programs are the rotator cuff muscles (supraspinatus, infraspinatus, subscapularis, and teres minor) and scapular stabilizer muscles (serratus anterior, rhomboids major and minor, trapezius, and levator scapulae). Although these are not the primary movers during the throwing motion, they are extremely important for stabilizing the shoulder and therefore must be emphasized in training (6). A comprehensive strengthening program along with proper throwing mechanics lessens the chances of throwing injuries (9).

■ Upper Extremity Injuries in Throwers

Upper extremity injuries in throwing athletes involve both the shoulder and the elbow. Some of the more common include (a) rotator cuff tendinitis, (b) degenerative rotator cuff tears, (c) scapular

stabilizer weakness, (d) shoulder instability, and (e) medial elbow pain. A brief anatomical review of each problem will illustrate the importance of strength training with emphasis on the rotator cuff and scapular musculature.

Rotator Cuff Tendinitis

The function of the rotator cuff musculature is to depress the head of the humerus while the arm is raised overhead in the throwing motion. In a thrower with a weak rotator cuff, humeral head depression is minimized and the humeral head will be forcefully elevated or impinged under the acromion process and/or coracoacromial ligament. Previous authors have demonstrated an association between rotator cuff weakness and impingement (3, 13). This impingement, secondary to repetitive throwing, may irritate the structures that pass between the humeral head and the acromion/coracoacromial ligament, namely the supraspinatus tendon, subacromial bursa, long head of the biceps tendon, and the glenohumeral joint capsule.

Rotator Cuff Tears

As chronic irritation of these structures continues, due to impingement, they become thickened and weakened and may result in degenerative tears of the rotator cuff (2).

Scapular Stabilizer Weakness

Scapular weakness is usually noted as the thrower begins to fatigue. Weakness of the scapular stabilizers disrupts the normal rhythm between the humerus and scapula. This abnormal rhythm changes the throwing technique and places more stress on the shoulder complex. Without adequate endurance of the scapular stabilizers, good throwing mechanics may not be possible over repeated throwing bouts.

Shoulder Instability

Shoulder instability in throwers usually results from repetitive microtrauma placed on the joint capsule and ligaments due to the throwing motion (10). Laxity in these static stabilizers of the

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shoulder magnifies the importance of dynamic stabilization which is provided by the rotator cuff musculature. Thus, throwing athletes who complain of their shoulder "sliding" with activities need an aggressive rotator cuff strengthening program (3, 4).

Medial Elbow Pain

Throwing athletes may also complain of medial elbow pain. This pain is usually due to stress placed on the medial collateral ligament and ulnar nerve (12). Baseball pitchers with a sidearm delivery seem to have more risk of medial elbow pain (1).

As can be seen from the brief description of these problems, many injuries may be avoided by strengthening the rotator cuff and scapular stabilizers. As in many athletic movements, power and stability are produced from a structure other than the one performing the movement. Therefore, proper throwing mechanics are based on strong scapular and humeral stabilizing muscles.

■ Strengthening Program

The process of strengthening the rotator cuff and scapular stabilizers must be viewed with a different frame of mind than normal weight training. Since most of these exercises involve smaller muscles, lighter weights must be used to ensure proper form and decrease the risk of injury. Movements must be done in a steady, controlled fashion; avoid quick and jerky movements. If the athlete is struggling, decreasing the weights may help him or her better control the action and maintain proper form throughout the exercise.

The off-season program is very important in preparing an athlete for the lengthy intense season. The in-season program is equally important; it helps the

