ROTATOR CUFF INJURY

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Introduction

In 2006, 75-million people went to the doctor with shoulder pain (Editors OrthoInfo, 2021). Approximately 4.1 million of these patients suffered from rotator cuff injuries (Editors OrthoInfo, 2021). It is estimated that shoulder pain occurs in up to 21% of the general population with at least 40 % of that number having shoulder pain that lasted a year or more (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014). The estimated annual cost of shoulder pain each year is 39-billion dollars (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014). Shoulder Impingement is the number one reported cause for shoulder injury at 40 – 65% of all reported shoulder pain (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014). Shoulder Impingement is associated with rotator cuff injury. Injuries of the rotator cuff can be classified as degenerative which include both genetic age related as well as repetitive overuse injury and, Trauma related (Eisenberg, 2010; Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; JAMES MONICA, ZACHARY VREDENBURGH, JEREMY KORSH, & CHARLES GATT, 2016; Editors Hospital for Special Surgery, 2021; Cleveland Clinic, 2021; Yetman, 2020).

Rotator cuff injuries are classified as damage to the tendinous soft tissue of the Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis muscles which surround the humeral head inside of the Glenoid Fossa and give support to the humerus during regular movement function and especially in the act of shoulder rotation (S., 2011; Lippert Lynn S. PT, 2017). Due to a majority of incidents being caused by overuse and degeneration, people 40 years and older are at a greater risk (Weber & Chahal, 2020). According to Sher JS et al, 54% of asymptomatic patients aged 60 years or older, having sustained either a partial or complete rotator cuff tear (RCT) on magnetic resonance imaging (Weber & Chahal, 2020). Rotator cuff injuries often do not heal on their own well because of the frequent use and movement that

occurs at the shoulder joint and limited blood flow to the tendon. Many cases of rotator cuff injury are asymptomatic, therefore adding to the cumulative damage which occurs over time (Weber & Chahal, 2020). Rotator cuff injuries can lead to movement impairments and arthrokinematics dysfunction if left untreated (S., 2011; Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Lippert Lynn S. PT, 2017; Yetman, 2020; Weber & Chahal, 2020). Injuries of the rotator cuff can range from tendonitis or strain to a partial or complete tear.

Structures of the rotator cuff

The rotator cuff is a musculotendinous protective ring which wraps around the Humeral head inside of the Glenoid Fossa (S., 2011; Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Stax, 2017; Lippert Lynn S. PT, 2017). This ring and associated bursa help to strengthen and stabilize the shoulder joint (S., 2011; Lippert Lynn S. PT, 2017). The shoulder joint is the most mobile of all the joints in the human body and therefore is the least stable (S., 2011; Lippert Lynn S. PT, 2017). The shoulder is comprised of the shoulder girdle, rotator cuff and shoulder muscles (S., 2011; Lippert Lynn S. PT, 2017). Each of these are links in a kinetic chain which help to provide strength, stability and movement at the shoulder joint, arm, and hand. The shoulder gridle is comprised of the trapezius, rhomboids, levator scapulae, serratus anterior, and pectoralis minor muscles (S., 2011; Lippert Lynn S. PT, 2017).

The rotator cuff is comprised of the 4 muscles which originate at the scapula and insert on the humerus. These muscles are the Supraspinatus, Infraspinatus, Teres Minor, and Subscapularis and are commonly referred to as the SITS muscles (S., 2011; Lippert Lynn S. PT, 2017). The shoulder muscles are comprised of the Deltoid, Pectoralis Major, Latissimus Dorsi, Teres Major, Supraspinatus, Infraspinatus, Teres Minor, Subscapularis, and Coracobrachialis

muscles (S., 2011; Lippert Lynn S. PT, 2017). For the purposes of this discussion, we will focus on the rotator cuff specific muscles.

The Scapula

The Scapula is a bony structure which is part of the shoulder complex and is a key component of the shoulder joint. The shoulder joint or Glenohumeral joint is comprised of the scapula and the humerus. The scapula is a triangular shaped flat bone that has a slightly concave anterior surface. It is located on the posterior side of the thorax and clavicle and is indirectly attached to the trunk through ligamentous structures at the clavicle. Many muscles also attach the scapula to the trunk. At rest it is located between the 2nd and 7th ribs and is approximately 2 to 3 inches laterally to the spinous process of the 3rd and 4th thoracic vertebrae. Because the ribcage is curved the scapula rests approximately 30 degrees anterior to the frontal plane in its resting position posterior to the thoracic ribcage. Because of this its natural movement does not coincide completely within the frontal or sagittal planes and has its own plane of movement commonly referred to as the scapular plane.

Key bony features of the scapula include: The Superior angle, Vertebral border, Inferior Angle, Axillary border, Glenoid Fossa, Acromion Process, Coracoid Process and Spine. The muscles that originate at the scapula are the SITS muscles and Coracobrachialis. Scapulothoracic articulation occurs in the following motions: Scapular Elevation, Depression, Protraction, Retraction, Upward Rotation, Downward Rotation, Scapular Tilt and Winging. The scapula aids the shoulder joint in performing the following movement patterns: Flexion, Extension, Hyperextension, Abduction, Adduction, Medial Rotation, Lateral Rotation, Horizontal Abduction, and Horizontal Adduction.

Motions of the shoulder joint and scapula	
Shoulder Joint	**Scapula**
Flexion	Upward Rotation / Protraction
Extension	Downward Rotation/ Retraction
Hyperextension	Scapular Tilt
Abduction	Upward Rotation
Adduction	Downward Rotation
Medial Rotation	Protraction
Lateral Rotation	Retraction
Horizontal Abduction	Retraction
Horizontal Adduction	Protraction

Rotator Cuff Muscles and Function

Each of the muscles of the rotator cuff are named based on their position in relation to the scapula. The Supraspinatus rests on the scapula above the scapular spine. The Infraspinatus is located below the Supraspinatus just below the scapular spine. The Teres Major is named because of its shape (Latin; *Teres = Long and round*). The Subscapularis is located below (Anterior) the scapula, between the scapula and thoracic ribcage. The Coracobrachialis originates at the Coracoid Process of the Scapula.

Muscle Origin, Insertion, & Action Chart			
Muscle	**Origin**	**Insertion**	**Action**
Supraspinatus	Supraspinous Fossa of Scapula	Greater Tubercle of Humerus	Shoulder Abduction
Infraspinatus	Infraspinous Fossa of Scapula	Greater Tubercle of Humerus	Shoulder Lateral Rotation / Horizontal Abduction
Teres Minor	Axillary Border of Scapula	Greater Tubercle of Humerus	Shoulder Lateral Rotation / Horizontal Abduction
Subscapularis	Subscapular Fossa of Scapula	Lesser Tubercle of Humerus	Shoulder Medial Rotation
Coracobrachialis	Coracoid Process of Scapula	Medial Surface of Humerus near Midpoint	Stabilizes Shoulder Joint

Common Mechanism(s) of Injury

Rotator cuff injuries can occur due to an acute injury such as a fall, or perhaps lifting a heavy object too quickly or with poor form (S., 2011; Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; JAMES MONICA, ZACHARY VREDENBURGH, JEREMY KORSH, & CHARLES GATT, 2016; Lippert Lynn S. PT, 2017; Weber & Chahal, 2020). However, most cases of rotator cuff injury are due to overuse or degeneration. Overuse injuries often occur as a result of an occupation or participation in an activity that incorporates repetitive or overhead motion such as throwing, rowing, painting, hammering, or lifting (S., 2011; Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; JAMES MONICA, ZACHARY VREDENBURGH, JEREMY KORSH, & CHARLES GATT, 2016; Lippert Lynn S. PT, 2017; Weber & Chahal, 2020). This makes carpentry, painting, competitive rowing, baseball, tennis, or weightlifting potentially risky activities regarding rotator cuff injuries. When it comes to rotator cuff damage, the subscapularis is the most commonly injured muscle of the rotator cuff.

