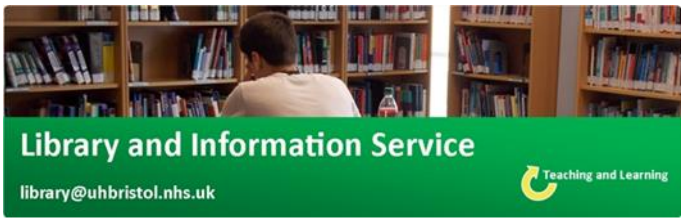
University Hospitals Bristol NHS
NHS Foundation Trust

Physiotherapy Outpatients

Evidence Update

November 2017
(Quarterly)

Respecting everyone
Embracing change
Recognising success
Working together
Our hospitals.



Training Calendar 2017

All sessions are ***one hour***

November (13.00)

2nd Thu	**Literature Searching**
10th Fri	**Critical Appraisal**
13th Mon	**Statistics**
21st Tues	**Literature Searching**
29th Wed	**Critical Appraisal**

December (12.00)

7th Thu	**Statistics**
15th Fri	**Literature Searching**

Your Outreach Librarian – Helen Pullen

Whatever your information needs, the library is here to help. Just email us at library@uhbristol.nhs.uk

Outreach: Your Outreach Librarian can help facilitate evidence-based practice for everyone in the team, as well as assisting with academic study and research. We also offer one-to-one or small group training in **literature searching, critical appraisal and medical statistics**. Get in touch: library@uhbristol.nhs.uk

Literature searching: We provide a literature searching service for any library member. For those embarking on their own research it is advisable to book some time with one of the librarians for a one-to-one session where we can guide you through the process of creating a well-focused literature research. Please email requests to library@uhbristol.nhs.uk

Contents

Latest Evidence

NICE National Institute for Health and Care Excellence

[The Modern Outpatient: a collaborative approach 2017-2020](#) *[PDF]*

08 September 2017 - Publisher: Scottish Government

The Modern Outpatient is designed to avoid the need for routine planned care by predicting risk, enabling self-management, providing support and intervention only when necessary, whilst maximising...

Cochrane Library

Nothing to add

UpToDate®

OpenAthens login required. Register here: https://openathens.nice.org.uk/

Author:

Craig Parsons, MS, PT

Section Editor:

Karl B Fields, MD

Deputy Editor:

Jonathan Grayzel, MD, FAAEM

Contributor Disclosures

All topics are updated as new evidence becomes available and our peer review process is complete.
Literature review current through: Sep 2017. | **This topic last updated:** Dec 02, 2015.

INTRODUCTION — Shoulder impingement syndrome (SIS) refers to a combination of shoulder symptoms, examination findings, and radiologic signs attributable to the compression of structures around the glenohumeral joint that occurs during shoulder elevation. Such compression causes persistent pain and dysfunction. SIS is a common cause of shoulder pain among patients presenting to primary care clinics.

The principles of rehabilitation and a physical therapy program for the treatment of SIS are discussed here. The risk factors, pathophysiology, diagnosis, and general management of SIS and other shoulder problems are reviewed separately. (See "Shoulder impingement syndrome" and "Rotator cuff tendinopathy" and "Presentation and diagnosis of rotator cuff tears" and "Frozen shoulder (adhesive capsulitis)" and "Evaluation of the patient with shoulder complaints" and "Physical examination of the shoulder".)

PRINCIPLES OF REHABILITATION — The normal biomechanics of any joint can be disrupted by problems intrinsic to the joint or in related structures. Muscles, tendons, or ligaments that are relatively tight or loose, weak or strong can contribute to such problems. To understand and rehabilitate injuries properly we need to understand the requirements of the involved joint complex and how imbalances in strength and flexibility affect its function. Once the fundamental problems are recognized, a progressive program can be designed to address them.

Proper rehabilitation makes use of the overload principle, which involves providing a progressive stimulus (or stress) to which the body must adapt [6]. According to this principle, a muscle will only become stronger if resistance is increased. Each exercise program starts with simple movements involving light resistance. Over time, depending upon the muscle group involved, more complex exercises using greater resistance are added, as the patient can tolerate them. In other words, as soon as the patient can perform an exercise without difficulty, the amount of weight or the tube tension being used should be increased. Such increases in resistance should be gradual but steady.

It is important to maintain the patient's confidence during rehabilitation. If a program is too easy and provides little benefit, patient compliance may fall; if a program is too difficult, pain may increase and the patient may quit rehabilitation. Increasing the stimulus by an appropriate amount and at an appropriate rate leads to steady improvement.

All therapeutic exercise programs follow the basic steps of rehabilitation:

- Decrease pain and inflammation
- Restore normal range of motion (ROM)
- Improve individual muscle function
- Restore overall functional capacity
- Educate and direct injury prevention exercises to avoid re-injury

Often the pace of recovery is determined by pain and inflammation. As an example, shoulder pain can inhibit the primary movers of the shoulder (ie, the rotator cuff). When the rotator cuff is not working properly the head of the humerus migrates superiorly impinging on structures in the subacromial space [7,8]. Therefore, decreasing pain and inflammation must be the first step in treating shoulder dysfunction. With shoulder impingement syndrome (SIS), this is accomplished in part by improving scapular stability. Improved scapular stability contributes to better rotator cuff function, and as the rotator cuff becomes better able to hold the head of the humerus against the glenoid fossa during arm elevation, impingement decreases and overall shoulder function improves [9]. In addition, exercises specifically for improving rotator cuff function are necessary to treat SIS.

Each muscle group performs specific actions in a particular manner, and rehabilitation of each muscle group involves different exercises and workout volumes (ie, number of exercises, sets, and repetitions). In general, we prefer to use several different exercises to ensure that every major movement for each involved muscle is appropriately trained. Another benefit of using a range of exercises is the ability to modify a program based upon the patient's abilities and limitations, for example when a patient is unable to perform a particular exercise. For the rotator cuff, the major movements are internal rotation (subscapularis), external rotation (teres minor, infraspinatus), and abduction (supraspinatus), and for the muscles that provide scapular stability, the major movements are retraction, elevation, and depression-rotation (or protraction) of the scapula.