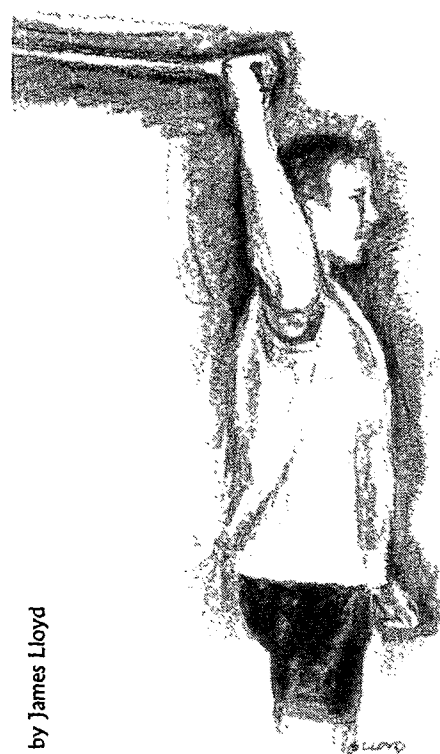
athlete maintain adequate levels of strength and decrease the risk of injury. Since most in-season schedules do not allow for regular structured strengthening programs, a protocol of on-field and rubber tubing exercises is suggested. Many of these exercises may be the ones used in the weight room as well.

The exercises in the next section are designed for a nonsymptomatic athlete. Although most of these are used in rehabilitation, some modifications may be necessary if the athlete is symptomatic. If any of the exercises are painful or if the athlete develops an injury at any time, an orthopedic specialist should be consulted before further training.

Have the athlete do the following exercises every day during both the preseason and in-season. One set of 15 reps may be used for warm-up prior to stretching and throwing. Do not let the athlete become fatigued during warm-up exercises before a practice or game because fatigue could compromise his or her mechanics and strength. This could lead not only to decreased performance but also to shoulder or elbow problems. Strengthening should be completed either long before or following practices or games, 3 to 4 times a week, 3 sets of 15 reps.

■ Rotator Cuff Program

The muscles of the rotator cuff are active during the throwing motion both during the cocking phases and largely during the follow-through or deceleration phase (7). A good rotator cuff program consists of three basic movements: internal rotation, external rotation, and the 45° side lateral raise, or upright row (8). There are many variations and modes of resistance for each exercise. Variety and specificity are usually the



Illustrations by James Lloyd



Figure 1 Internal rotation:
(a) start position,
(b) ending position.



Figure 2 External rotation: (a) start position, (b) ending position.

best guidelines when selecting which are best for your needs.

For internal and external rotation, use either rubber tubing or hand weights. Rubber tubing is easy to take on field and may be used for both strengthening and warm-up purposes. Sport specificity is important in developing strength, coordination, and endurance, so these exercises are best performed in the throwing position. They may also be done with hand weights either in a prone or supine position on a bench or on the floor.

Internal rotation (subscapularis): Attach tubing approximately 6 in. above head, body facing away from tubing. Maintaining proper "L" throwing position and elbow and shoulder height, rotate hand forward and down. Steadily return to start position and repeat. Try to keep elbow stationary; do not move it anteriorly or posteriorly (Figure 1).

External rotation (infraspinatus, teres minor): Attach tubing at midchest height, facing toward

tubing. Maintaining same techniques as above, rotate hand upward and back. Steadily return to start position and repeat. Keep elbow stationary as mentioned in internal rotation (Figure 2).

The 45° side lateral raise (coracobrachialis, deltoid) should be performed with the elbow straight and the thumb pointing downward. The hand should not be raised above shoulder height, and a 3-lb maximum weight limit must be strictly enforced on this exercise to avoid impinging the shoulder joint (Figure 3). The upright row lift may be substituted for this exercise to further protect the shoulder, or if pain is felt in the above exercise.

■ Scapular Stabilizer Program

A scapular stabilizer program concentrates on the muscles that secure the scapula during shoulder movement. The importance of



Figure 3 45° side lateral raise.

these muscles in the throwing process has been reported by Gowan et al. (5) to show peak activity during acceleration. Again, there are many variations to the following exercises but the emphasis must remain on the scapular stabilizers, not the major movers (10).

Scapular push-ups (serratus anterior) are performed in a normal push-up position. If the athlete cannot perform the exercise correctly from this position due to pain or weakness, the position may be modified and performed with knees on the floor or from a standing position, leaning against a wall, at a 45° angle. It is important that the elbows remain in a firm position; the chest and triceps are not the emphasis in this exercise. Shrug the shoulder blades toward the spine (retraction), then abduct them (protraction) as far from the spine as possible (Figure 4).

