BY DR CHRIS NORRIS PHD, MCSP

SHOULDER IMPINGEMENT

Impingement accounts for up to 65% of all shoulder pain, and yet studies have been unable to determine the precise structure which is at fault. This article uses an evidence-based approach to guide clinical practice by looking at anatomy, pathology and function of the shoulder region. By understanding how to optimise shoulder function, treatment of several body regions can be combined to address impingement problems. Rehabilitation is used to target compensatory movements and re-establish optimal shoulder function, and the practitioner is guided through a rehab programme which can be applied to patients immediately.

SHOULDER IMPINGEMENT

Shoulder pain is a common occurrence both in sport and the general public, and one which can be long lasting. Prevalence is high with 30% of individuals reporting pain in their lifetime, and over 50% complaining that symptoms last beyond 3 years (1). Up to 65% of all shoulder pain can be attributed at least in part to impingement (2). The results of surgical treatment are comparable to that of conservative treatment, but in the long term up to one third of patients are left with persistent pain and disability (3). To understand this condition we need to look at the anatomy, pathology and management options.

ANATOMY

The arm is attached to the trunk through the shoulder girdle with the scapula resting on the back of the rib cage, and the shoulder held away from the trunk by the clavicle which acts as a strut. As the arm is moved away from the body, movement occurs between the clavicle and breastbone (sternoclavicular joint), clavicle and scapula (acromioclavicular joint), scapula and ribcage (scapulothoracic joint) and the shoulder joint itself (glenohumeral joint). The shoulder offers the greatest range of motion of any joint in the body, and is said to sacrifice stability for mobility. Compared to the hip joint for example, which is also a ball and socket, the shoulder joint has a larger ball (head of the humerus) and a relatively small socket (glenoid fossa), the glenoid fossa being one third the size of the humeral head itself. The joint is surrounded by a loose capsule with a volume twice that of the humeral head. As the arm moves away from the body movement occurs in a specific sequence throughout the shoulder girdle and upper trunk. This sequence is very precise, and when it breaks down impingement is often the result.

The roof of the joint (coracoacromial arch) is formed by the coracoacromial ligament together with the coracoid process and acromion process. The area below the coracoacromial arch is called the *subacromial space* officially defined as having the humeral head as its base, and the under surface of the anterior acromion, coracoacromial ligament and the acromioclavicular joint as its roof. Within the subacromial space there are three structures: the supraspinatus tendon, subacromial bursa and

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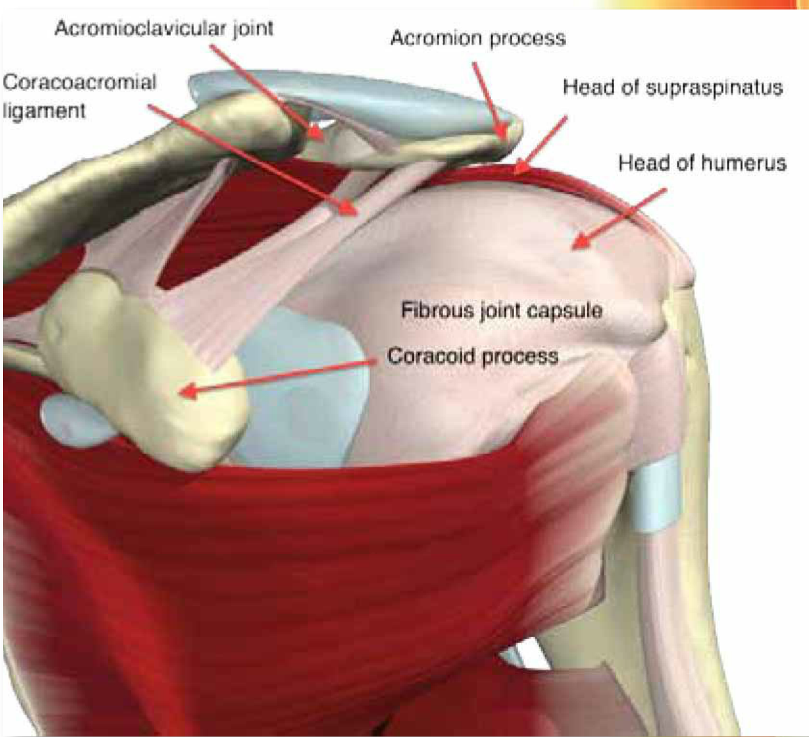

Video 1: Anatomy of the shoulder (video online) [developed by sportEX]

TABLE 1: CAUSES OF SUBACROMIAL COMPRESSION (C. Norris, 2014)

Intrinsic	Extrinsic
Tendon trauma (partial or full thickness tears)	Referral from cervical spine
Tendon degeneration	Postural changes to thoracic spine
Bursal swelling	Altered scapular movement
	Altered humeral movement
	Tightness of posterior shoulder structures (rotator cuff/capsule)
	Altered bony orientation (osteophytes).

long head of the biceps tendon (2). Subacromial impingement syndrome (SAIS) occurs when the tissues within the subacromial space generate pain or are compressed. Once general medical considerations have been eliminated, mechanical compression may be considered either *intrinsic* due to changes in the structures within the subacromial space, or *extrinsic* due to external compression of the space (Video 1) (Table 1).