Degeneration occurs as the result of a combination of cumulative use and the gradual weakening of the musculotendinous tissue of the rotator cuff over time (S., 2011; Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; JAMES MONICA, ZACHARY VREDENBURGH, JEREMY KORSH, & CHARLES GATT, 2016; Lippert Lynn S. PT, 2017; Weber & Chahal, 2020). As we age, the tendons lose elasticity (S., 2011; Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Lippert Lynn S. PT, 2017; Stax, 2017). Poor lifestyle choices such as diet, lack of exercise, alcohol use, and smoking lead to impaired circulation and blood flow. This has an adverse effect on the tendons of the body which already have limited blood supply (S., 2011; Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Lippert Lynn S. PT, 2017; Stax, 2017).

Symptoms

Rotator cuff injuries can range from tendonitis and strain to partial or even complete tear (Editors Hospital for Special Surgery, 2021). There are often many asymptomatic cases that eventually manifest into more serious conditions because they were left untreated. Symptoms range from anterior shoulder pain and swelling to incapacitation and excruciating pain in the shoulder joint.

Symptoms Chart	
Rotator Cuff Tendonitis	**Torn Rotator Cuff**
Pain / Swelling anterior Shoulder	Pain / Swelling in Anterior / Lateral Shoulder
Pain / Swelling in the side of the arm	Difficulty raising the arm
Painful raising / lowering the arm	Weakness in the shoulder
Clicking or popping when arm is moved	Painful movement when moving the arm

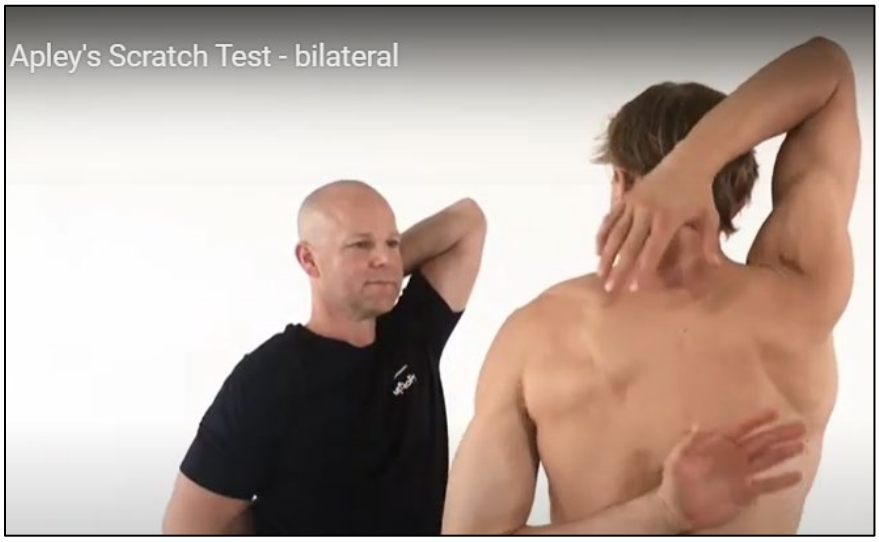
Pain that disrupts sleep	Unable to Lift things
Loss of strength / mobility in the arm	Clicking or popping when the arm is moved

Diagnosis

When it comes to diagnosing a rotator cuff injury, it is impossible to know whether there is a tear unless the patient is subjected to imaging (Eisenberg, 2010; JAMES MONICA, ZACHARY VREDENBURGH, JEREMY KORSH, & CHARLES GATT, 2016; Stax, 2017; Yetman, 2020). However, there are tests that can indicate whether there is generalized damage to the rotator cuff (Yetman, 2020). When a patient sees the physician or specialist, they will undergo a standard musculoskeletal examination which includes a range of motion test. Range of motion testing begins with having the subject stand in the anatomical or functional position and then performing shoulder lateral abduction and medial rotation until they are able touch their hands together over their head, then placing their hands behind their head and moving back to over their head and back to their side.

If pain is experienced within the first 60 – 120 degrees of abduction, this is an indicator of rotator impingement (S., 2011; Lippert Lynn S. PT, 2017). If they are able to continue from 120 to 180 degrees and experience pain this is indicative of injury to the Acromioclavicular joint (S., 2011; Lippert Lynn S. PT, 2017). Results of painful range of motion may indicate the need for special testing. Damage of each muscle of the rotator cuff can be identified through specific tests performed by the specialist. All testing is performed bilaterally and the joints above and below the affected area are also tested in order to narrow down the source of the pain.

The Apley's Scratch Test is a test that can be used to indicate potential rotator cuff injury or limited range of motion (Yetman, 2020). This test requires that the subject reach over the shoulder with one hand, and behind the back with the other in an attempt to touch hands. A positive test is pain or limited range of motion on one side in comparison to the other.

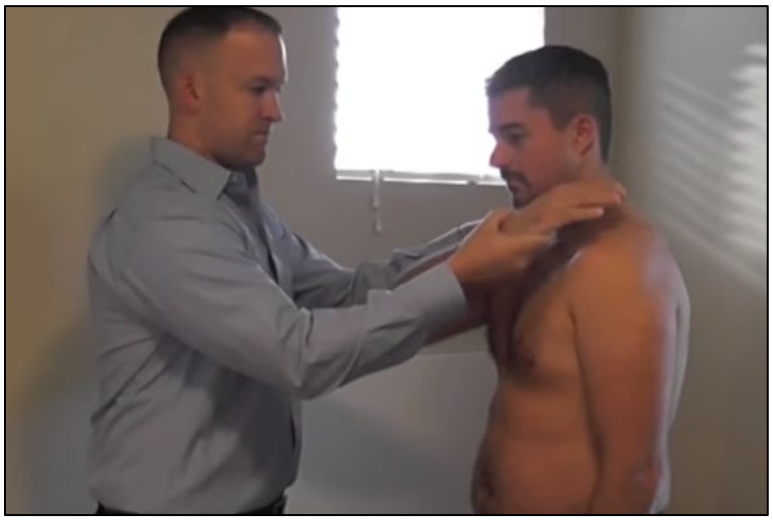


(Yetman, 2020)

The Horn Blower's Sign Test is a special test used to identify damage to the Teres Minor. A doctor will raise the patient's arm to their side and bend their elbow to 90 degrees (Yetman, 2020). The patient will then externally rotate their arm as the doctor resists. A positive test is pain and inability to externally rotate.

(Yetman, 2020)

The Bear Hug Test is used to identify damage to the Subscapularis (Yetman, 2020). The patient will put the hand of their injured arm on their opposite shoulder. A doctor will then try to pull their hand off from their shoulder while they resist. A positive test is pain and the inability to resist the doctor's pull.



(Yetman, 2020)

The Neer's Sign Test is a test that can be used to identify impingement of the rotator cuff (Yetman, 2020). Impingement is the leading cause of other degenerative and overuse rotator injury. A doctor will stabilize the patient's scapula, rotate their arm internally, and flex their arm. Pain is a positive result and indicates impingement.