Scapular dips (trapezius inferior fibers) are performed on either a dip bar or off the edge of a bench or chair. Beginning in a normal dip position, lower the body toward the floor without bending the elbows. Try to keep the body in an upright position; do not lean forward. As in scapular push-ups, raise the body upward by pushing the shoulders toward the floor in a reverse shrug movement of the scapula (not shown).

Bent-over side lateral raises (trapezius middle fibers, rhomboid major and minor), for the purposes of this program, are performed with a lighter weight than the athlete would normally use. This allows for a shrugging of the shoulder blades toward the spine at the top of the action (Figure 5).

Shoulder shrugs and horizontal (bent-over or seated) rowing (trapezius superior fibers, levator scapulae, and trapezius middle fibers and rhomboids major and minor) are performed without modification or restrictions to the normal weight training protocol. Illustrated are two modifications that may be performed on field for in-season training (Figure 6).

■ Throwers'-Elbow Program

The muscles of the elbow show steady activation throughout the entire throwing motion, with the least amount being during the follow-through phase (11). The throwers'-elbow program may be performed either with weights or rubber tubing, depending on preference. Wrist curls, radial and ulnar deviation, and pronation and supination can all be easily performed in a seated position with tubing. Resting the forearm on the thigh, grasp the tubing with the hand while placing the opposite

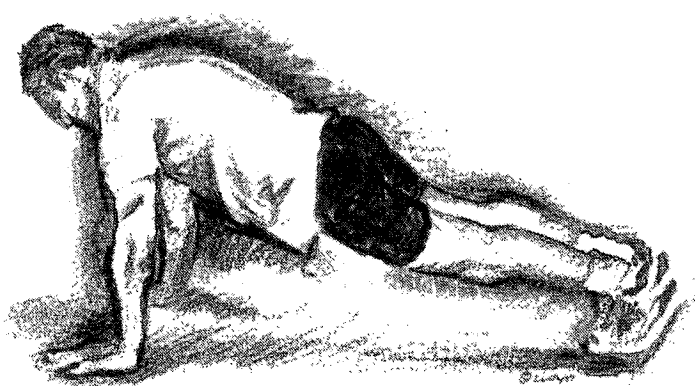


Figure 4 Scapular push-ups: (a) start position, (b) ending position.

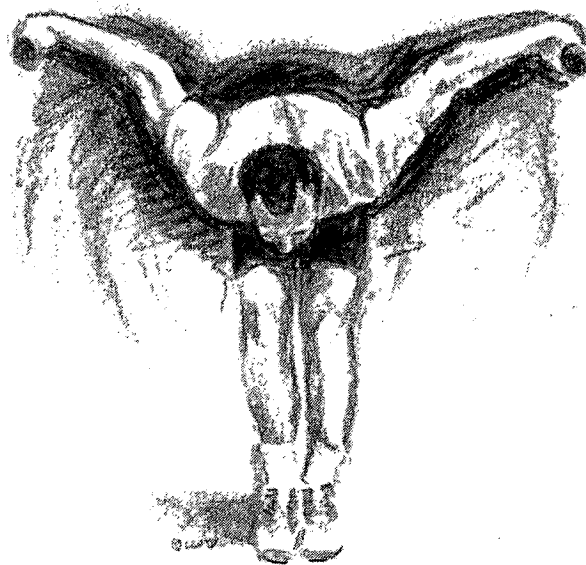


Figure 5 Bent-over side lateral raises.