The height of the subacromial space (acromiohumeral distance or AHD) is between 7 and 14mm in healthy subjects (3). A reduction in AHD may occur at rest, but only measurement taken during active arm elevation is able to demonstrate functional narrowing. MRI studies of AHD have demonstrated smaller distances in the region of 3mm during arm elevation in those with rotator cuff tendinopathy due to SAIS (4).

MOVEMENT

Movement of the arm away from the side of the body is termed the *abduction cycle* and may be conveniently described in three stages, although the cycle itself is a continuous process (Video 2).

In *stage one* it is what we don't see as clinicians which is important. The scapula should remain fixed to the rib cage through action of the scapula stabilising muscles especially the serratus anterior, supported by the trapezius. As the arm moves from the side of the body, the muscle action of the scapular stabilisers fixes the scapula to the rib cage and so the scapula appears to sink into the surrounding muscle mass. There is a very slight upward displacement of the humeral head and this movement should be limited by a synergistic action of the rotator cuff drawing the head of the humerus downwards while the deltoid abducts the arm and draws the head of the humerus upwards. From the force vectors of the muscles, the infraspinatus and subscapularis are best placed to provide downward displacement of the humeral head in opposition to the upward translation brought about by deltoid action, while the supraspinatus is a more effective compressor, drawing the humeral head further into the centre of the glenoid. Decreased electromyographic (EMG) activity in the infraspinatus and subscapularis together with the middle deltoid has been seen in subjects with SAIS from 30 to 60° abduction (5). The long head of the biceps has been shown to assist in stabilising the head of the humerus in an anterior and superior direction and to decrease pressure within the subacromial space (6). Fluctuations of translation of the humeral head are relatively small in the healthy subject, with movement in the region of 1mm being recorded. The humeral head should remain centred within the glenoid. Where the rotator cuff muscles have reduced activity, or contract too late in the movement, upward displacement of the humerus occurs due to the unopposed pull of the deltoid. Anteroposterior movement of the humeral head varies with values between 0.7 and 2.7mm of anterior translation and 1.5 and 4.5mm of posterior translation being recorded for different ranges of abduction (7). Increased superior and/or anterior humeral head movement is associated with SAIS, with increased superior translation of 1.5mm and increased anterior translation of 3mm being quoted (2).

Tightness in the posterior capsule induced surgically in cadavers results in an increase in the superior and anterior humeral head translation (8). This finding has been used to justify manual therapy aimed at the posterior capsule, and exercises such as the cross body and sleeper stretch (Figs 1 and 2). Although these techniques are often effective therapeutically in SAIS, they will probably affect both the posterior

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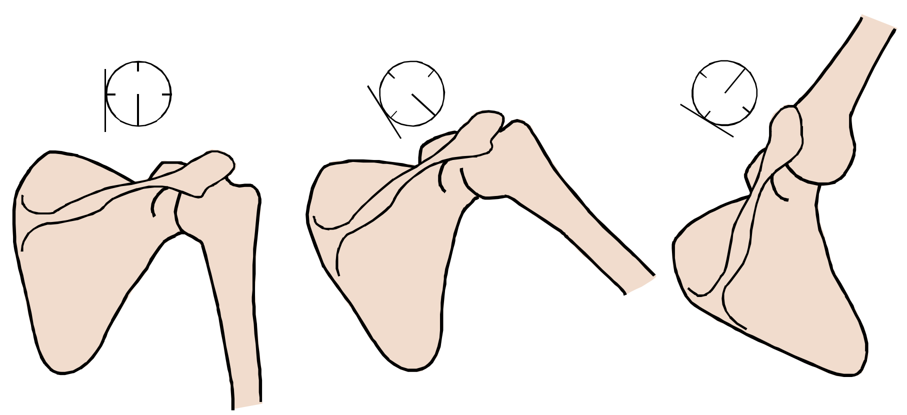
Video 2: Scapula movement as the arm moves into abduction (video in online version).



rotator cuff and capsule as it unlikely that the capsule can be selectively isolated non-operatively (2).