(Yetman, 2020)

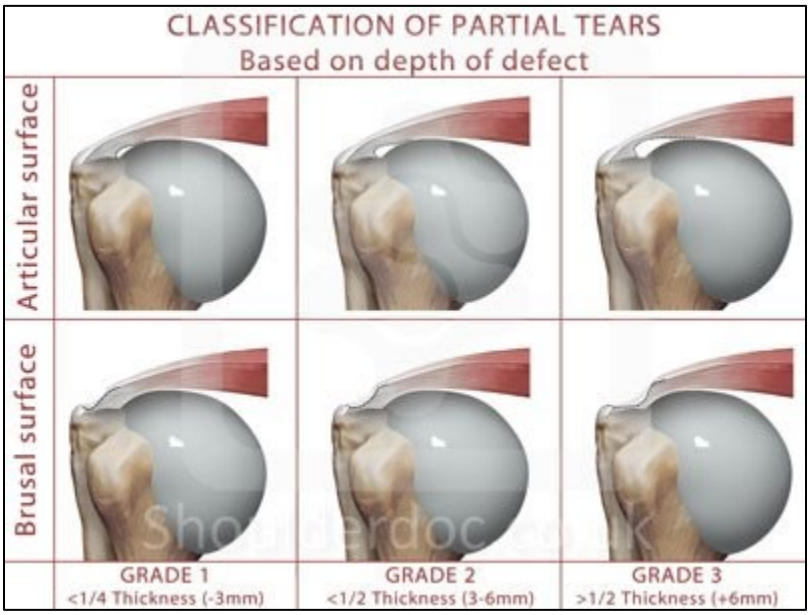
The Drop Arm Test is a test used to indicate rotator cuff tear (Yetman, 2020). The test is performed by raising the patients' arms to the side as high as possible and lower them to 90 degrees. A positive sign is an inability to hold the arm at 90 degrees because of pain.

(Yetman, 2020)

In addition to the forementioned special tests, imaging is used to verify the type of injury the patient has sustained. X-rays cannot identify tissue tear but are used to rule out bone spurs that may result in impingement. Ultrasound can be used to monitor and compare the muscles in one arm to another. Magnetic Resonance Imaging (MRI) can be used to identify damage to connective tissues and are often used as the gold standard for identifying rotator cuff damage (Xie, 2016; JAMES MONICA, ZACHARY VREDENBURGH, JEREMY KORSH, & CHARLES GATT, 2016; Weber & Chahal, 2020; Yetman, 2020).

Although imaging is the surest way to identify rotator and other soft tissue damage, range of motion and other special testing does offer insight into the nature of the root cause of injury. It also aids primary care providers in prescribing interim treatment protocols until imaging can be performed. In many cases imaging is not readily available and must be scheduled at a later date than the initial examinations. This is dependent on the access the provider has to such resources.

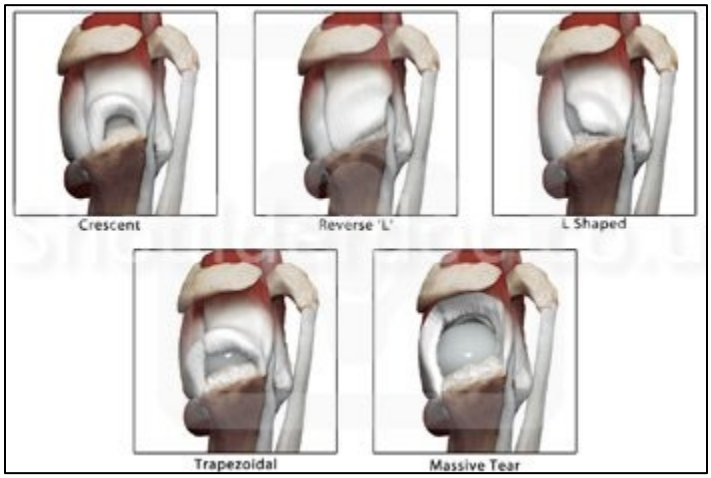
Partial Tear



(Courtesy Shoulder Doc. UK)

With a partial tear the rotator cuff is damaged but not completely torn. The damage is graded according to the size of the tear and the level of damage. There are three grades of tearing. A Grade One tear is less than 3mm in size. A Grade Two tear is 3mm in thickness, and a Grade Three tear is 6mm or more in size.

Complete Tear (Full Thickness Tear)



(Courtesy Shoulder Doc. UK)

In a complete tear, the soft tissue is torn into two separate pieces. The tendons are torn away from their insertion at the humerus. These tears are also graded in accordance to their size. A Grade One tear is up to1cm after debridement. Debridement pronounced (De -BREED-ment) is when soft tissue is cleared from or no longer intact with the joint (Xie, 2016; Editors Shoulder Doc. UK, 2021). A Grade Two tear ranges between 1 – 3 cm after debridement (Editors Shoulder Doc. UK, 2021). Grade Three tears measure approximately between 3 - 5 cm and are large tears (Editors Shoulder Doc. UK, 2021). Anything over 5cm is generally classified as a Global tear and in cases of Global tearing there is no cuff remaining (Editors Shoulder Doc. UK, 2021). This type of tear can be described as trapezoidal or massive and the description is based on the general shape.

Acute Tear

Acute tears are generally caused by trauma such as falls (Xie, 2016; Yetman, 2020; Weber & Chahal, 2020; Editors Shoulder Doc. UK, 2021). Acute tears also commonly occur when something is lifted in an awkward or inefficient position at a high rate of speed. The weight causes compression in the joint greater than what the tissue is capable of handling and results in a tear of the soft tissue.

Degenerative Tear

Degenerative tears are multifactorial and are generally associated with overuse and age (S., 2011; Lippert Lynn S. PT, 2017; Stax, 2017). These injuries occur as a result of repetitive use and the gradual wearing away of the tendon (S., 2011; Lippert Lynn S. PT, 2017; Stax, 2017). This type of injury may go on for a prolonged period of time without any symptoms or pain. One of the common precursors to these types of injuries is shoulder impingement syndrome. This injury can be brought on by a number of causes to include, previous injury,

muscle shortening, movement imbalance and repeated arthrokinematics dysfunction (S., 2011; Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Lippert Lynn S. PT, 2017). These injuries are common in occupations that entail overhead work such as carpentry and painting, as well as in sports such as baseball and tennis (S., 2011; Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Lippert Lynn S. PT, 2017).

Treatment

There are options for treatment and these options are usually a collaboration between patient and physician. Due to the specificity of injury, rotator cuff injuries are often referred out to a specialist who has very specific expertise in handling shoulder injuries (Xie, 2016; Yetman, 2020; Weber & Chahal, 2020; Cleveland Clinic, 2021). Treatment if frequently approached in a progressive manner that begins with rest, ice, compress, elevate (RICE) protocol. This includes not moving the affected appendage in a manner or direction that causes discomfort. The limb may also be immobilized via sling (Xie, 2016; Yetman, 2020; Weber & Chahal, 2020; Cleveland Clinic, 2021). Compressive sleeves or slings may be worn to increase support and blood flow to the area. Ice is used to reduce inflammation and the accompanying pain that comes from it. RICE protocol is used as needed to reduce the symptoms and pain. This is generally the first stage of treatment and can then be followed up either by surgical or non-surgical means.

Non-Surgical Treatment

Due to the nature of the injury and the anatomical design of the shoulder, rotator cuff injuries are difficult to heal on their own (Chris Centeno, 2018). At best one can hope for a stabilization of the injury through non-surgical means (Bates, 2018; Brandon J Erickson, 2019). This means that the goal of the treatment is not healing but stabilization of the injury and alleviation of the symptoms. Non-surgical means of treatment entails RICE protocol, lifestyle/

activity changes, and physical therapy. Non-Steroidal Anti-Inflammatory medications (NSAIDs) are also used on an as needed basis.

Lifestyle and activity changes are required to stop the reoccurring motions that caused the degeneration, wear, or damage in the first place. When used in conjunction with RICE protocol and NSAIDs during reoccurring bouts of pain or discomfort one may see progress over time. In addition, Physical Therapy (PT) is prescribed to inhibit muscles that may be chronically overused due to movement adaptation and synergistic dominance (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Richard S. Boorman, 2018). At the same time therapy seeks to lengthen these muscles while activating underused muscles in order to restore normal arthrokinematics and osteokinematics (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Richard S. Boorman, 2018). Next activated muscles must be strengthened to prepare for integration of normal movement. Lastly, rehabilitation seeks to integrate the inactive muscles into normal and functional movement patterns (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Richard S. Boorman, 2018).