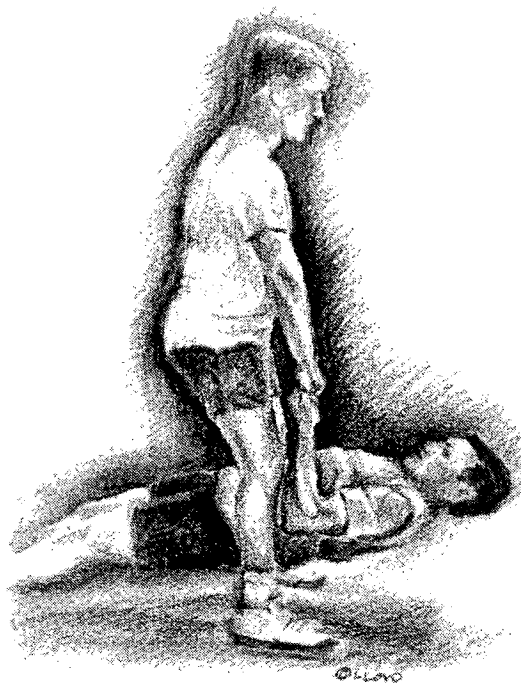
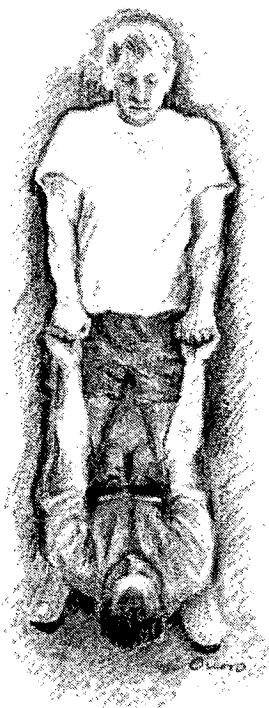


Figure 6 (a) Shoulder shrugs. (b) Horizontal rowing.

end of the tubing under the foot. Increased resistance may be obtained by shortening the length of tubing between hand and foot. These exercises may also be used in both a strengthening and warm-up program.

Wrist curls (flexor carpi radialis and ulnaris, extensor carpi radialis longus, brevis, and ulnaris) and *biceps curls* (biceps brachii, brachialis, brachioradialis) should be performed in three different hand positions: palm up (regular), palm down (reversed), and thumb up (hammer). These grip variations allow for the training of all of the above mentioned muscle groups (Figure 7).

Ulnar deviation may be performed by holding the tubing above the hand in a hammer grip. Pull tubing toward the floor (not shown).

Pronation and supination (pronator teres, pronator quadratus

and supinator, biceps brachii) are performed by hooking the tubing on the thumb, either palm up for pronation or palm down for supination, and simply rotating the wrist. Do not grasp the tubing with the hand or lift the forearm from the lap or table during this exercise (Figure 8).

Triceps extensions (triceps brachii) may be performed in a variety of positions. Illustrated here is how rubber tubing may be used in an on-field situation (Figure 9).

Wrist rollers are a good exercise for the forearm's extensors and flexors as well as the shoulder's deltoid and coracobrachialis. To work the extensors with palms facing downward, rotate the stick toward the body until the weight is fully drawn up. Rotate the weight steadily back to start position and repeat (Figure 10). For flexors, repeat these with palms facing up.

■ Stretching Program

The following stretches are solely for the throwing movement (8). A full-body stretching program designed specifically for the needs of each athlete and sport is recommended. Hold each stretch 15 to 20 sec, repeat two or three times.

Inferior capsular stretch: With the throwing arm overhead and elbow bent, stretch the arm toward the back by pulling with the opposite arm (Figure 11).

Posterior capsular stretch: Grasp the throwing arm elbow and pull across the chest to stretch the back of the throwing shoulder (Figure 12).

Stretching of the *anterior capsule* should not be performed (Figure 13), nor should any other variations of this stretch. Due to the extremely large ranges of motion, high velocity, great force, and repetition experienced during the throwing motion, the ligamentous and muscular structures become vulnerable, inviting injury through anterior instability (10).

Semi-sidelying rotator cuff stretch: Lying on the shoulder blade on throwing arm side, position the elbow in front of the body at chest height with lower arm pointing upward. With the opposite hand, press the throwing arm, contact at wrist, toward the floor and rotate the shoulder into internal rotation. A pulling on the posterior shoulder should be experienced. Hold for 30 sec and repeat two or three times (not shown).