As abduction progresses the greater tuberosity moves closer to the subacromial arch and to prevent the two structures touching lateral rotation of the humerus occurs, and the capsular ligaments relax to allow maximal movement. In addition, to move the subacromial arch away from the approaching humerus the scapula must upwardly rotate during *stage 2* of the movement, an action brought about by a force couple between the serratus anterior working in parallel with the upper and lower fibres of the trapezius. The opposite movement (downward rotation of the scapula) occurs through action of the levator scapulae, rhomboids, and pectoralis minor muscles and is a requirement in activities where the body is lifted on the fixed arm such as a dipping action in the gym. If these latter muscles become dominant or are stiffer through tightness, upward rotation of the scapula will occur more slowly, or be more limited in range. Decreased performance in the serratus anterior and lower trapezius has been identified in subjects suffering from rotator cuff tendinopathy due to SAIS, with reduced total EMG activity and onset of activation (3).

The scapula is a relatively flat bone moving on the curved shaped drum of the rib cage. As we move the arm above the horizontal position to draw it overhead upward rotation of the scapula is complete and the scapular is drawn around the rib cage. This lateral movement is only possible if the kyphotic curve of the thoracic spine is reduced to produce a flatter rib cage surface. This action forms *stage 3* of the abduction cycle, and will be limited where the thoracic kyphosis is increased (round shouldered posture) or stiffer. In both cases the increased curvature of the thoracic region limits lateral movement of the scapular meaning it is difficult for the subject to lift into pure abduction to draw the arm level with the ear. Instead the arm moves forwards (flexion abduction) towards the side of the face, as a compensatory action.

PATHOLOGY

It is generally considered that compression of the soft tissues between the head of the humerus and the acromion during abduction and elevation causes pain, with the classic impingement test combining abduction and internal rotation (Empty can test) to press the greater trochanter onto the under surface of the acromion, sandwiching any impinging structure between the two.

The classical development of impingement syndrome is of mechanical compression through three progressive phases (9). The condition has been said to begin (stage I) in the younger patient (under 25) with oedema and haemorrhage through persistent overhead activities, leading to deterioration of the tendon and bursa (stage II in the 25–40 year old) to final full thickness rupture and bone spur formation in later life (stage III, over 40 years of age). This progressive pathology has now been challenged (10). If compression of the supraspinatus tendon occurs beneath the subacromial arch, the direct mechanical strain should lead to abrasion to the tendon's upper surface. However, damage to the inferior (joint) side of the tendon has been found in over 90% of cases (6) in athletes and over 80% of cadavers (11), representing internal impingement (12). The prevalence of partial thickness tears in cadavers has been shown to be roughly 30% with damage to the articular aspect of the tendon or intra-tendon substance (13). The fibres on the lower (non-acromial) side of the tendon have a smaller cross sectional area than those on the upper surface. The lower fibres are therefore more vulnerable to tensile loading, especially during elevation where tendon strain is increased. Movement of the upper tendon fibres upon the lower may result in intratendinous shearing, giving reaction through physiological failure of the lower tendon fibres rather than injury through external compression (10).

Where external compression is a cause of SAIS, the shape of the acromion becomes relevant. Three types of acromion have been described, flat (type I), curved (type II), and hooked (type III) (14). The suggestion is that rotator cuff tears as a result of SAIS are more common in those with a hooked acromion, justifying the need for surgical removal of the anterior/inferior aspect of the acromion (acromioplasty). However, many asymptomatic individuals have been found to have a curved or hooked acromion, and it has been suggested that the success of acromioplasty may be due to enforced rest following surgery rather than to the surgical procedure itself (10). The shape of the acromion itself may be a secondary rather than a primary effect. Bony spur formation of the acromion seems to be at the insertion of the coracoacromial ligament. A repetitive upward translation force (due to impaired action of the rotator cuff) may create tension at the acromial insertion of the ligament which is smaller than the coracoid side. The ligament may be a source of pain as free nerve ending have been identified within it (10).

The subacromial bursa is innervated by the lateral pectoral nerve

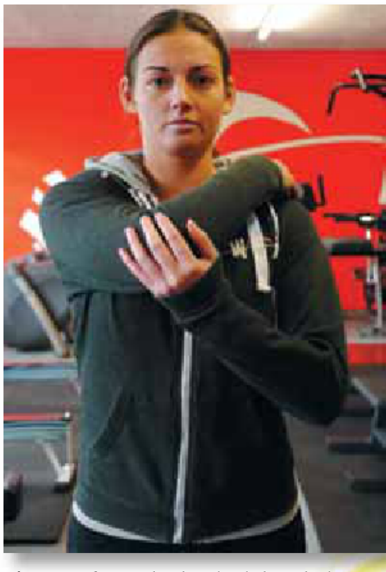


***Figure 1: Cross body stretch.** (**Photo credit: C. Norris, 2014**)*

***Figure 2: Sleeper stretch.** (**Photo credit: C. Norris, 2014**)*

TABLE 2: COMMON CLINICAL TESTS FOR SAIS (C. Norris, 2014)