Surgical Treatment

It is estimated that non-surgical treatment is successful for approximately 50% of cases in which it is used (Weber & Chahal, 2020). For those who are not able to achieve stabilization or symptom relief and for very severe injury, surgery is an option. Once the specialist and the patient determine that surgery is the best option, there are three different types of surgery used to perform a rotator cuff repair. These surgeries are Arthroscopic, Open, and Mini Open surgeries (Dr. Andrew Parker, 2021). Arthroscopic surgery is the least invasive and uses small incisions to insert fine tools and cameras from which to perform the repair.

Open surgery is as the name suggests a procedure which entails creating a large open incision to repair the damage. A Mini Open surgery is a combination procedure that generally begins with arthroscopy and then allows the repair to be performed with a larger incision, although not as large an incision as the Open surgery. Research has shown there to be no difference in surgeries, but those who undergo Mini-Open surgeries have reported returning to work / play approximately one month sooner than those who underwent other surgeries (Weber & Chahal, 2020).

Post-Surgery Rehabilitation

Once the surgery is complete the healing process begins. The first 3 days post operation the wound cannot get wet (Editors: premierboneandjoint.com, 2014; Weber & Chahal, 2020; Dr. Andrew Parker, 2021). This is to assist the granulation process in the first phase of healing. The healing process takes place over 4 phases hemostasis, inflammation, proliferation, and remodeling. Hemostasis, inflammation, and proliferation coincide with the first 4 to 6 weeks. During the first 4 to six weeks after surgery the shoulder will be immobilized (Editors: premierboneandjoint.com, 2014; Weber & Chahal, 2020; Dr. Andrew Parker, 2021). Ice will also be used to reduce swelling and inflammation (Editors: premierboneandjoint.com, 2014; Weber & Chahal, 2020; Dr. Andrew Parker, 2021). There is absolutely no overhead movement of the limb or weight bearing of the recovering shoulder. Physical therapy should begin as early as possible and is based on the subject's healing process. In general, physical therapy will begin within the second week after surgery (Editors: premierboneandjoint.com, 2014; Weber & Chahal, 2020; Dr. Andrew Parker, 2021).

Expected Healing Time

Healing time for both surgical and non-surgical interventions vary based in the individual. For non-surgical treatment the best that one can hope for is stabilization of the injury (Richard S. Boorman, 2018; Chris Centeno, 2018; Weber & Chahal, 2020). This entails that the muscles of the shoulder and rotator cuff can be strengthened, mobility and range of motion increased, symptoms resolved or limited, and the tear will remain the same size. This is a lifelong process, and it may take 6 to 8 weeks to go from extremely limited movement with considerable pain to improved range of motion at a lesser degree of pain. Most cases can sustain recovery within 3 months (Richard S. Boorman, 2018). However, it may take 6 months to a year to stabilize a partial tear. Consequently, the subject may experience periodic bouts of severe discomfort along the way.

In terms of surgical recovery, physical therapy begins at week two post recovery and can last up to 12 weeks or more to go from acute phase to functional progression phase. During this period the affected limb and supporting muscles and joints undergo a specific process. The process is designed to slowly reintegrate the joint and supporting muscles into functional activity. The first phase is inhibition and lengthening and includes limiting some muscles from working, while lengthening others. This is achieved through a variety of passive and active stretches and range of motion exercises. The next stage is activation. The activation stage includes passive and active range of motion exercises, static and active stretching, balance and stabilization exercises. Activation stage relies heavily on isolated exercises. As the patient progresses through the activation stage, they are also being conditioned for more complex movements that incorporate the rest of the human movement chain. This leads up to the

functional stage and incorporates everyday movement to gear the patient toward going back to work / play.

Expectations on the first day of rehabilitation

The first day of physical rehabilitation will be dedicated to examination and the collection of both subjective and objective data which will be used to determine the rehabilitation programming that follows. The patient will complete forms and questionnaires that provide valuable information to the rehabilitation team. This will also be an opportunity for the patient to describe in their own words what they are experiencing. An examination will follow and then the therapist will discuss a rehabilitation plan moving forward.

Return to Function Expectations

In both surgical and non-surgical treatments research has shown that most cases reach functional mobility within 9 to 12 weeks (Eisenberg, 2010; JAMES MONICA, ZACHARY VREDENBURGH, JEREMY KORSH, & CHARLES GATT, 2016; DPT. H. L., 2021; DPT. M. W., Rotator Cuff Strain Rehabilitation Program, 2021). Functional does not necessarily equate to the same state as prior to injury. Functional suggests that the subject can integrate their physical movements into regular everyday activities (Jonathan Cluett, 2020). This may very between subjects and some subjects. Full activity can be expected for most within 4 to 6 months (Jonathan Cluett, 2020).

Rehabilitation Protocol

It is important to focus the rehabilitation protocol on the cumulative injury cycle which suggests that injury occurs resulting in inflammation, muscle spasm, adhesion, altered movement patterns and then muscle shortening, which ultimately leads to further injury (Micheal A. Clark,

Scott C. Lucett, & Brian G. Sutton, 2014). To facilitate healing while at the same time maintaining range of motion for unaffected joints, gaining range of motion in the affected joint, and preventing future movement dysfunction and further injury; the program will be structured accordingly (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014). Rehabilitation will be structured in the following phases, inhibition, lengthening, activation, strengthening, and integration.

Inhibition is the shortest phase and will concentrate on limiting movement of the muscles that move the shoulder (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Jonathan Cluett, 2020; DPT. M. W., Rotator Cuff Strain Rehabilitation Program, 2021; DPT. H. L., 2021; DPT. M. W., Supraspinatus Tear, 2021). This will aid in the granulation and healing process helping the tissue recover to the proliferation phase of healing. At the same time cervical, elbow and wrist range of motion will still be worked on in order to prevent movement dysfunction and increase blood flow to the distal portion of the limb, which indirectly will increase blood flow to the site of the injury (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Jonathan Cluett, 2020; DPT. M. W., Rotator Cuff Strain Rehabilitation Program, 2021; DPT. H. L., 2021; DPT. M. W., Supraspinatus Tear, 2021). It is imperative that the scapula remain as inactive as possible during this phase.

Lengthening and Activation stages of recovery will be implemented early in the recovery and center on lengthening muscles that are at risk of overuse to prevent muscle imbalance and movement dysfunction (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014). Lengthening also takes place to break up adhesion which occurs naturally as a result of muscle spasm (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014). Activation occurs between 2 to 4 weeks post-surgery and is centered around motor unit recruitment in muscles that have

been underused as a result of the surgery (Jonathan Cluett, 2020; DPT. H. L., 2021; DPT. M. W., Rotator Cuff Strain Rehabilitation Program, 2021; DPT. M. W., Supraspinatus Tear, 2021). In this case the rotator cuff musculature of the scapula.

The stabilization and strength phase occurs between weeks 6 – 12 and is the natural progression to the activation stage (Jonathan Cluett, 2020; DPT. H. L., 2021; DPT. M. W., Rotator Cuff Strain Rehabilitation Program, 2021; DPT. M. W., Supraspinatus Tear, 2021). Here active isolation exercises are used to specifically target the SITS muscles. In addition, the muscles of the shoulder girdle are gradually implemented into the work. In addition to developing strength specifically to the rotator cuff and shoulder girdle, the body is being conditioned for the integration stage (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014). This stage also seeks to place the target musculature by placing the body in a proprioceptively challenging environment. By increasing proprioceptive challenges to the muscles, the shoulder will increase its ability to contract and maintain stability (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014).

The final stage of recovery will be the integration stage. Here the exercises will challenge the musculature proprioceptively and dynamically (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014). The goal is to prepare the body for reintegration into work or sport (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Jonathan Cluett, 2020; DPT. M. W., Rotator Cuff Strain Rehabilitation Program, 2021; DPT. H. L., 2021; DPT. M. W., Supraspinatus Tear, 2021). In this stage postural and movement dysfunction will be corrected, controlled strength developed, and work capacity increased (Micheal A. Clark, Scott C. Lucett, & Brian G. Sutton, 2014; Jonathan Cluett, 2020; DPT. M. W., Rotator Cuff Strain Rehabilitation Program, 2021; DPT. H. L., 2021; DPT. M. W., Supraspinatus Tear, 2021).

