

## Exploring the Rotator Cuff

Improving one's performance in sports and daily activity is a factor of neuromuscular efficiency and metabolic enhancements. To attain proficiency, reaction force must be effectively transferred through force couples at a velocity consistent with the requisite movement speeds of the activity. The attainment of efficient movement is dependent on the muscle's force production and reduction capabilities, magnitude of reaction force, and proprioceptive management of the action (including postural equilibrium). This is accomplished, in part, through the use of neutralizing and stabilizing muscles to prevent diminution of reaction force across joints and to accelerate the movement as needed for the action. Much of the recent literature has focused on the trunk musculature to transfer ground reaction force across the spinal segments in closed-chain movements. By now many professionals are more familiar with the muscles of the inner unit (transverse abdominis, diaphragm, muscles of the pelvic floor and the thoraco-lumbar fascia) and the role these muscles play in stabilization and energy transfer. These muscles should be trained to functional levels specific with the highest demands of routine stress. This being said there are additional stabilization and energy management demands once the reaction force has been transferred through the trunk. Since most actions outside of slow bipedal locomotion use the upper body, stabilization at the articulation sites of upper limbs is very important. Most of these actions manifest in the hands, therefore energy must effectively reach this terminal area. Analyses of the joints of the upper limbs identify the shoulder as the weak link in the system. Working backward, the wrist is a gliding joint and the elbow a hinge, both of which are very stable joints. The shoulder, though, is an incomplete ball and socket joint, giving up stability for mobility. The glenohumeral articulation, as it is formally referred to, has a shallow fossa which allows the limb to be fully abducted and flexed and provides for large ranges of motion in multiple planes. In fact, the human body is designed specifically for range compared to speed or high force. This factor limits the application of high force in exchange for lower force over a greater range. This fact lends itself to the importance of stability.

In most cases a person has significantly more force production capabilities in the prime mover than can be measured in a free moving environment. This suggests that the absolute strength of the muscle lies as a potential. The reason for this is due to the need for stability. When bench pressing, performing over head shoulder presses, or even shooting a basketball, the stability in the shoulder determines the energy transferred through the joint. Therefore, to increase strength or performance in upper body movements, the training program should maintain a focus on stability of the shoulder. By simply adding stability you will become stronger and gain endurance without changing any other aspect of the drive component within the system. Of key importance to stability improvements is the rotator cuff. This four-muscle functioning unit provides the foundations for glenohumeral performance. Due to its relevance in performance most people think rotator activities are only necessary for athletes in throwing or racquet sports, but this assumption would grossly underestimate the importance of the rotator cuff to all activities. Injuries to the rotator cuff are comparable between sedentary and the physically active, suggesting everyone needs a healthy system if they intend on using the upper limbs for physical activity.

The rotator cuff is the site of one of the most common exercise and sports-related injuries. Any improperly performed overhead lifts, or sports with high acceleration and deceleration of the shoulder can lead to rotator cuff tears. Prime examples include the throwing actions used in baseball or football, spiking in volleyball, and overhand serving in tennis. Performing routine contraindicated exercises such as behind the neck pulls or presses also may lead to rotator cuff trauma. The propensity for injury of the cuff has led to the development of several rehabilitative programs for injured athletes as well as their non-competitive counterparts. These same programs can be used in a preventative manner to strengthen and balance the four muscles of the rotator cuff, increasing the stability of the glenohumeral articulation and decreasing the probability of injury.

The muscles of the rotator cuff include the infraspinatus, subscapularis, supraspinatus, and teres minor. The infraspinatus is responsible for shoulder extension and external rotation of the humerus. The subscapularis is another extensor but also internally rotates the shoulder. The supraspinatus abducts the humerus, while the teres minor is an adductor of the humerus with some contribution as a secondary external rotator.

More so than performing independent contractions for specific movements, these muscles function in concert to stabilize the glenohumeral joint, especially during dynamic movements. For example, the baseball throw has been systematically divided into 5 phases while measuring EMG activity. The first is defined as the “wind up” phase, during which the rotator cuff muscles are inactive increasing joint laxity. The second “early cocking” stage is characterized by shoulder external rotation and abduction which is primarily executed by the deltoid. Third is the “late cocking” phase, which continues until full range of motion (ROM) of external rotation is achieved. This phase is characterized by intense rotator cuff activity, especially of the subscapularis which eccentrically contracts acting as the main stabilizer. The fourth “acceleration” stage includes high activity of the pectoralis major and latissimus dorsi during internal rotation and little activity by the rotator cuff muscles. The ball is released during this phase. The final “follow-through” stage is the decelerating phase. It is characterized by high level deltoid and rotator cuff activity, especially eccentric contraction of the supraspinatus.