Test name	Action
1. Neer's sign test (Fig.3)	1. Also called the forward *flexion impingement test*. Stabilise the scapula and grip the arm below the elbow with the other hand. Passively elevate arm into full flexion. Positive if pain is produced at end of passive elevation.
2. Hawkins–Kennedy test (Fig.4)	2. Elbow flexed to 90°, shoulder passively forward flexed to 90°. Take shoulder into internal rotation.
3. Full/empty can test (Fig.5)	3. Also called *Jobe's test* and the *Scaption test*. Passively elevate arm to 90° in scapular plane. Turn hand down so thumb point towards floor for internal rotation (Empty can) and apply resistance to abduction. Repeat with palm up for external rotation (Full can).

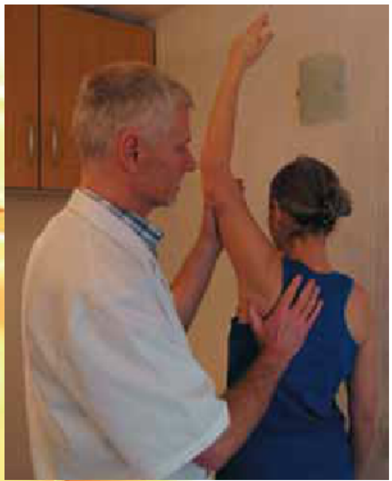


***Figure 3**: Neer's test. (Photo credit: C. Norris, 2014)*

***Figure 4**: Hawkins–Kennedy test. (Photo credit: C. Norris, 2014)*

***Figure 5**: Empty can test. (Photo credit: C. Norris, 2014)*

and subscapular nerve, and is capable of both nociception and proprioception. Removal of the bursa (bursectomy) alone gives the same degree of pain relief as bursectomy combined with acromioplasty with no significant differences at 2.5 years follow-up (15).

Changes to the supraspinatus tendon seen in SAIS indicate that the condition is likely a tendinopathy rather than a tendinitis. No infiltration of cells associated with inflammation are seen within tendon in specimens taken during surgery, but increased volume of the tendon seen experimentally may be the result of a reactive phase similar to Achilles or patellar tendinopathy (10). An increased vascular response (neovascularisation) in degenerative areas of the supraspinatus has been noted with Doppler ultrasound (16), suggesting a healing response to microtrauma as is seen in tendonitis in other body areas. The presence of tendinopathy and increased metabolic response during a reactive phase would suggest that relative rest and graduated loading should form part of the management of this condition.

PATIENT ASSESSMENT

Tests used to assess SAIS are effective at provoking the subject's pain, but may be less useful at identifying the pathological tissue responsible for the pain. Traditional passive tests aim to compress the structures within the subacromial space by combining some degree of abduction with internal rotation (Table 2).

With many conditions there can be a poor clinical correlation between pathology and pain, and the shoulder is no exception to this. Some subjects may have pain with few apparent indicators on imaging, while others are asymptomatic in the presence marked bone or soft tissue changes. Systematic review with meta-analysis of the Neer and Hawkins–Kennedy tests for impingement (and the Speed test for labral pathology) concluded that diagnostic accuracy is limited (17).

The use of clinical tests as symptom-provoking procedures to monitor treatment effect has been proposed for SAIS (1) using the *shoulder symptom modification procedure* which provides a logical synopsis of common tests and methods from several areas of physiotherapy, such as mobilisation with movement (MWM), exercise therapy, manual therapy, and taping. Techniques in four areas are used (Table 3).

The patient-described outcome is normally that of pain measured on a numerical rating scale (NRS) or visual analogue scale (VAS), with a minimal clinical important difference (MCID) being set at a 30% improvement from baseline to represent a meaningful change (1). Movement range may also be used to assess the effectiveness of a technique.

Humeral head positioning

Pressure techniques are used on the

TABLE 3: SHOULDER SYMPTOM MODIFICATION PROCEDURE
[Adapted from Lewis (1)]

Anatomy involved	Mechanical technique
Humeral head	Application of mobilisation with movement
Scapular position	Passive stabilisation or modification with or without taping
Cervical spine	Neuromodulation procedure to address pain and movement quality
Thoracic spine	Reduction of increased kyphosis.

humeral head which are similar to traditional MWM procedures but used with manual pressure, belts or elastic tubing. Either anterior or posterior directed pressure is maintained during the subject's movement in an attempt to reduce symptoms.