Phase I Inhibit (Surgery – 2 Wks.)	
Appointments	3 – 5 x Weekly
Goals	• Decrease pain • Maintain elbow, wrist and neck ROM • Protect and inhibit scapular motion
Precautions	• Constant use of sling • Rest • 0° External Rotation (ER) 0 – 6 weeks • Passive Range of Motion (PROM) Abduction and flexion while maintaining Glenohumeral Internal Rotation (GH / IR)
Exercises	• Neck, Elbow, and Wrist Active Range of Motion (AROM) • Ball Squeezes • PROM 0- 90° while IR • Gentle Pain-Free PROM, IR, and ER while at 0° Abduction
Cardiovascular	Walk, Stationary Bike, NO TREADMILL, ROWER, VERSACLIMBER, Etc.
Progression	2 weeks post-surgery and non-surgical

Phase II Inhibit/ Lengthen/ Activate (2 - 6 Wks.)	
Appointments	2 x Weekly
Goals	• Controlled restoration of PROM • Activate shoulder and scapula while protected 0 - 30° Abduction • Correct posture dysfunction
Precautions	• Weaning off sling by week 6 with MD approval • No active IR w/ Abduction • No pulleys except forward flexion @ 4 weeks • No behind the back stretches till week 6
Exercises	• Gentle AROM – IR/ ER, w/ arm in neutral position • PROM in all directions • Pulleys/ cables in forward flexion @ 4 weeks • AROM and rotation @ 4 weeks • Shoulder mobilization (as needed) • Multi-angular IR/ ER Isometrics (0 - 30° abduction) @4 weeks • Scapular Strengthening (Arm in neutral position o Prone retraction o Arm extension to neutral • C- Spine AROM • Scapular AROM • Core strengthening exercises
Cardiovascular	Walk, Stationary Bike, NO TREADMILL, ROWER, VERSACLIMBER, Etc.
Progression	To phase 3 when full PROM (Except ER) is equal to the unaffected side. • Or at the 6-week mark.

Phase III Inhibit/ Lengthen/ Activate (6 - 8 Wks.)	
Appointments	1 x Weekly
Goals	• Full AROM all planes w/o adduction • Manual Muscle Test (MMT) Strength 5/5 IR/ ER @ 0° abduction • Correct Postural dysfunction
Precautions	• No active adduction weeks 1 – 8 o Weeks 1 – 12 Post-Op (Subject dependent)
Exercises	• IR/ ER with bands/ weights o Start at 0° abduction and increase as strength increases • PNF stretching Gently into IR with adduction • Scapular Stability & Strength training • AROM and PROM (as needed) • Core strength • Begin trunk and hip mobility
Cardiovascular	Walk, Stationary Bike, NO TREADMILL, ROWER, VERSACLIMBER, Etc.
Progression	Meets goals or week 8

Phase IV Stability / Strength (8 - 12 Wks.)	
Appointments	1 x every 2 – 3 weeks
Goals	• 5/5 MMT rotator strength and endurance @ 90° abduction and scaption • Proprioceptive & Dynamic control training • Correct postural and movement dysfunction (as needed) • Begin Strength and Control for work / sport
Precautions	Post therapy soreness (Should subside in 12 hours)
Exercises	• Multi-planar AROM o Gradually increase in velocity o Assess scapular rhythm and smoothness of motion • Shoulder Mobilization (As needed) • Rotator Strength training @ 90° o Overhead strength • Open Kinetic Chain (OKC) and Closed Kinetic Chain (CKC) Scapular Strength o CKC @ 12 weeks (Hands & knees only) • Core and Lower body training • OKC supine elevation exercises o Stars or alphabet • Gentle CKS Stability @ 12 weeks
Cardiovascular	Same as phases 1 – 3 plus treadmill, Stairmaster, light running. NO SWIMMING, ROWING, THROWING
Progression	Goals achieved

Phase V Strengthen/ Integrate (Phase IV- 18 Wks.)	
Appointments	1 x every 2 – 3 weeks
Goals	• 5/5 Rotator Cuff MMT @ 90° abduction • Advanced proprioceptive / Dynamic control • Correct Postural / Movement dysfunction (As needed) • Increase work/ sport specific cardiovascular endurance
Precautions	Post therapy soreness (Should subside in 12 hours)
Exercises	• Multi-planar AROM o Increase Velocity and Rhythm as needed • Shoulder Mobilization (As needed) • Work / Sport Related Scapular Strength o Overhead strength • Work / Sport Related Rotator Strength o Eccentric o Velocity • Lower body / Core Strength • Throwing, Overhead Racket, Swimming (As needed) • CKC Progression including plank on forearms o MD clearance dependent
Cardiovascular	Work / Sport Specific Energy systems
Progression	May Return to work / sport with MD clearance and goals met

Annex

Exercises for the Supraspinatus

4 – Point Support

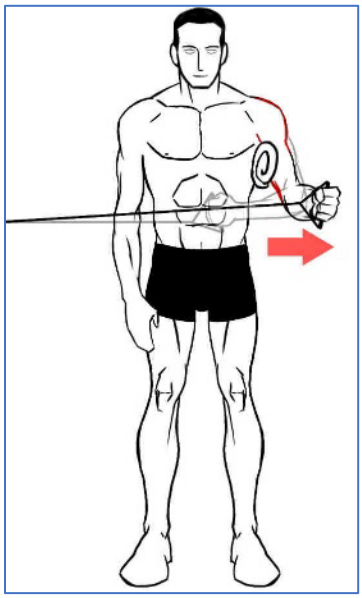
(Movement, 2021)

Steps:

- Assume Quadruped position
- Base of support with palms and toes/ balls of feet
- Knees slightly elevate.
- Isometrically hold 30 – 45 Seconds.

This is a fundamental isometric exercise intended to develop base strength to support mobility.

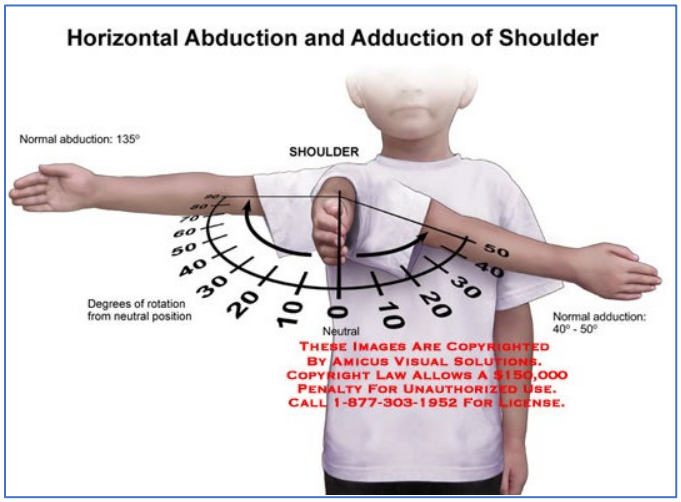
External Rotation



(Helper.com, 2021)

Steps:

- Use cables or light resistance bands.
- Place a rolled towel between elbow and ribcage (disengages lat).
- Set cable or band so that line of pull is parallel to the body in the frontal plane.
- Start at 90 degrees elbow flexion and 0 degrees shoulder adduction/ abduction (neutral)
- Externally rotate to approximately 30 degrees of abduction concentrically
- Adduct eccentrically beyond 0 to approximately 30 degrees adduction.