Extensor stretch: With the arm straight and palm down, pull the hand down and rotate outward (Figure 14).

Flexor stretch: With the arm straight and palm up, pull the hand down and rotate inward (Figure 15).

Arm circles: Holding a weighted object (2 to 5 lbs) with the throw-



Figure 7 Wrist curls: (a) palm up, (b) palm down, (c) thumb up.

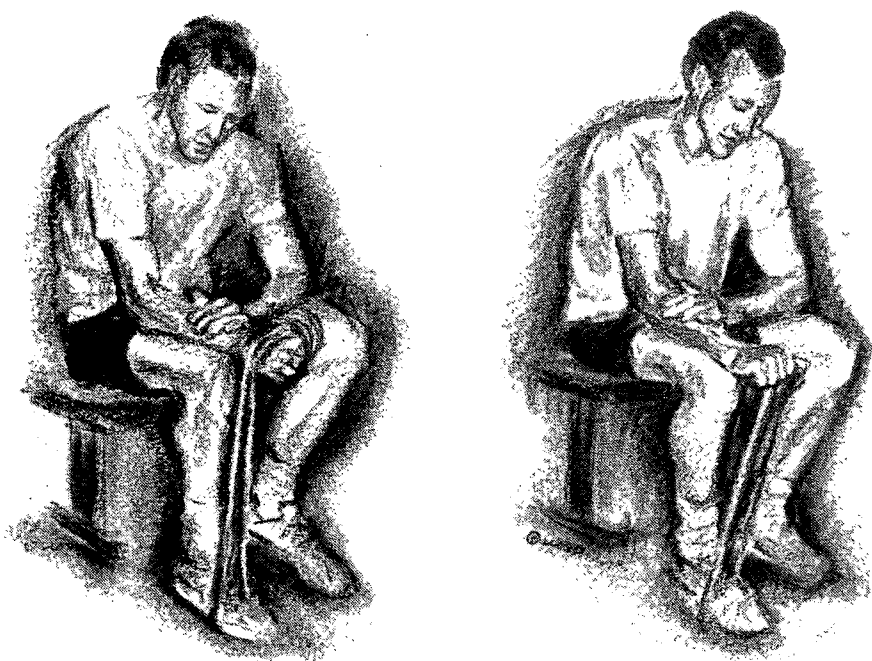


Figure 8 (a) Pronation. (b) Supination.

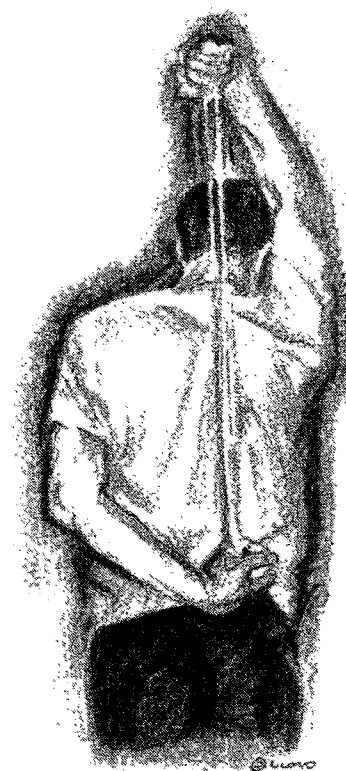


Figure 9 Triceps extensions.