Movements which caused pain during testing may be repeated using minimal resistance to modify symptoms. External rotation and humeral head depression are performed to restrict or modify internal rotation and elevation stresses which traditionally exacerbate SAIS. A posterior glide MWM applied manually has been shown to immediately reduce pain by 20.2% and increase movement range by 15.3% in a group of subjects with anterolateral shoulder pain which restricted shoulder elevation (18). In this study the increase in motion range was not related to change in pain, leading the authors to suggest that joint or muscle mechanisms may be responsible for the movement change rather than pain.

Scapular positioning

Manual techniques and taping may be used to slightly modify scapular position, as altered scapular kinematics is often associated with impingement symptoms (19). The same scapular modifications may then be used for re-education. Scapular positions of elevation/depression, protraction/retraction, tipping (also called tilt, representing rotation about a mediolateral axis), and rotation (rotation about an anteroposterior axis) are all compared to the unaffected side and modified if required. Scapular winging may be modified by manual stabilisation or taping, to assess the effect on the subject's symptoms.

Radiculopathy

If shoulder pain arises from the cervical spine, manual therapy to this region can affect pain and movement in the shoulder region. Both soft tissue and joint based techniques may be used. A study that used lateral mobilisations applied to the C5/C6/C7 spinous processes in sitting demonstrated both a reduction in pain (mean 1.3 cm measured in a VAS scale) and increased abduction motion range (mean 12.5° measured using video analysis) in patients with shoulder pain of at least 6 weeks duration (20). Cervical mobilisation has been shown to increase lateral rotation motion range at the shoulder in subjects with restricted movement in the absence of shoulder treatment (21). Oscillatory mobilisation was given to the C4/5 and C5/6 segments, with lateral rotation range at the shoulder increasing from 0–1/4 range to 1/2–3/4 range. It was suggested that pain referred from the cervical spine to the shoulder resulted in increased muscle tone to the shoulder musculature restricting motion range at that joint. The restricted and/or painful shoulder movement should be performed and cervical tissue treatment applied to assess change in the shoulder symptoms.

Thoracic kyphosis

Changes to the thoracic kyphosis have been shown to alter scapular tipping and rotation, and to decrease the amount of elevation at the glenohumeral joint (2). Altering thoracic and scapular posture has been shown to significantly increase shoulder flexion and abduction range in the scapular plane, and to delay the point of onset of pain within the motion range in subjects with SAIS (22). Manual techniques using overpressure and/or taping may be used to reduce the subject's kyphosis and movement quality is reassessed. Where thoracic stiffness is present localised manual therapy may be applied, as this has been shown to change impingement signs (Neer, Empty can, Hawkins–Kennedy, and active abduction) in subjects with impingement syndrome (23).

REHABILITATION

Rehabilitation aims to reduce the subject's symptoms during aggravating movements and to improve movement quality. Loss of translational control of the humeral head within the glenoid is strongly associated with impingement symptoms, and poor co-contraction of the rotator cuff muscles during the abduction cycle is often found in symptomatic subjects. Over time compensatory muscle strategies are put in place to maintain adequate

> "65% OF ALL SHOULDER PAIN CAN BE ATTRIBUTED TO IMPINGEMENT"

function, and as glenohumeral and scapulothoracic movements are optimised, compensatory actions that have become habitual must be identified and reduced. With chronic conditions especially, *central sensitisation* and altered *neuroplastic changes* are seen. Central sensitisation occurs when altered processing is seen within the dorsal horn cells of the spinal cord, while neuroplastic changes may include altered representation of the body part within the somatosensory cortex, increased strength of internal neural connections, and reorganisation of neuronal territory (24,25). Motor skill training which is functionally relevant to the patient may help normalise the representation of the body part in the somatosensory cortex and so be instrumental in managing a subject's pain (26).

Rehabilitation aims to: (i) re-establish muscle co-contraction and translational control of the humeral head, (ii) enhance scapular stability and positioning during the abduction cycle, (iii) reduce habitual compensatory movements and (iv) optimise body segment and whole body alignment, and appropriate movement strategies.

Early rehabilitation begins with the techniques described in the shoulder symptom modification procedure (SSMP), which aim to reduce symptoms in aggravating movements. Isolation movements may be used to re-education scapular stability and rotator cuff co-contraction during abduction actions. Movements in the scapular plane (30–45° anterior to the frontal plane) are used with ranges below the horizontal to reduce pressure within the subacromial space. Passive or active lateral rotation of the humerus is maintained to distance the greater tuberosity from the anterior aspect of the acromion process.

Hand grip, tactile feedback of the wrist and hand, and closed-chain upper-limb actions can all lead to co-contraction of the rotator cuff musculature to initiate the presetting phase of muscle activity in the shoulder. Sensorimotor input may be enhanced by working the scapulothoracic joint and glenohumeral joint in unison, in contrast to isolation movements often prescribed.