(Exhibits.com, 2021)

Front Support on Medicine Ball

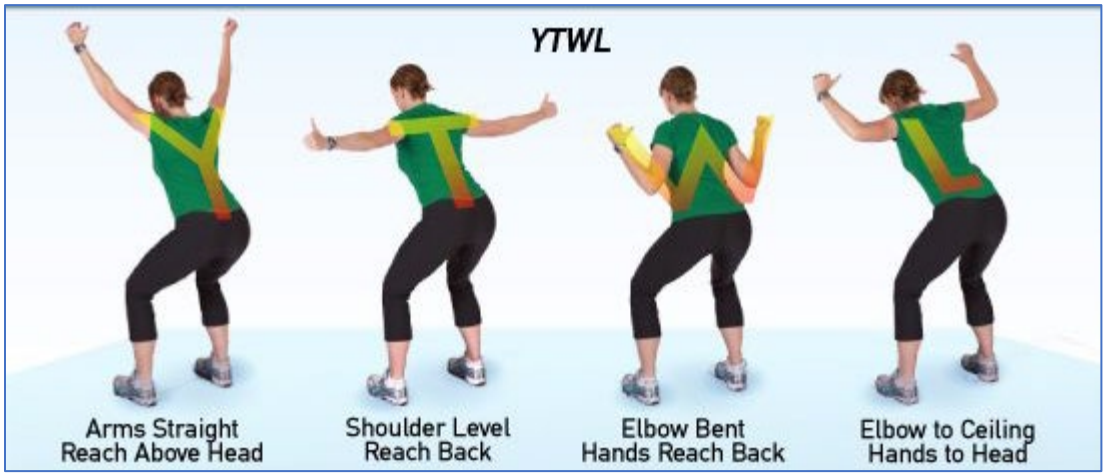
(Movement, Front Support Medicine Ball, 2021)

Steps:

- Assume plank position using medicine ball and toes as a base of support.
- Brace at the core
- Isometric holds for 30 – 45 Seconds.

Exercises for the Infraspinatus

Standing YTWL's

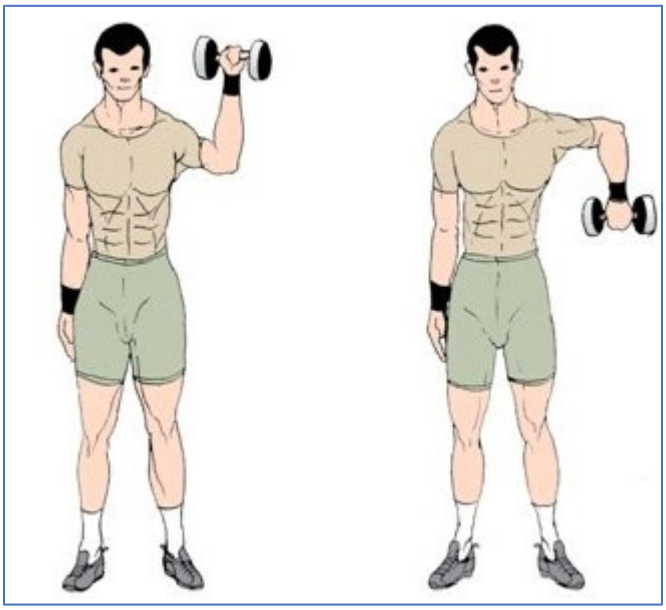


(Moore, 2021)

Steps:

- Stand, knees bent, arms at the anatomical position.
- Concentrically contract the arms and shoulder into the Y position as seen in the chart. (Hold for 2 – 4 seconds isometric contraction)
- Eccentrically lower
- Concentrically contract to the T position as seen in the chart.
- Eccentrically Lower
- Concentrically contract to the W position as seen in the chart
- Eccentrically Lower
- Concentrically contract to the double L position as seen in the chart.
- Eccentrically Lower

Upright Shoulder External Rotation



(Goals.com, 2021)

Steps:

- Using Light Cables. Bands, dumbbells
- Row the weight upward, elbows facing up until the shoulders are in 90 degrees of abduction.
- Externally rotate the cable, band or dumbbell until the arm is at 180 degrees of rotation.
- Eccentrically lower to 0 degrees of external rotation

Incline Row to External Rotation

(Up, 2015)

Steps:

- Use an inclined bench with an incline of 30 - 45° of inclination.
- Lay on the bench with chest high on the bench.
- Using light dumbbells, band resistance or cable resistance, row the weight to chest level
- Externally rotate the weight to the point where it is in line with the ears. (Isometric hold 2 – 4 seconds)
- Eccentrically lower to start position.

Exercises for the Teres Minor

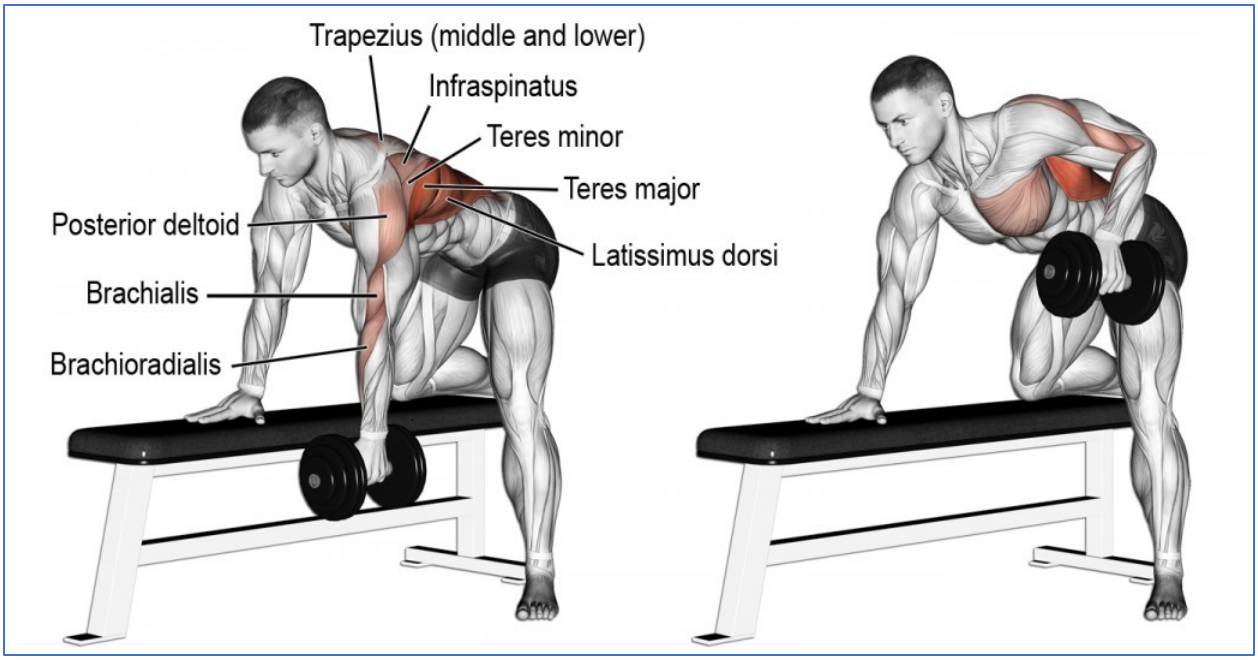
Horizontal Band External Rotation

(Academy, 2021)

Steps:

- Using a light resistance band anchored at a horizontal line of pull (depicted in the photo).
- Row to the position of 90 ° shoulder flexion and abduction
- Externally rotate.
- Eccentrically lower to the start point.