In addition, researchers in rehabilitation have identified the need to create specific training regimens for postural muscles versus phasic muscles [10]. Postural, or tonic, muscles are primarily involved in endurance functions and contract over longer periods while phasic muscles primarily perform in short bursts of activity and exert greater power. The number of repetitions used for a particular exercise will vary depending upon the muscle type. As an example, a high number of repetitions (50 to 100) is necessary to improve the endurance of postural muscles, while phasic muscles become stronger when performing fewer repetitions (10 to 20) using greater resistance.

Proper exercise technique and posture are essential for effective physical therapy. During rehabilitation, exercises for the shoulder complex should be performed in a deliberate, controlled manner; patients must avoid using momentum to make exercises easier. The muscles involved in executing a particular movement should move smoothly. If a patient is unable to complete the prescribed number of repetitions in a controlled manner, it is better to stop as soon as the form starts to break down, rather than risk injury, and build up to the desired number over time. Our goal is to improve muscle function, not just to complete the sets and repetitions.

Appropriate exercise technique depends in part on whether a muscle is contracting concentrically or eccentrically. When a muscle is contracting and the lever arm is shortening, this is called a concentric contraction. One example is the biceps muscle when a person is pulling their body up to the bar during a chin up. Concentric exercises during physical therapy are generally performed to a 2 second count. When a muscle is contracting and the lever arm is lengthening, this is called an eccentric contraction (sometimes referred to as a “negative” repetition by weightlifters). An example would be the biceps muscle when a person is lowering their body down from the bar during a chin up. Eccentric exercises during physical therapy are generally performed to a 4 second count.

These second counts reflect the importance of using controlled deliberate movements to perform resisted rehabilitation exercises and the relative strength of eccentric movement generally. This approach ensures that the appropriate muscles are doing the work and the role of momentum is minimized. In addition, an eccentric contraction can generate forces up to one and a third times that of a concentric contraction involving the same muscle. By increasing the duration of the eccentric contraction, a suitable challenge is created for the muscle without changing the load.

Of note, eccentric contraction involves the breaking actin-myosin cross-bonds in muscle sarcomeres, while concentric contraction involves the creation of such cross-bonds. The breaking of cross-bonds is associated with the delayed onset muscle soreness associated with weight lifting and other intense athletic activities involving significant eccentric contraction under a load [11].

Posture has a large effect on muscles and movement, and this is particularly true of the shoulder. If exercises are performed with slumped, internally rotated shoulders and poor spinal posture, anterior muscles, such as the pectoralis major (which in most patients are too tight and too strong relative to the muscles of the upper back and rotator cuff) can overcompensate for deficiencies elsewhere and physical therapy will be ineffective.

Once rehabilitation is completed and healthy shoulder function is achieved, it is crucial that patients not resume the postures and practices that predispose to disability. Therefore, it is important that patients continue to perform a few times each week a subset of exercises prescribed by the physical therapist that will maintain the strength of the scapular stabilizers and rotator cuff muscles and overall shoulder function. In addition, proper posture and ergonomics at home, work, and play are essential to avoiding a recurrence of shoulder impingement. Techniques for improving and maintaining proper posture and ergonomics are reviewed separately. (See "Overview of joint protection", section on 'The principles of joint protection'.)

REHABILITATION PROGRAM

Overview — Rehabilitation of any injury requires a specific plan and exercise progression. With shoulder impingement syndrome (SIS), there are three primary goals of rehabilitation

[3,12-14]:

- Strengthen the muscles that stabilize the scapula: By strengthening the scapular stabilizers, greater stability is provided for the rotator cuff muscles, which originate on the scapula. This stability allows for greater efficiency and muscular endurance of the rotator cuff, and improved overall shoulder function. This is a critical first step in rehabilitation.
- Correct imbalances in strength among the rotator cuff muscles: Typically, before rehabilitation, the muscles at the front of the shoulder complex (anterior deltoid, internal rotator (ie, subscapularis)) are 1.5 to 2 times stronger than those at the posterior (posterior deltoid, external rotators).
- Stabilize the secondary movers of the shoulder complex: Once the primary muscles of the shoulder are strong and functional, the next step is to rehabilitate the secondary shoulder muscles in order to improve coordination of the entire shoulder complex.

In addition to these three primary goals, a fourth goal for many athletes is to improve sport-specific biomechanics and function. This may entail performing exercises that simulate key movements in their sport using resistance or other techniques to improve performance. Proper technique is an essential component of this phase.

Patients should be made aware that successful completion of such a program generally requires from 8 to 16 weeks, but that some improvement is usually noted within the first three to four weeks. A patient who has successfully completed a rehabilitation program for SIS should have complete, pain-free motion of the glenohumeral joint and should be able to perform all functional movements and exercises in the program without pain. Several months following the completion of rehabilitation may be needed before pain during sleep completely resolves.

It is important to maintain the patient’s confidence during rehabilitation. If a program is too easy and provides little benefit, patient compliance may fall; if a program is too difficult, pain may increase and the patient may quit rehabilitation. To avoid such problems when rehabilitating patients with shoulder pain, it is important to distinguish between SIS and rotator cuff tears at the outset, and to refer patients back to their referring primary care or sports medicine clinician to discuss possible surgical evaluation as soon as the need is recognized (eg, patient demonstrates significant weakness consistent with a substantial rotator cuff tear). A discussion of how to work through the differential diagnosis of the adult with shoulder pain and specific discussions of how to diagnose a rotator cuff tear are provided separately. (See "Evaluation of the patient with shoulder complaints" and

"Presentation and diagnosis of rotator cuff tears".)