Through linked kinetic chains, movement of the whole body contributes to upper limb function. Fault in one part of the kinetic chain may cause compensation elsewhere in the chain, a feature called link fallout, and rehabilitation should reflect this. Movement and/or stability of the proximal body component is begun prior to the distal, with an emphasis on functional rotation patterns. Throughout the rehab programme the therapist should aim to minimise compensatory patterns in the client, which may be localised to the shoulder and upper limb or appear in other body areas. Within traditional therapy approaches there is often a focus on isolation actions at the shoulder. Although this approach has a place within the whole programme, if rehab is restricted to isolation actions alone it may fail to restore full function. The use of exercise focusing on a dynamic whole body approach, using both rotator cuff action and scapular stability as part of a kinetic chain movement is likely to produce a better functional outcome. The use of complex exercise has been shown to be superior to isolation exercise for the rotator cuff using a 6-week programme with subjects training 3 times per week (27). These authors suggested that rehabilitation for the shoulder should begin with isolation actions to stimulate the weaker muscles, and progress to complex actions to give greater overload, an approach also used successfully during the rehabilitation of other body areas (28).

EXAMPLE REHABILITATION EXERCISES

The following are example exercises which may be used as part of a structured rehabilitation programme following a full client assessment.

Sternal lift (Fig.6)

Begin with your client sitting on a bench or stool with their feet flat on the ground. The action is one of thoracic extension (sternal lifting), rather than ribcage expansion (taking a deep breath). Use tactile cueing by placing your hands onto your client's sternum, or use a pen placed flat against the sternum to show that the sternal plate is angled downwards as the thoracic kyphosis increases, and upwards as the kyphosis reduces. If your client has difficulty isolating the sternal-lift action from deep inhalation, ask them to breathe in, and then lift the sternum as they breathe out. Where they sway their body forwards or backwards ask them to stand or sit with their back pressed up against a wall and perform the sternal-lift action from this starting position. The action is to draw the scapulae down the wall as the sternum lifts upwards.

Figure 6: Sternal lift start position (a) and end position (b). (Photo credit: C. Norris, 2014)

Overhead stretch on gym ball (Fig.7)

This exercise combines thoracic extension with full range flexion/abduction at the shoulder. Ask your client to lie over a large (65cm) gym ball. Have them reach overhead with their elbows straight but not locked completely. At the same time encourage their chest to open and thoracic spine to extend. To increase overload, a light dumb-bell may be held between the hands. Where shoulder flexibility is limited, practice the movement close to a wall so the hands rest on the wall rather than overhead.

Figure 7: Overhead ball stretch without weight (a) and with weight (b). (Photo credit: C. Norris, 2014)

Gym ball superman with star arms (Fig.8)

Have your client lie over a gym ball with their chest on the ball surface, feet apart and on the floor. Their arms should be out to the side in a T shape, hands resting on the floor. Raise the arms out to the sides (extension-abduction) turning them so the thumbs point to the ceiling (lateral rotation at the shoulder). At the same time perform a thoracic extension movement by drawing the scapulae down and inwards and opening the chest. Raise the head slightly to look

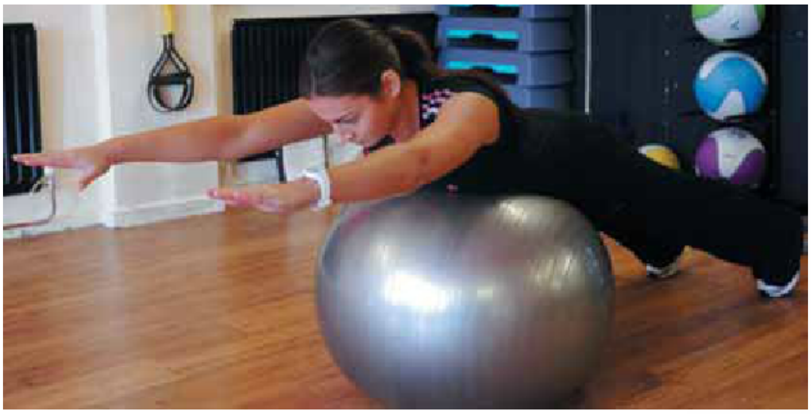


Figure 8: Gym ball superman stretch with star arms. (Photo credit: C. Norris, 2014)

at the floor 1–2m in front of the ball. Hold the top position for 2–3 seconds breathing normally (do not allow them to hold their breath) and then lower the arms and trunk under control.