Single Arm Dumbbell Row

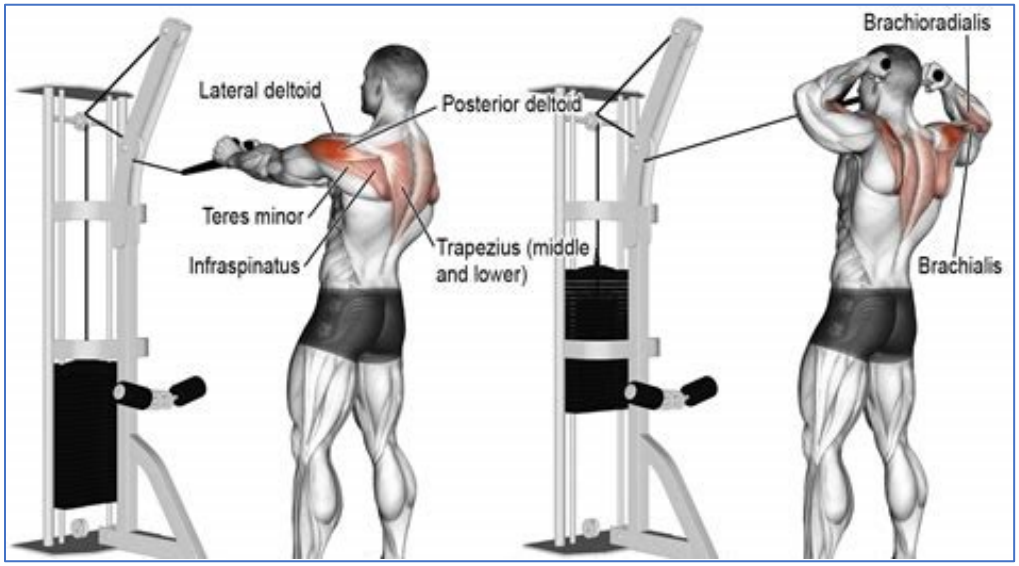


(admin, 2018)

Steps:

- Position self on a flat bench with 3 points of contact between the bench and the floor as seen in the photo.
- Using a light dumbbell concentrically squeeze the rear deltoid, and back muscles bringing the dumbbell to approximately chest level (Isometric hold 2 – 4 seconds)
- Eccentrically Lower

The Face Pull Exercise



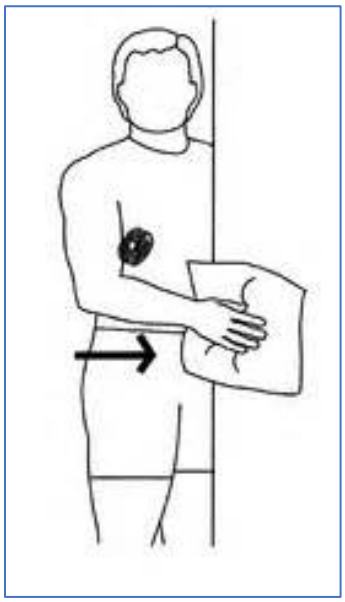
(Lord, 2016)

Steps:

- Starting off with a horizontal line of pull with cables or bands.
- Use an underhand grip to maximize the activation of the rotator cuff.
- Shoulders should be at 90 degrees of flexion arms straight to the front.
- Externally rotate using concentric contraction as seen in the photo.
- Isometric hold 2 – 4 seconds
- Eccentrically lower to the start position

Exercises for the Subscapularis

Isometric Internal Rotation

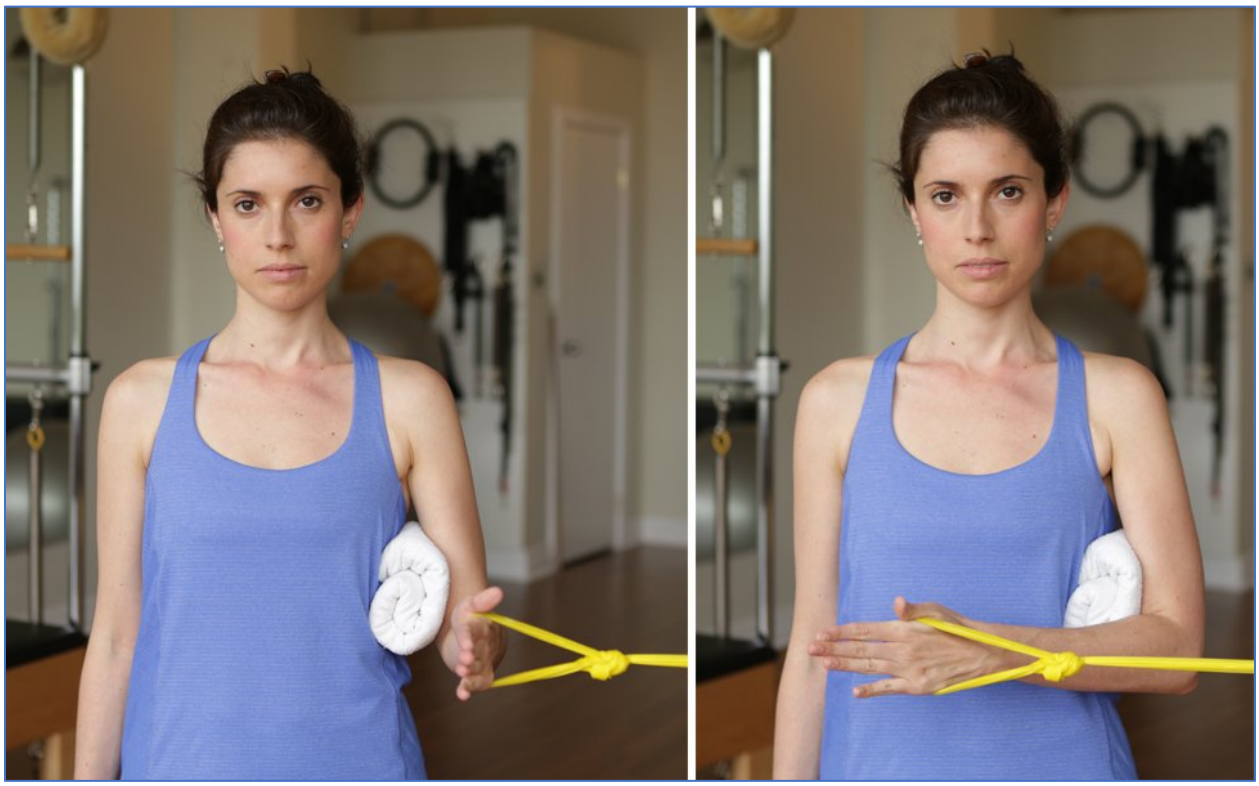


(Quizlet.com, 2021)

Steps:

- Using a doorway or wall and a towel for cushioning
- Perform isometric hold for 30 – 45 seconds.

Internal Rotation with Bands or Cables



(KAJARY, 2015)

Steps:

- Place a towel between elbow and ribcage (Disengages the lats)
- Using a lateral line of pull and elbow flexion to 90 degrees internally rotate to approximately 30 - 50° adduction.
- Isometrically hold 2 – 4 seconds.
- Using eccentric contraction move back to the start position.

Band Internal Rotation with Abduction

(Go, 2021)

Steps:

- Begin with a horizontal line of pull above shoulder level with the resistance behind.
- The start position is with the shoulder in 90° of flexion with the elbows bent at 90° (Flexion and Abduction)
- Concentrically lower the resistance cable till the hand, arm, and shoulder are on the same plane horizontally.
- Isometric hold 2 – 4 seconds.
- Eccentrically allow the arm to move back into external rotation.

Rotator Cuff Stretches

Elbow Out Rotator Stretch

(Walker, 2019)

Steps:

- Place a hand in the center of the back (Palm out)
- Reach across the front of the body with the other hand grasp the arm behind the back at the elbow.
- Apply gentle pull stretching the shoulder.
- Hold 30 seconds.