Step one: Improve scapular stability — Scapular instability is common in patients with SIS and improving the stability of the scapula is the first goal in rehabilitating these patients. The scapula is the origin for the rotator cuff muscles and thus, if it is unstable, rotator cuff contractions are weaker and less efficient. Strengthening the muscles that stabilize the scapula allows for better rotator cuff function [1-4,14-16]. The muscles targeted in this phase of physical therapy are, in order of importance, the rhomboid and mid-trapezius, lower trapezius, upper trapezius and levator scapulae, and the serratus anterior.

The key to success in this step is getting the patient to focus on the scapula. This is often accomplished by having the patient exaggerate squeezing the shoulder blades together. Initially, it may help for the clinician or therapist to place a finger or object in the space between the scapulae while this is done. The most common mistakes that patients make when performing these exercises are overemphasizing arm movement and neglecting scapular movement.

The muscles providing scapular stability contract continuously during the day to help maintain posture. Thus, the patient must perform exercises using relatively low resistance but many repetitions in order to improve the endurance of these muscles. In one randomized trial of patients with chronic SIS, the group assigned to rehabilitation involving exercises performed with high repetitions (three sets of 30) demonstrated significantly greater improvements in pain and function than the group treated with low repetitions (two sets of 10) [17].

The author's preferred exercises for scapular stabilization include:

- Row – Use tubing anchored to a doorknob, table leg, or sturdy stair banister. While standing, hold the tubing in each hand at about waist height. Pull the tubing back by letting the elbows bend and squeezing the shoulder blades together as much as possible, as if you are trying to hold a pencil between your shoulder blades (picture 3 and movie 1). Pull back while slowly counting to two, and then return to the starting position while slowly counting to four. Perform two sets of 20 to 25 repetitions with 30 seconds rest between sets.
- Shoulder extension – Use tubing anchored to a doorknob, table leg, or sturdy stair banister. While standing, hold the tubing in each hand at about waist height. Keeping the elbows straight, pull the tubing back and squeeze the shoulder blades together as much as possible, like you are trying to hold a pencil between your shoulder blades (picture 4 and movie 2). Pull back while slowly counting to two, and then return to the starting position while slowly counting to four. Perform two sets of 20 to

25 repetitions with 30 seconds rest between sets.

- Scapular downward rotation and depression ("Supermans") – Lay on your stomach with your arms straight and directly overhead. Lift your arms off the floor and hold the position while slowly counting to two, and then slowly lower your arms while counting to four. Perform two sets of 20 to 25 repetitions with 30 seconds rest between sets.
- Horizontal shoulder abduction – Use tubing anchored to a doorknob, table leg or sturdy stair banister. While standing, hold the tubing in each hand at about shoulder height. Keeping the elbows straight, pull the tubing back and squeeze the shoulder blades together as much as possible. Your arms and body will form a T shape. Pull back while slowly counting to two, and then return to the starting position while slowly counting to four. Perform two sets of 20 to 25 repetitions with 30 seconds rest between sets. The exercise can also be performed from a prone position (picture 5).

The author prefers to have patients begin performing these exercises using rubber tubing for resistance and performing a moderate number of repetitions (eg, 15 to 20). Gradually, the patient works up to three sets of 50 to 100 repetitions [3]. For most patients, it is reasonable to increase the number of repetitions by five each session. It is generally safe for the patient to increase the resistance of an exercise (eg, use tubing with greater tension) when he or she can successfully perform two to three sets of 50 repetitions without an increase in pain. For each group of exercises, it usually takes two to three weeks for a patient to achieve the full number of repetitions and progress to more difficult tubing.

Tubing is made by a number of manufacturers and different tubes or bands have variable resistance. As an example, Thera-Band tubing has resistance as follows: yellow tubing 2.4 to 3.4 lbs (1.1 to 1.5 kg); red 3.7 to 5.5 lbs (1.7 to 2.5 kg); green 4.6 to 6.7 lbs (2.1 to 3 kg); blue 5.8 to 8.6 lbs (2.6 to 3.9 kg); black 7.3 to 10.2 lbs (3.3 to 4.6 kg); silver 10.2 to 15.3 lbs (4.6 to 6.9 kg).

Once an appropriate number of repetitions can be performed for each exercise above using more difficult tubing, patients begin using weighted resistance. Suitable exercises to perform once this stage is reached include:

- Seated rows – While seated, grasp the handle of a pulley bar directly in front of you and, while maintaining an erect posture, gradually pull the bar straight to your belly, hold for one second, and then return the bar to the starting position (picture 6). Do three sets of 15 repetitions with a weight that does not cause pain but challenges the muscles. Work up to three sets of 20 repetitions without pain, while maintaining proper form, before increasing the weight. Each time the weight is increased, begin with three sets of 15 repetitions and work up to 20 repetitions.
- Close-grip pull-downs – While seated, grasp the handle of an overhead pulley bar

and, while maintaining good posture, gradually pull the bar straight to your chest, hold for one second, and then return the bar to the starting position (picture 7). Do three sets of 15 repetitions with a weight that does not cause pain but challenges the muscles. The progression is identical to that for seated rows.

●I-T-Y's with dumbbells – I-T-Y's can be performed in different positions and one or both arms can be used; the author's preferred approach is described here. Begin by lying prone with your upper torso extended beyond the edge of a stable flat surface. An examination table, bed, weight bench, or stability ball can be used. Initially, perform each exercise without weight for two sets of 15 to 20 repetitions. As the exercises become easier, add resistance in one pound (0.45 kg) increments until the exercises can be performed using 8 to 10 pound (3.6 to 4.5 kg) dumbbells.

"I" exercises begin with the involved arm hanging straight down from the shoulder. Keeping the elbows straight, extend your shoulders until the arms are pointing straight down and are adjacent to your torso (picture 8). Hold this position for one second, and then slowly return the arms to the starting position.

"T" exercises begin from the same starting position. Keeping the elbows extended, raise your arms straight to the side (combination of shoulder extension and abduction) until they are perpendicular to the torso (if both arms are used, the arms and torso form a T) and in line with the body (picture 9 and picture 10). Hold the position for one second, and then slowly return the arms to the starting position.