Pilates dumb waiter with band (Fig.9)

Have your client stand with their feet hip width apart, and elbows bent to 90° and tucked into the side of their trunk. For the dumb waiter action, have the palms facing upwards and laterally rotate the shoulders to draw the forearms outwards in an arc away from the body. Pause at the outer range position and then return to the starting position. To increase overload hold a resistance band between the hands and pull outwards against the resistance. Again pause at the outer range point and then move back to the starting position under control.

Abduction with lateral rotation using band (Fig.10)

Begin by hooking a resistance band

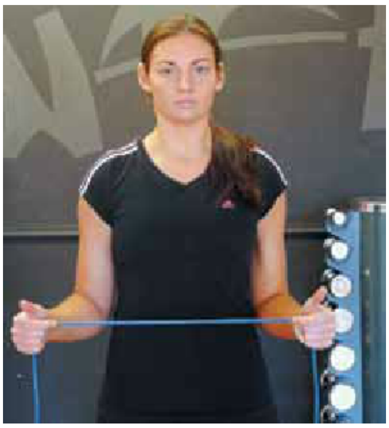


Figure 9: Pilates dumb waiter with band. (Photo credit: C. Norris, 2014)

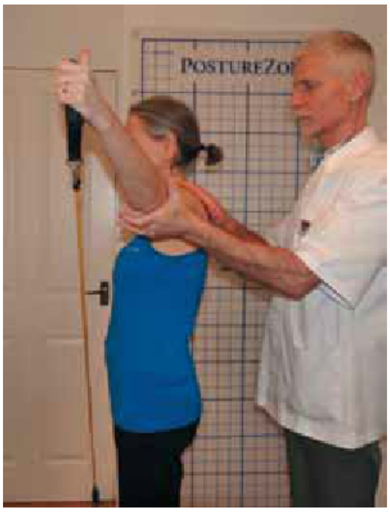


Figure 10: Abduction with lateral rotation using band. (Photo credit: C. Norris, 2014)

beneath a door using a door stop. This exercise has two parts. For the first part have your client perform an isolation action with the shoulder. Get them to stand with their feet hip width apart and their affected arm away from the door, arm held across the body in adduction taking the slack off the band. The action is a combined movement of abduction and lateral rotation to draw their hand outwards and turn the palm forwards so their thumb moves towards the ceiling. When they have performed this action several times and are comfortable with it, they can move to part two of the action which is a complex movement combining trunk rotation and arm movement. Now, they stand with their far foot turned outwards (lateral rotation at the hip) and reach downwards towards the door. They then turn their whole body outwards, away from the door as they abduct their arm and turn

> "THE ABDUCTION CYCLE IS CENTRAL TO THE UNDERSTANDING OF THIS CONDITION"

it outwards. Their eyes should follow their hand throughout the action as the trunk turns inwards towards the door when the arm is lowered. The second action works the shoulder musculature with the core muscles at the same time. To increase overload on the core, perform the action in single-leg standing so that whole body balance is challenged.

Pilates cat paws (Fig.11)

This exercise works the scapular stabilisers with the arm in flexion and in closed-chain position (hand on the floor). Have you client begin in a four-point-kneeling position on a gym mat with their knee beneath their hip and hand beneath their shoulder. Ask them to stabilise their scapula by drawing it down slightly and inwards. Verbal cues such as 'press your chest outwards' or 'push your hand into the floor and make your arm longer' can be useful, and tactile cues placing your flat hand onto the scapula or using a book placed on the upper thorax are also suitable. The action is to shift the shoulders to the right to take the chest weight over the right hand and to lift the heel of the left hand, leaving the fingers just in contact with the mat. The right scapula must now work hard to remain fixed to the thorax and not wing outwards. Reverse the action taking the weight to the left. Once the action can be performed with good scapulothoracic alignment, have your client progress to

Figure 11: Pilates cat paws. (Photo credit: C. Norris, 2014)

"IN CASES OF SHOULDER PAIN, THE CERVICAL SPINE SHOULD ALWAYS BE EXAMINED"

lifting the hand by bending their elbow. Ensure that the shoulders remain level, and do not allow the shoulder on the lifted side to dip down.

Standing band pull (Fig.12)

Begin with your client standing, shoulders hip width apart. Have them hold the ends of a resistance band in each hand and loop the centre beneath their feet. Adjust the band so it is tight, and encourage them to draw their scapulae down and inwards, at the same time lifting their sternum. Use verbal cues such as 'open your chest' and 'draw your shoulder blades down into the back pocket of your shorts'. Tactile cues can encourage both movements simultaneously by placing one finger between their scapulae and drawing the skin downwards and another finger on the sternum to draw the skin upwards. Ensure that they do not increase their lumbar lordosis as the lift their ribcage.