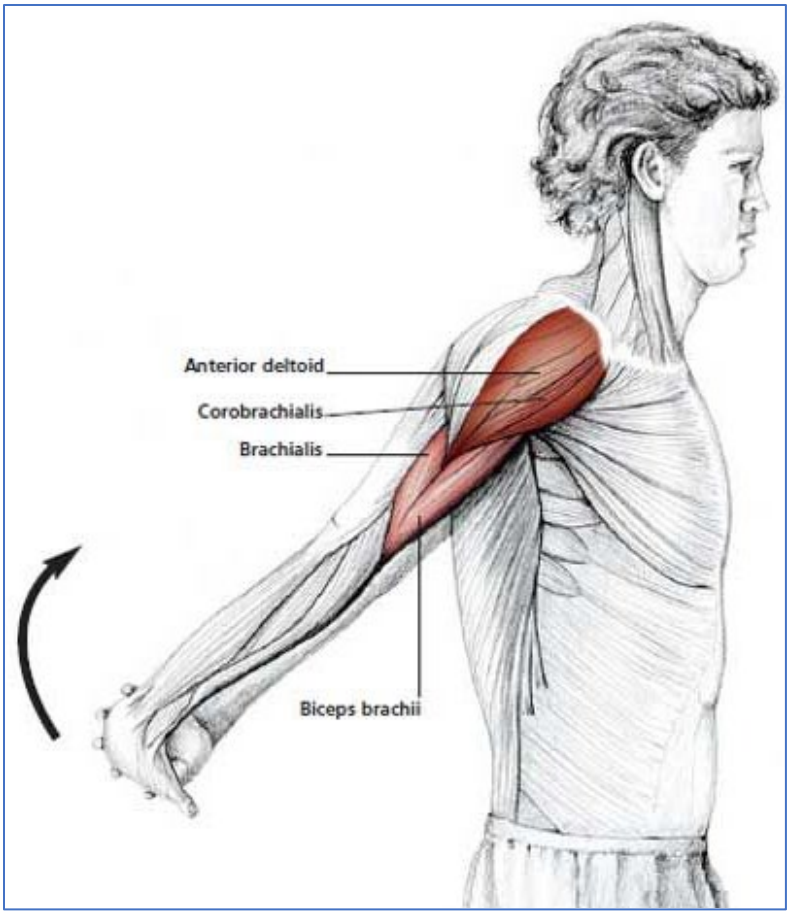
Up Arm Rotator Stretch

(Walker, Arm-up Rotator Stretch, 2019)

Steps:

- Use a stick approximately 1 meter in length.
- The arm being stretched will grasp the stick high. Shoulder is at 90° flexion and in external rotation.
- The arm not being stretched will grasp the stick low.
- Using gentle leverage, the bottom arm pulls the stick causing external rotation at the top.
- Hold 30 seconds.

Reverse Shoulder Stretch

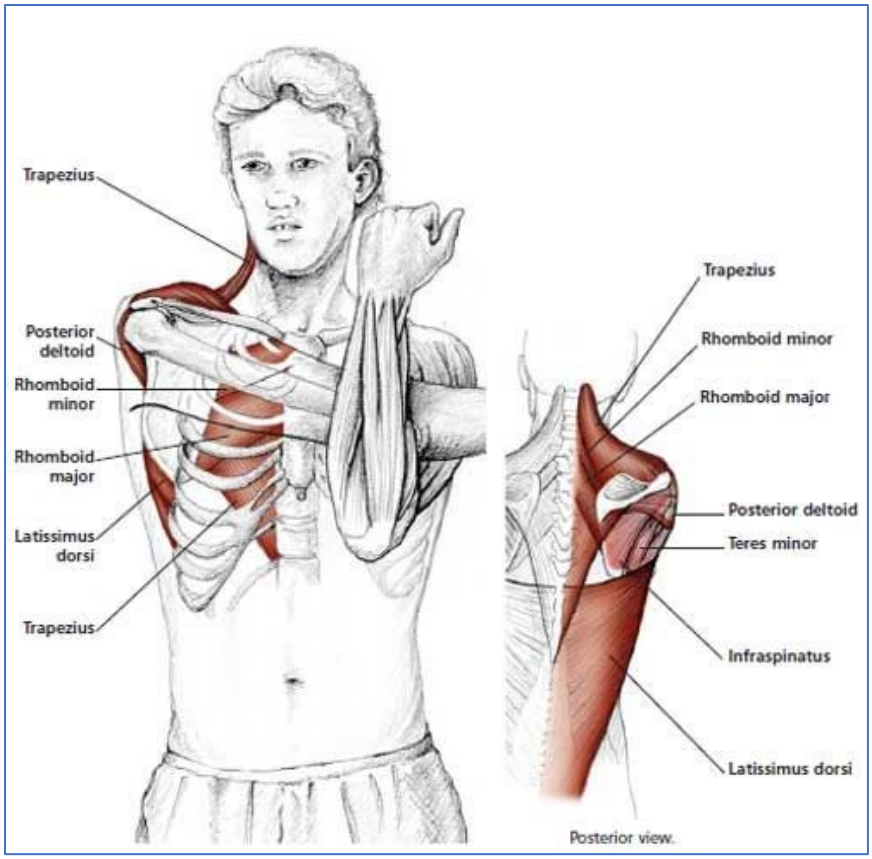


(Shoulder.com, 2021)

Steps:

- Place hands behind the back
- Both hands grasp each other.
- Raise the shoulders into flexion behind the back.
- Hold 30 seconds.

Parallel Shoulder / Neck Stretch



(FrozenShoulder.com, 2021)

Steps:

- Reach across the body at approximate chest level with one arm.
- Use the other arm to perform elbow flexion at or just above the elbow of the arm reaching across the body.
- Squeeze the arm across the chest.
- Hold 30 seconds.

Self-Myofascial Release Techniques

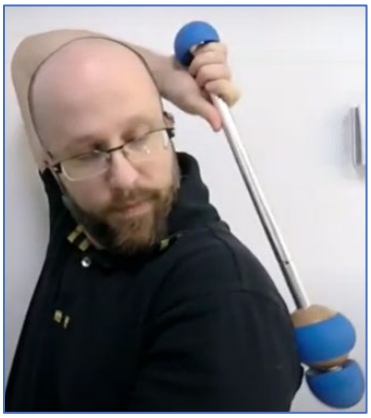
Supraspinatus Release (Using Lacrosse Ball)

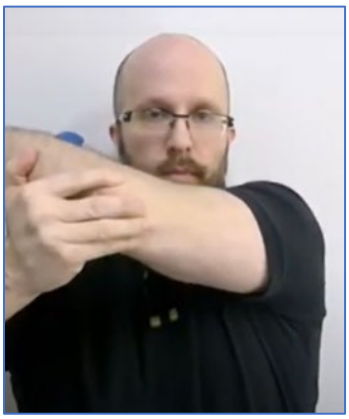
(Notley, 2019)

Steps:

- Locate the Supraspinatus.
- Place the ball on the Supraspinatus.
- Lean against the wall applying pressure.
- Reach the arm of the side being released behind and across the back.
- Slowly roll the ball until the tender spot is covered.
- Apply firm pressure for 30 seconds to 1 – minute.

Infraspinatus Release Using a Ball (or Other Therapeutic Apparatus)





(Notley, Self Myofascial Release of the Rotator Cuff – Infraspinatus, 2019)

Steps:

- Locate the Infraspinatus.
- Using a ball, or stick with a ball, place it on the muscle.
- Using a wall, hold the ball in place.
- Hold pressure on the ball at the first tender location.
- Reach the arm of the side being released across the body.
- Use the other arm to place pressure on the elbow of the arm reaching across the body.
- Hold for 30 seconds to 1 – minute.

Teres Minor/ Infraspinatus SMR (Foam Roller)

(Clinic, 2021)

Steps:

- Using a foam roller, side lay, placing the roller on the latissimus.
- Roll the roller up into the axillary region, then rotate until the roller is on the Teres Minor.
- Apply pressure to the first tender area and hold for 30 seconds to 1 – minute.
- This can also be used for the infraspinatus.

Subscapularis Release Using a Stick

(Notley, Self Myofascial Release of Subscapularis (rotator cuff), 2019)

Steps:

- Locate the Subscapularis.
- Using a stick for leverage, apply pressure.
- Hold at the tender spot for 30 seconds to 1 – Minute.

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