"Y" exercises begin from the same starting position. With the elbows extended and the thumbs pointing up, flex your shoulders in a plane approximately at a 45 degree angle from the body until the arms are in line with the body (if both arms are used, the arms and torso form a Y) (picture 11). Hold the position for one second, and then slowly return the arms to the starting position.

●Shoulder shrugs – Holding a dumbbell in each hand, gradually shrug your shoulders completely, hold the top of the shrug for a second, and then gradually lower them to the starting position. Do three sets of 15 repetitions with a weight that does not cause pain but challenges the muscle. The progression is identical to that for seated rows.

In the final stages of rehabilitation, more complex exercises are performed. These exercises may involve the use of suspension training (eg, TRX), free weights, or other equipment. However, regardless of the complexity of the movement or the equipment used, the exercises should involve relatively low resistance but steadily build to a high number of repetitions (50 to 100). With each new group of more challenging exercises, the patient should begin with lighter resistance and perform two to three sets of 15 repetitions. Gradually the number of sets and repetitions are increased until the patient can perform three sets of 50 to 100 repetitions. Then, resistance is gradually increased and the process begins anew. Repetitions can be increased for as long as there is no shoulder pain.

Stretching — Many patients with SIS have inadequate flexibility in the muscles of their anterior shoulder and chest, and tightness in the posterior capsule of their glenohumeral joint. These problems contribute to shoulder impingement and thus an important part of rehabilitation for SIS is a stretching program. Stretching exercises are performed throughout rehabilitation.

The author prefers the following stretching exercises:

- Corner stretch (for chest and anterior deltoid) (picture 12)
- Posterior capsule stretch (movie 3 and picture 13)
- Sleeper stretch (movie 4 and picture 14)
- Pectoralis minor stretch (picture 15)

Each stretch is held for 30 seconds and repeated three times. A rest interval of about 60 seconds between sets is generally adequate. For exercises that involve one extremity at a time, both sides should be stretched.

During the initial stages of rehabilitation, pain may limit the patient's ability to perform stretches. Thus, early on, patients stretch once a day to the extent that they can without causing pain. However, improving flexibility generally requires more frequent training than improving strength. Therefore, as pain subsides and patients are able to perform physical therapy exercises, we tell patients to stretch twice daily. When patients reach the final phase of shoulder rehabilitation, and are preparing to resume their usual activities, we tell patients to stretch two to three times daily, and have them continue this regimen until they achieve full, pain-free shoulder movement. Thereafter, they can stretch following exercise to maintain flexibility.

Step two: Strengthen the rotator cuff — There are four rotator cuff muscles involved in three distinct shoulder movements (although the coordinated action of all four muscles is essential for healthy shoulder function). To address strength imbalances among the rotator cuff muscles, it is necessary for patients to perform exercises that isolate particular muscles.

Although rotator cuff muscles perform postural functions during some activities of daily living (ADL), the rotator cuff muscles are primarily phasic and most often perform short bursts of activity. Phasic muscles become stronger when performing exercises with 10 to 20 repetitions. Thus, the best rehabilitation volume consists of two to three sets of 10 to 20 repetitions. As soon as the patient can perform a workout without difficulty, the amount of weight or the tube tension being used should be increased. Increases in resistance should be gradual but steady. (See 'Principles of rehabilitation' above.)

It is important that the patient perform the rotational exercises described below in a deliberate, controlled manner, thereby forcing the muscles involved to rotate the arm and stabilize the glenohumeral joint simultaneously.

Supraspinatus — SIS often involves weakness or dysfunction of the supraspinatus muscle, which is involved in abduction of the arm. Therefore, exercises to strengthen this muscle are generally included in the rehabilitation program.

Abduction exercises performed with the thumbs pointed upwards are the safest way to train the supraspinatus, according to a systematic review of biomechanical and clinical studies performed to identify the most effective rehabilitation exercises for rotator cuff and scapulothoracic muscles [12,18]. These exercises are sometimes referred to as “full can” exercises because the patient’s hands are positioned as if they are holding a full can of liquid they do not want to spill. Exercises that isolate the supraspinatus but are performed with alternative positioning have been found to compress subacromial structures.

The progression of exercises used to strengthen the supraspinatus consists of the following:

- Isometric holds in the mid-range of abduction using the “full can” position (movie 5). Start with your arms hanging straight down from your body. With your arm in a thumbs-up position, lift your arm in a plane at approximately 45 degrees of shoulder external rotation (ie, arm in front of your body) to waist height so that it engages the counter or a wall and then maintain it at this height for five seconds. Perform two sets of 10 to 15 repetitions. When this exercise can be performed without pain, progress to the next exercise.
- Active abduction using the “full can” position (movie 6). Start with your arms hanging straight down from your body. With your arm in a thumbs-up position, lift your arm in a plane at approximately 45 degrees of shoulder external rotation to shoulder height, hold this position for one second, and then slowly return to the starting position (picture 16). Perform three sets of 15 repetitions.
- Active abduction using the “full can” position against resistance (tubing or free weights) (picture 17 and movie 7). Start with your arms hanging straight down from your body while holding a 1 lb (0.45 kg) dumbbell. Alternatively, you can use light resistance tubing attached at about waist height to a fixed object behind you. With your arm in a thumbs-up position, lift your arm in a plane at approximately 45 degrees of shoulder external rotation to shoulder height. Perform three sets of 15

repetitions. Each time the patient is able to perform three sets of 20 repetitions without pain, add 1 lb (0.45 kg) to the load being raised. A reasonable goal for the average patient is to perform the exercise with 10 to 12 lbs (4.5 to 5.5 kg) for three sets of 20 repetitions.

Avoid elevating the arm too much in these exercises.

External rotators (infraspinatus and teres minor) — The infraspinatus and the teres minor are the rotator cuff muscles responsible for external rotation of the shoulder. In addition, the external rotators decelerate the humerus during overhand throwing and racquet sports. These muscles are trained together during rehabilitation.