Single arm row with single leg stand (Fig.13)

This action combines a shoulder

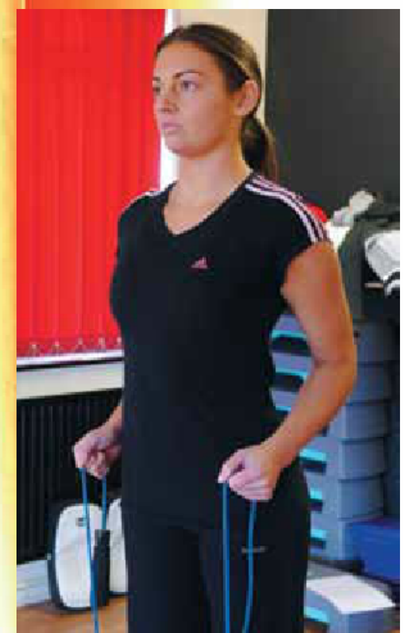


Figure 12: Standing band pull. (Photo credit: C. Norris, 2014)

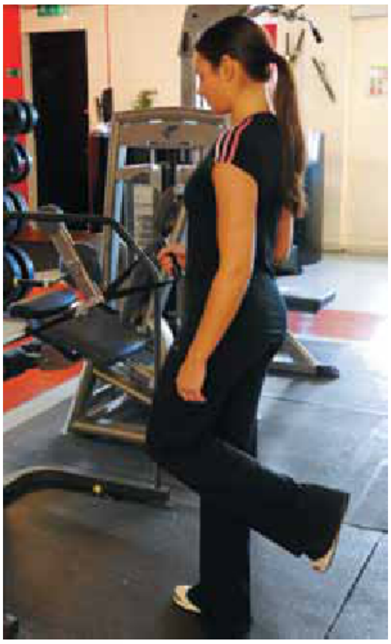


Figure 13: Single-arm row with single-leg stand. (Photo credit: C. Norris, 2014)

movement with whole body action to provide complex work of overall body balance and coordination. Begin with your client facing a pulley machine or resistance tubing secured to a door frame. Have them take the slack up on the cable or tubing and stand on one leg, establishing their balance. They should maintain a good upright posture and draw the cable towards themselves moving the shoulder blades downwards as they do so. The action is to stabilise the scapula as the arm moves, but not to overly brace the shoulders or thrust the chest forwards. The knee of the supporting leg should bend slightly (soften) and the hips are aligned horizontally, Do not allow the pelvis to dip towards the non-weight-bearing side.

SUMMARY

This article has demonstrated how the anatomy of the shoulder can contribute to the pathology of shoulder impingement and has described tests that are useful for assessing a patient's condition as well as monitoring treatment. The reader will also now be familiar with a number of rehabilitation exercises that can be used in a structured rehab programme.

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FURTHER RESOURCES

1. Managing Sports Injuries: a guide for students and clinicians (4th edn) by C. Norris. Churchill Livingstone Elsevier 2011. ISBN 0702034738 (£48.44). Buy from Amazon http://spxj.nl/THNgxy

KEY POINTS

- **Impingement accounts for up to 65% of all shoulder pain.**
- **In order to treat shoulder impingement, a thorough understanding of the shoulder anatomy and pathology of the condition is needed.**
- **The shoulder offers the greatest range of motion of any joint in the body, and is said to sacrifice stability for mobility.**
- **Compared to the hip joint, the shoulder joint has a larger ball (head of the humerus) and a relatively small socket (glenoid fossa).**
- **As the arm moves away from the body, movement occurs in a specific sequence; the breakdown of which can often result in impingement.**
- **The classical development of impingement syndrome is mechanical compression through three progressive phases.**
- **The use of clinical tests as symptom-provoking procedures to monitor treatment effect has been proposed for SAIS.**
- **Rehabilitation aims to reduce the subject's symptoms during aggravating movements and to improve movement quality.**
- **Within traditional therapy approaches there is often a focus on isolation actions at the shoulder. However, if rehab is restricted to isolation actions alone it may fail to restore full function.**

- Describe the abduction cycle
- Name and describe the rotator cuff muscles
- On a partner, identify the sternoclavicular and acromioclavicular joints

THE AUTHOR

Dr Chris Norris is a physiotherapist with over 35 years experience. He has an MSc in Exercise Science and a PhD in back pain rehabilitation, together with clinical qualifications in manual therapy, orthopaedic medicine, acupuncture, and medical education. He is the author of 12 books on physiotherapy, exercise, and acupuncture and lectures widely in the UK and abroad. He is a visiting lecturer and external examiner to several universities at postgraduate level. He runs private clinics in Cheshire and Manchester and his postgraduate courses for therapists are on his website www.norrisassociates.co.uk.

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