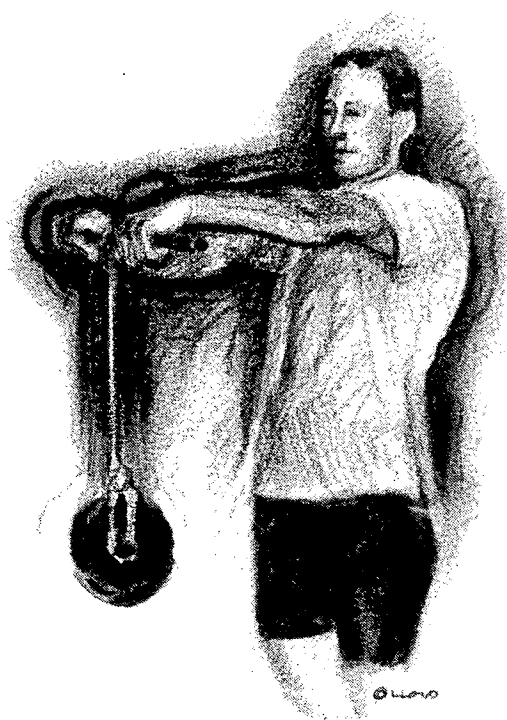


Figure 10 Wrist rollers.



Figure 12 Posterior capsular stretch.

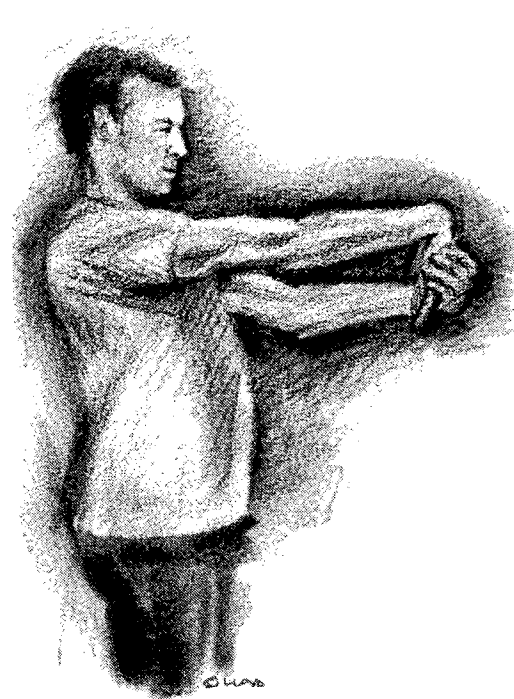


Figure 14 Extensor stretch.



Figure 11 Inferior capsular stretch.

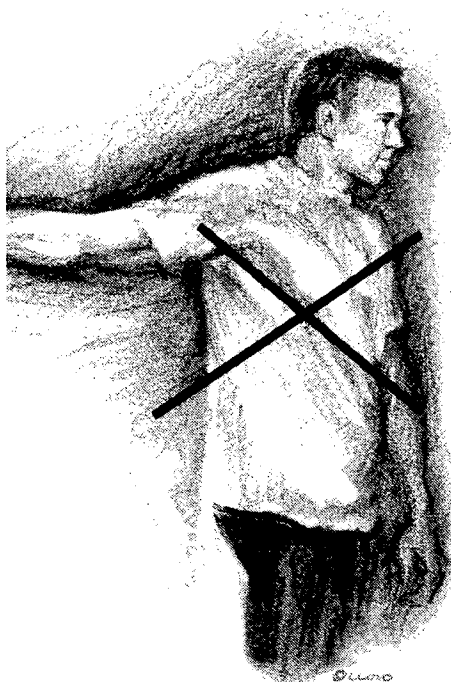


Figure 13 Anterior capsular stretch. As noted in text, do not perform this exercise.



Figure 15 Flexor stretch.



Figure 16 Arm circles.

ing arm, bend over at the waist. Starting with small circles, gradually work to larger ones in both clockwise and counterclockwise directions. Continue each direction for 30 to 60 sec (Figure 16).

Weighted throwing motion: Grasp a weighted object in the throwing hand (1 to 3 lbs). Perform 15 to 25 steady and fluid throwing motions. Do not try to accelerate through the motion! Concentrate on good form, elbow at shoulder height and in proper "L" position. Follow through in a Figure 8 motion and continue (Figure 17).

■ Conclusion

When designing any training program, do not overlook the joint stabilizers while the major movers are being trained. It is through these stabilizers that the power created must be translated. It is also through these stabilizers that the joint is protected from injury, but they cannot be effective if they are overpowered by the major movers or if poor mechanics are used. ▲



Figure 17 Weighted throwing motion: (a) start position, (b) ending position.

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