Several exercises can be used to strengthen the external rotators and selection is sometimes based upon the specific activities in which the patient participates. The author prefers to begin with isolated movements and then progress to more complex movements designed to help the patient improve performance in their chosen activity.

A typical progression of exercises used to strengthen the external rotators consists of the following:

- ●Isometric holds in neutral position (movie 8). Standing with your body perpendicular to a wall, flex your elbow to 90 degrees and make sure that your posture is erect. While keeping your elbow tight to your side throughout the exercise, push your forearm into the wall by externally rotating your shoulder. Maintain the contraction for 5 seconds and then relax for 2 to 5 seconds. Perform two sets of 10 to 15 repetitions. When this can be done without pain, progress to the next exercise.
- ●Active external rotation with the arm held in neutral position. While standing or sitting, flex your elbow to 90 degrees. Keeping your elbow tight to your side throughout the exercise, externally rotate your shoulder so your forearm travels approximately 90 degrees; your forearm will move from touching your abdomen until it points directly in front of your torso. Perform three sets of 15 repetitions.
- ●Active external rotation while lying on the side. While lying on the uninvolved side, rest your affected arm on the side of your torso and flex the elbow to 90 degrees, allowing your forearm to rest against your abdomen. Keeping your elbow tight to your side throughout the exercise, externally rotate your shoulder such that your forearm moves a little beyond 90 degrees (ie, forearm is just beyond parallel to the floor). Perform three sets of 15 repetitions.
- ●Active external rotation against resistance, using either tubing or free weights (movie 9). Stand with your body perpendicular to the wall or to the site to which the tubing is anchored. Hold the weight or tubing in the hand furthest from the wall or

anchor site and flex your elbow to 90 degrees. If you are using tubing, move away from site to which the tubing is anchored until there is no slack and your forearm is resting against your abdomen (picture 18). Keeping your elbow tight to your side throughout the exercise, externally rotate your shoulder until the forearm is slightly more than 90 degrees from your body. The goal is to perform three sets of 20 repetitions with 10 to 15 lbs (4.5 to 6.8 kg), or at least 50 percent of the resistance used for internal rotation exercises.

In order to isolate the rotational component of these exercises, it is often helpful to have the patient pinch a towel between their body and the arm involved in performing the exercise.

Subscapularis — Internal rotation of the shoulder is performed by the subscapularis, a relatively large muscle that originates on the undersurface of the scapula. The subscapularis is generally quite responsive to exercise and rarely limits the rehabilitation potential of the patient with SIS, or other shoulder problems. Therefore, beginning isometric exercises are usually unnecessary, unless the shoulder has sustained acute trauma involving an anterior glenohumeral force moment (eg, anterior glenohumeral dislocation). In such circumstances, rehabilitation would begin with isometric holds in a neutral position, with the patient performing two sets of 15 repetitions with five second holds for each repetition (movie 10).

In most circumstances, a typical progression of exercises used to strengthen the subscapularis consists of the following:

- Active internal rotation with the arm held in neutral position. Stand or sit and flex the elbow of your involved arm to 90 degrees. Keeping your elbow tight to your side throughout the exercise, begin with your forearm pointing straight in front of your body and then internally rotate your shoulder, moving your forearm until it rests against your abdomen. Perform three sets of 15 repetitions.
- Active internal rotation while lying on the side (movie 11). While lying on your involved side, position your bottom (ie, affected) arm under your body and flex the elbow to 90 degrees, allowing your forearm to rest against the floor or table. Keeping your elbow tight to your side throughout the exercise, internally rotate your shoulder until your forearm touches your abdomen. Perform three sets of 15 repetitions.
- Active internal rotation against resistance, using either tubing or free weights (movie 12 and movie 13). Stand with your body perpendicular to the wall or to the site to which the tubing is anchored with the affected arm closest to the wall. Hold the weight or tubing in the hand closest to the wall or anchor site and flex your elbow to 90 degrees. If you are using tubing, move away from site to which the tubing is anchored until there is no slack and the forearm arm is rotated a little more than 100 degrees from your body (picture 19). Keeping your elbow tight to your side

throughout the exercise, internally rotate your shoulder until the forearm touches your abdomen. The goal is to perform three sets of 20 repetitions with 15 to 25 lbs (6.8 to 11.3 kg).

Step three: Improve overall strength and coordination of shoulder complex — Gaining strength in isolated movements is essential for proper rehabilitation, but exercises to improve coordinated shoulder movement are a critical, and often overlooked, final step in treatment that is necessary to attain maximal function.

As symptoms and shoulder function improve, patients gradually resume their usual daily activities. These activities often include manipulating an object overhead at arm's length (eg, removing or replacing a dish from a high shelf). Thus, the final stages of SIS rehabilitation should include more challenging functional exercises that develop the scapular stability and rotator cuff strength necessary to counteract the torque created at the end of the lever arm when they perform such activities. Incorporating more complex movements, like combined internal and external rotation or diagonal pulls across the body, and more difficult exercises, such as plyometric and closed kinetic chain exercises, helps to achieve these functional goals.

Two exercises suitable for the general patient population that help to improve overall shoulder strength and coordination are the following:

- Active internal rotation against resistance in a "90-90" position (movie 14). Attach appropriate tubing to a stationary object at about waist height. Stand facing away from the object while holding the tubing at head height with the arm in a "90-90" position (90 degrees of elbow flexion and 90 degrees of arm abduction). Internally rotate the shoulder until the forearm is parallel to the ground (picture 20). The goal is to perform three sets of 20 repetitions with blue or black tubing (or 20 to 30 lbs [9.0 to 13.6 kg] resistance).
- Active external rotation against resistance in a "90-90" position (movie 15). Attach appropriate tubing to a stationary object at about waist height. Stand facing the object while holding the tubing at head height with the arm in a "90-90" position (90 degrees of elbow flexion and 90 degrees of arm abduction). Externally rotate the shoulder until the forearm is perpendicular to the ground (picture 21). The goal is to perform three sets of 20 repetitions with blue or black tubing (or 10 to 15 lbs [4.5 to 6.8 kg]), or 50 percent of internal rotation resistance.