If there is injury, the first goal of any program is pain management and reduction of edema. This can effectively be accomplished by the RICE method; rest, ice (20 min. 3-4/day), compression, and elevation. If necessary, NSAIDs (non-steroidal anti-inflammatory drugs) may be used.

Following enough rest, a typical strengthening program (which can be employed for prevention) is as follows:

**Warm-up Exercises:** approximately 15 minutes

1. Dumbbell pendulum
2. Draw sword stretch
3. Horizontal adduction stretch
4. Apley's stretch
5. Alternating isometric internal/external rotation

**Part 1:**

1. Internal rotation: 3 sets of 12-15 repetitions

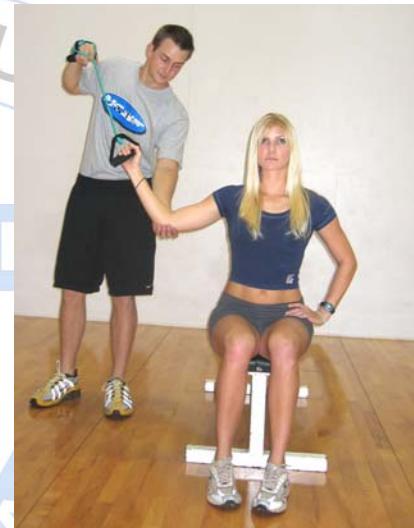
Slightly abduct the humerus and stabilize its place below the shoulder (a small folded towel can be placed between the arm and side to maintain proper position); then internally rotate the humerus utilizing a theraband for resistance.

2. External rotation: 3 sets of 12-15 repetitions

Maintain the position from above and externally rotate the humerus utilizing a theraband for resistance.

*Alternative Method*

This exercise can also be performed with the client lying on his/her side utilizing a dumbbell for resistance.



*Seated Internal Rotation*

*Advanced Method*

Utilizing a theraband while facing the support structure circumduct the shoulder by concurrently performing lateral and horizontal abduction and finish the movement by externally rotating the shoulder. 3 sets/ 10-12 reps



*Standing External Rotation*

**Part 2:**

1. Scapular protractions: 3 sets of 15-20 repetitions

While maintaining a straight arm, held at 90° of shoulder flexion, and checking for any accessory motion at the hip, grasp a theraband and protract the shoulder.

2. Scapular retractions: 3 sets of 15-20 repetitions

Assume the same shoulder arm relationship as above; grasp a theraband and retract the shoulder using only shoulder girdle action.

*Alternate Method*

Perform prone shoulder protractions with the active shoulder and elbow in the same flexed and extended positions, respectively. Utilize a dumbbell for resistance. 3 sets of 15 repetitions

*Alternate method*

Perform supine shoulder retractions with the contralateral arm and knee supported by a bench and the ipsilateral foot on the floor. The upper torso should be parallel to the bench. Maintain 90° of shoulder flexion. This should be the neutral position of the hanging arm. Utilize a dumbbell for resistance. 3 sets of 15 repetitions

**Part 3:**

Shoulder flexion, hyper-extension, horizontal abduction circuit: 3 sets, 10 repetitions each (total of 30 reps/ set)

Perform 10 repetitions of straight arm shoulder flexion to 90°; followed by 10 repetitions of straight arm shoulder hyperextension to functional range followed by 10 repetitions of shoulder horizontal abduction to functional range

*Alternate Method*

The shoulder flexion can be performed with a dumbbell for resistance while standing. Transition to the prone position and perform the shoulder extensions. Finally, stand up again and perform the horizontal abductions set.



*Anterior Med Ball Raise*

**Part 4:**

Supraspinatus "empty can" raise: perform 3 sets of 12 repetitions

Assuming a pronated hand position (pinky up) abduct the shoulder to 30-70° while maintaining a straight arm position

It is important to note that these exercises are specifically designed to target the rotator cuff muscles. If there is any accessory motion or deviation from proper technique, the effectiveness will suffer. High scrutiny toward technique should be used by any professional overseeing the training bout in order to maximize the benefits.

Finally, it should be dually noted that to maximize shoulder stability, all of the supporting musculature should also be trained and strength-balanced. The trapezius, rhomboids, latissimus dorsi, and pectorals should be properly trained through full ranges of motion for desirable function. Excessive tightness and heavy loading incomplete range can lead to capsule dysfunction. Heavy bench press and rows may contribute to

dysfunction without preventative therapies. Personal trainers are not qualified to rehabilitate a diagnosed injury. These exercises although therapeutic are excellent at preventing injuries in otherwise healthy populations or to aid in return to sport training following a completed professionally supervised rehab program.