Exercises involving more complex movements are used for patients with specific needs, such as athletes preparing for a particular sport, but these are beyond the scope of this topic.

WHERE TO BEGIN — When deciding how to begin a rehabilitation program for the patient with SIS, it is important to determine the type and stage of their shoulder pathology. Is the problem acute inflammation or chronic overuse? Is there a history of shoulder problems in the affected extremity? Is a significant rotator cuff tear suspected?

Whenever SIS is suspected but there is doubt about the precise nature of the problem, it is best to begin treatment with simple isometric exercises. The patient can then progress to active range of motion (ROM) exercises as tolerated, and finally to resisted exercises. (See 'Principles of rehabilitation' above.)

The management of rotator cuff tears is debated, and most patients with a suspected tear can be assessed by any physician experienced in the management of shoulder disorders. Active patients with a suspected rotator cuff tear associated with significant shoulder weakness or instability who present acutely following an injury should be referred immediately to an orthopedic surgeon. (See "Management of rotator cuff tears", section on 'Surgical indications for rotator cuff tears'.)

A discussion of how to work through the differential diagnosis of the adult with shoulder pain and specific discussions of how to diagnose rotator cuff tendinopathy and rotator cuff tear are provided separately. (See "Evaluation of the patient with shoulder complaints" and "Rotator cuff tendinopathy" and "Presentation and diagnosis of rotator cuff tears".)

EVIDENCE SUPPORTING THIS APPROACH — Much of the evidence supporting the approach to physical therapy for shoulder impingement syndrome (SIS) described in this topic consists of clinical experience, biomechanical studies, and observational data [3,12,19-21]. However, further support can be found in a small number of controlled trials, including the following:

- In a controlled trial of 102 patients with chronic SIS (symptoms >6 months), the group randomly assigned to treatment with a specific physical therapy program for SIS showed significantly greater improvements in shoulder function and patient satisfaction than the group managed with general exercises for the shoulder and neck [13]. The mean change in the Constant-Murley shoulder assessment score was 24 points for patients in the specific program (95% CI 19-28) and 9 points in the general exercise group (95% CI 5-13). The specific program consisted of eccentric strengthening exercises for the rotator cuff and both concentric and eccentric exercises for the scapula stabilizers performed with progressive resistance, along with manual mobilization.

In addition to the rehabilitation program described in this topic, manual manipulation of the involved shoulder to improve mobility, when performed by experienced physical therapists, appears to improve outcomes in patients with SIS [22,23].

SUMMARY AND RECOMMENDATIONS

- ●Glenohumeral or shoulder impingement syndrome (SIS) is a chronic condition that develops when soft tissues are repeatedly compressed between the humeral head and the acromion when the arm is actively raised. A specific subtype of SIS is seen in overhead athletes (eg, pitchers, tennis players) (See "Shoulder impingement syndrome".)
- ●Rehabilitation of SIS requires a specific plan that includes appropriate exercises and progressions. Our suggested plan for general rehabilitation of SIS is described in the text. This plan is organized around the three primary goals of rehabilitation (see 'Principles of rehabilitation' above and 'Rehabilitation program' above):
  - •Strengthen the muscles that stabilize the scapula: By strengthening the scapular stabilizers, greater stability is provided for the rotator cuff muscles, which originate on the scapula. This stability allows for greater efficiency and muscular endurance of the rotator cuff, and improved overall shoulder function. (See 'Step one: Improve scapular stability' above.)
  - •Correct imbalances in strength among the rotator cuff muscles: Typically, before rehabilitation, the muscles at the front of the shoulder complex (anterior deltoid, internal rotator (ie, subscapularis)) are disproportionately stronger than those at the posterior (posterior deltoid, external rotators). (See 'Step two: Strengthen the rotator cuff' above.)
  - •Stabilize the secondary movers of the shoulder complex: Once the primary muscles of the shoulder are strong and functional, the next step is to rehabilitate the secondary shoulder muscles in order to improve coordination of the entire shoulder complex. (See 'Step three: Improve overall strength and coordination of shoulder complex' above.)
  - •Appropriate stretching is another important element of the rehabilitation program. Suggested stretches are described in the text. (See 'Stretching' above.)
- ●Successful completion of the SIS rehabilitation program generally requires from 8 to 16 weeks, but some improvement is usually noted within the first three to four weeks. A patient who has successfully completed a rehabilitation program for SIS should have complete, pain-free motion of the glenohumeral joint and should be able to perform all functional movements and exercises in the program without pain. It is important to instruct patients about proper posture, movement, and ergonomics to reduce the risk of recurrence.

REFERENCES

1. Cools AM, Dewitte V, Lanszweert F, et al. Rehabilitation of scapular muscle balance: which exercises to prescribe? Am J Sports Med 2007; 35:1744.
2. Cools AM, Declercq GA, Cambier DC, et al. Trapezius activity and intramuscular balance during isokinetic exercise in overhead athletes with impingement symptoms. Scand J Med Sci Sports 2007; 17:25.
3. Ellenbecker TS, Cools A. Rehabilitation of shoulder impingement syndrome and rotator cuff injuries: an evidence-based review. Br J Sports Med 2010; 44:319.
4. Kibler WB, McMullen J. Scapular dyskinesis and its relation to shoulder pain. J Am Acad Orthop Surg 2003; 11:142.
5. Warner JJ, Micheli LJ, Arslanian LE, et al. Scapulothoracic motion in normal shoulders and shoulders with glenohumeral instability and impingement syndrome. A study using Moiré topographic analysis. Clin Orthop Relat Res 1992; :191.
6. Dirix A, Knuttgen HG, Tittle K. Strength and power. In: The Olympic Book of Sports Medicine, Wiley-Blackwell, Chicago 1991. p.181.
7. Neer CS 2nd. Anterior acromioplasty for the chronic impingement syndrome in the shoulder: a preliminary report. J Bone Joint Surg Am 1972; 54:41.
8. American Academy of Orthopaedic Surgeons. Shoulder Pain. OrthoInfo. http://orthoinfo.aaos.org/topic.cfm?topic=a00065 (Accessed on May 13, 2012).
9. Levangie P, Norkin CC. Joint Structure and Function: A Comprehensive Analysis, 3rd, F.A. Davis, Philadelphia 2001.
10. Knuttgen HG. Strength training and aerobic exercise: comparison and contrast. J Strength Cond Res 2007; 21:973.
11. Hackney KJ, Engels HJ, Gretebeck RJ. Resting energy expenditure and delayed-onset muscle soreness after full-body resistance training with an eccentric concentration. J Strength Cond Res 2008; 22:1602.
12. Reinold MM, Escamilla RF, Wilk KE. Current concepts in the scientific and clinical rationale behind exercises for glenohumeral and scapulothoracic musculature. J Orthop Sports Phys Ther 2009; 39:105.
13. Holmgren T, Björnsson Hallgren H, Öberg B, et al. Effect of specific exercise strategy on need for surgery in patients with subacromial impingement syndrome: randomised controlled study. BMJ 2012; 344:e787.
14. Kibler WB, Ludewig PM, McClure PW, et al. Clinical implications of scapular dyskinesis in shoulder injury: the 2013 consensus statement from the 'Scapular Summit'. Br J Sports Med 2013; 47:877.
15. Pluim BM, van Cingel REH, Kibler WB. Shoulder to shoulder: stablilising instability, re-establishing rhythm, and rescuing the rotators! Br J Sports Med 2010; 44:299. http://bjsportmed.com/content/44/5/299.full.pdf+html (Accessed on May 21, 2012).
16. Cools AM, Struyf F, De Mey K, et al. Rehabilitation of scapular dyskinesis: from the office worker to the elite overhead athlete. Br J Sports Med 2014; 48:692.
17. Østerås H, Torstensen TA, Østerås B. High-dosage medical exercise therapy in patients with long-term subacromial shoulder pain: a randomized controlled trial. Physiother Res Int 2010; 15:232.
18. Poppen NK, Walker PS. Forces at the glenohumeral joint in abduction. Clin Orthop Relat Res 1978; :165.
19. McClure PW, Bialker J, Neff N, et al. Shoulder function and 3-dimensional kinematics in people with shoulder impingement syndrome before and after a 6-week exercise program. Phys Ther 2004; 84:832.
20. Bernhardsson S, Klintberg IH, Wendt GK. Evaluation of an exercise concept focusing on eccentric strength training of the rotator cuff for patients with subacromial impingement syndrome. Clin Rehabil 2011; 25:69.

21. Başkurt Z, Başkurt F, Gelecek N, Özkan MH. The effectiveness of scapular stabilization exercise in the patients with subacromial impingement syndrome. J Back Musculoskelet Rehabil 2011; 24:173.
22. Senbursa G, Baltaci G, Atay A. Comparison of conservative treatment with and without manual physical therapy for patients with shoulder impingement syndrome: a prospective, randomized clinical trial. Knee Surg Sports Traumatol Arthrosc 2007; 15:915.
23. Bang MD, Deyle GD. Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. J Orthop Sports Phys Ther 2000; 30:126.

Topic 82958 Version 5.0

Journal Tables of Contents

Click on the hyperlinked title (+Ctrl) for the current contents of key journals.

If you would like any of the papers in full text then please email the library: library@uhbristol.nhs.uk

Musculoskeletal Science and Practice

October 2017, Volume 31

Physiotherapy

September 2017, Volume 103, Issue 3

BMJ

November 2017

Spine

November 1, 2017, Volume 42, Issue 21

British Journal of Sports Medicine

November 2017, Volume 51, Issue 21

UpToDate® Anywhere

UpToDate® is now available as a Mobile App, free for all UHBristol staff

Interested in staying up to date?

Sign up at the Library, or email:

library@uhbristol.nhs.uk

University Hospitals Bristol NHS
NHS Foundation Trust

Recent Database Articles

Below is a selection of articles recently added to the healthcare databases, grouped into the following categories:

- **Achilles Tendon Rupture**
- **Anterior Cruciate Ligament Repair**
- **Cervical Spine Disc**
- **Shoulder Impingement and Dislocation**

If you would like any of the following articles in full text, or if you would like a more focused search on your own topic, then get in touch: library@uhbristol.nhs.uk

2. Tendon Length, Calf Muscle Atrophy, and Strength Deficit After Acute Achilles Tendon Rupture: Long-Term Follow-up of Patients in a Previous Study.

Author(s): Heikkinen, Juuso; Lantto, Iikka; Piilonen, Juuso; Flinkkilä, Tapio; Ohtonen, Pasi; Siira, Pertti; Laine, Vesa; Niinimäki, Jaakko; Pajala, Ari; Leppilahti, Juhana

Source: The Journal of bone and joint surgery. American volume; Sep 2017; vol. 99 (no. 18); p. 1509-1515

Publication Date: Sep 2017

Publication Type(s): Journal Article

PubMedID: 28926379

Available at The Journal of bone and joint surgery. American volume - from Ovid (Journals @ Ovid)

Available at The Journal of bone and joint surgery. American volume - from Ovid (Journals @ Ovid)

Abstract:BACKGROUNDIn this prospective study, we used magnetic resonance imaging (MRI) to assess long-term Achilles tendon length, calf muscle volume, and muscle fatty degeneration after surgery for acute Achilles tendon rupture.METHODSFrom 1998 to 2001, 60 patients at our center underwent surgery for acute Achilles tendon rupture followed by early functional postoperative rehabilitation. Fifty-five patients were reexamined after a minimum duration of follow-up of 13 years (mean, 14 years), and 52 of them were included in the present study. Outcome measures included Achilles tendon length, calf muscle volume, and fatty degeneration measured with MRI of both the affected and the uninjured leg. The isokinetic plantar flexion strength of both calves was measured and was correlated with the structural findings.RESULTSThe Achilles tendon was, on average, 12 mm (95% confidence interval [CI] = 8.6 to 15.6 mm; $p < 0.001$) longer (6% longer) in the affected leg than in the uninjured leg. The mean volumes of the soleus and medial and lateral gastrocnemius muscles were 63 cm (13%; $p < 0.001$), 30 cm (13%; $p < 0.001$), and 16 cm (11%; $p < 0.001$) lower in the affected leg than in the uninjured leg, whereas the mean volume of the flexor hallucis longus (FHL) was 5 cm (5%; $p = 0.002$) greater in the affected leg, indicating FHL compensatory hypertrophy. The median plantar flexion strength for the whole range of motion ranged from 12% to 18% less than that on the uninjured side. Finally, the side-to-side difference in Achilles tendon length correlated substantially with the strength deficit ($\rho = 0.51$, $p < 0.001$) and with

medial gastrocnemius (ρ = 0.46, p = 0.001) and soleus (ρ = 0.42, p = 0.002) muscle atrophy.CONCLUSIONSIncreased Achilles tendon length is associated with smaller calf muscle volumes and persistent plantar flexion strength deficits after surgical repair of Achilles tendon rupture. Strength deficits and muscle volume deficits are partly compensated for by FHL hypertrophy, but 11% to 13% deficits in soleus and gastrocnemius muscle volumes and 12% to 18% deficits in plantar flexion strength persist even after long-term follow-up.LEVEL OF EVIDENCETherapeutic Level II. See Instructions for Authors for a complete description of levels of evidence.

Database: Medline

3. Functional Outcome of Acute Achilles Tendon Rupture With and Without Operative Treatment Using Identical Functional Bracing Protocol.

Author(s): Lim, Che Siu; Lees, David; Gwynne-Jones, David P

Source: Foot & ankle international; Sep 2017 ; p. 1071100717728687

Publication Date: Sep 2017

Publication Type(s): Journal Article

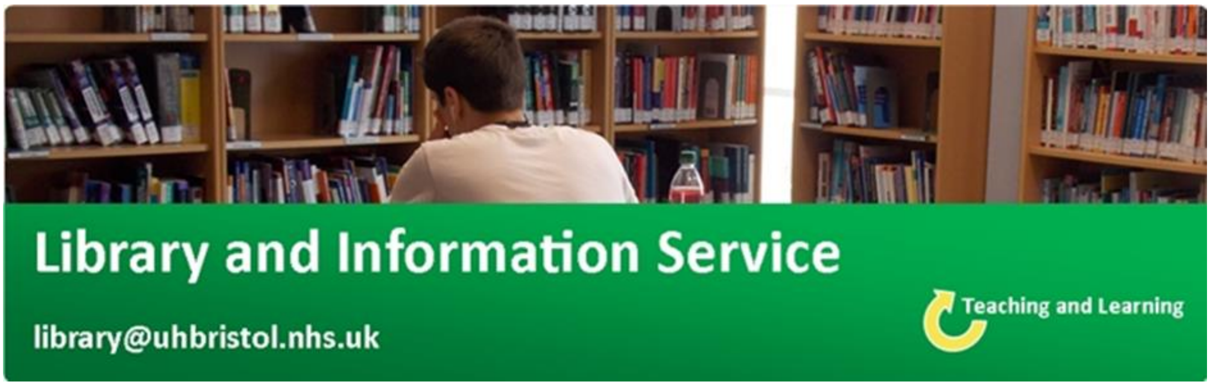
PubMedID: 28891323

Abstract:BACKGROUNDThe purpose of this study was to compare the functional results of operative and nonoperative treatment of acute Achilles tendon rupture using an identical rehabilitation program of functional bracing.METHODSOver a 10-year period, 200 patients (99 operative, 101 nonoperative) aged between 18 and 65 years were treated at our institution's physiotherapy department after acute Achilles tendon rupture. There were 132 patients (62 operative, 70 nonoperative) available for a minimum 2-year follow-up (average 6.5 years; range, 2-13 years). Functional outcome was assessed using the Achilles tendon total rupture score (ATRS).RESULTSWith the numbers available, no significant difference could be detected in ATRS between operative (mean 84.8, median 90) and nonoperative groups (mean 85.3, median 91; P = 0.55). No significant difference could be detected in ATRS between male and female patients however treated (P = 0.30) or between patients younger and older than 40 years at time of injury (P = 0.68). There was no correlation between ATRS score and age at injury in all patients (ρ = -0.0168, P = 0.85). In male patients, there was a weak trend with older patients at follow-up having better scores (ρ = 0.21, P = 0.069). However, among female patients, there was a significant negative correlation between ATRS scores and increasing age (ρ = -0.29, P = 0.03). Logistic regression analysis failed to show any significant effect of age at rupture, gender, or mode of treatment on ATRS.CONCLUSIONSThis study showed no significant difference detectable in ATRS between operative and nonoperative patients in the treatment of acute Achilles tendon ruptures using an identical rehabilitation program with functional bracing.LEVEL OF EVIDENCELevel II, prospective comparative study.

Database: Medline

Sheth U, Wasserstein D, Jenkinson R, et al. The epidemiology and trends in management of acute Achilles tendon ruptures in Ontario, Canada: a population-based study of 27 607 patients. Bone Joint J 2017; 99-B:78.

Toanen C, Demey G, Ntagiopoulos PG, et al. Is There Any Benefit in Anterior Cruciate Ligament Reconstruction in Patients Older Than 60 Years? Am J Sports Med 2017; 45:832.



Library Opening Times

Staffed hours: 8am-5pm, Monday to Friday

Swipe-card access: 7am-11pm, Seven days a week

Level 5, Education and Research Centre

University Hospitals Bristol

Contact your Outreach Librarian:

Helen Pullen

library@uhbristol.nhs.uk