Physical Therapy

Treatment of Common Orthopedic Conditions




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CHAPTER 2

Scapular Dyskinesis

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ABSTRACT

Over the past two decades, an increase in attention and understanding has been given to the role of the scapula in upper extremity function. It has become widely accepted that the scapula plays an important role in the proper movement of the shoulder, and that alterations to that movement (scapular dyskinesis) can result in inefficient and potentially painful motion. Scapular dyskinesis has been linked to numerous shoulder pathologies across a variety of patient populations.

When faced with treating a patient with scapular dyskinesis, it is important to complete a thorough examination to help recognize all the potential contributing factors. Once all the contributing factors are realized, a specific treatment plan can be implemented to address these deficits and improve the patients' outcome.

INTRODUCTION

Epidemiology

The primary function of the shoulder joint complex is to help position the elbow and hand in space, allowing the individual to interact with the environment.[1,2] To accomplish this task, the shoulder joint requires both, sufficient mobility to achieve the extremes of motion, and adequate stability to control the extremity through these large motions.

The mobility of the shoulder joint comes from the interaction of the articular surfaces of the humerus, clavicle, scapula and thorax. Together these joints (and pseudo joints) allow for large degrees of freedom. The stability of the shoulder joint comes from the surrounding capsule, labrum, ligaments, muscles and other soft tissue restraints.[2-4] In an active orthopedic patient, the relationship and balance between the stability and mobility becomes extremely important to allow proper pain-free function.

Over the past two decades, an increase in attention and an improved understanding of the role of the scapula in upper extremity function has evolved.[5] It is now widely accepted that the scapula plays an important role in the proper movement of the shoulder, and that alterations to that movement (scapular dyskinesis) can result in inefficient and potentially painful motion.[6] Scapular dyskinesis has been linked to numerous shoulder pathologies across a variety of patient populations, including those patients diagnosed with labral or rotator cuff pathologies.[7,8] Dyskinesis is most commonly seen in athletes performing repetitive overhead motions, specifically in baseball and volleyball players. However, anyone required to perform daily and repetitive overhead motions is likely at an increased risk.[9-11] The actual prevalence of scapular dyskinesis is not known. This is likely because quantifying dyskinesis across examiners is not consistent.

Additionally, dyskinesis is usually found in the presence of additional shoulder complaints and may be missed in the evaluation, or may have been misdiagnosed as a different shoulder pathology. The focus of this chapter will be on the treatment of scapular dyskinesis with or without concurrent glenohumeral (GH) pathology. To better assess and treat this deficit, it is important for the clinician have a thorough understanding of normal scapular kinematics and how to test for faulty scapular mechanics.

Kinematics of Shoulder Girdle

Normal scapular humeral rhythm, that is the proper alignment and motion of the scapula on the humerus, is the key to proper and efficient shoulder function.[12] Centering the humeral head on the glenoid during overhead motion arises from proper scapular positioning, which is a result of the synchronized cocontractions of the muscles controlling the scapula and humerus.

The scapula has no bony articulation with the thorax, and thus the available motion is quite large.[5] Scapular movement (Fig. 1) is typically thought of in three planes of motion: (1) upward and downward rotation, (2) internal and external rotation and (3) anterior and posterior tilting. Upward and downward rotation is the movement of the scapulae around a horizontal axis perpendicular to the plane of the scapulae. Internal and external rotation is rotation of the scapulae around a vertical axis perpendicular to the plane of the scapulae. Lastly, anterior and posterior tilting is movement of the scapulae around an axis along the plane of the scapulae.[12]

The clavicle acts as a strut between the humerus and the more proximal sternum, helping to transfer loads from the distal joints to the more proximal sternum.[1] The complimentary movements of the clavicle include protraction-retraction, elevation-depression and anterior-posterior rotation. With scapular movement of upward and downward translation, clavicular protraction and retraction occur, respectively, to help stabilize the scapulae along the thorax. With shoulder elevation, clavicular elevation, retraction and posterior tilting occur at the acromioclavicular (AC) joint. During this same motion, 31° of posterior clavicular rotation occurs at the sternoclavicular (SC) joint.[12]

The SC and AC joints complement each other's movements. While the SC joint retracts, the AC joint internally rotates, allowing scapular internal and external rotation. The AC joint is primarily responsible for scapular posterior tilting, an important motion during full shoulder flexion.[12]

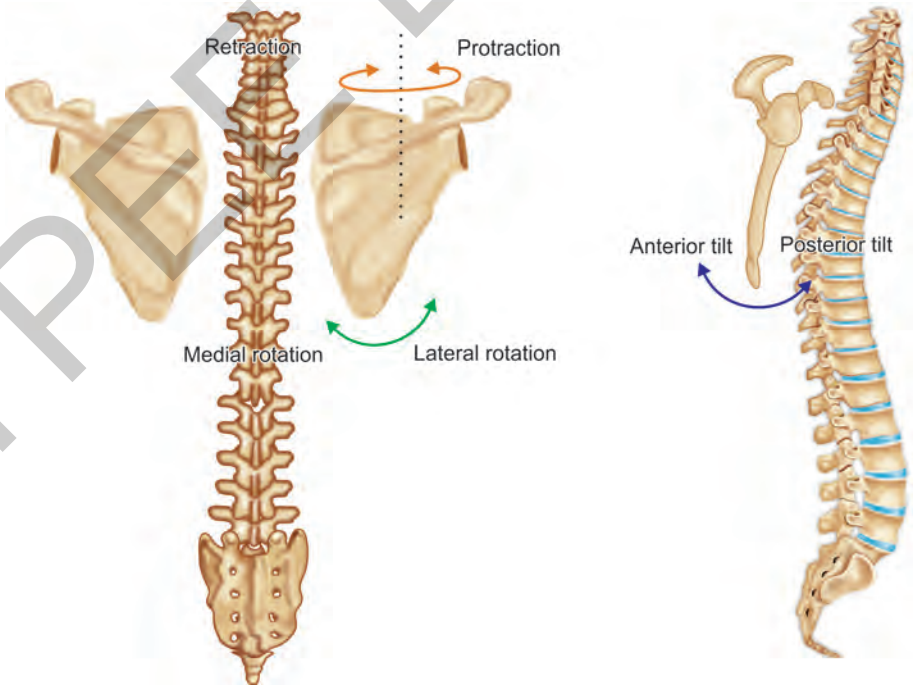

FIG. 1: Scapular kinematics: the three planes of scapular movement[13]
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To summarize, shoulder flexion in a healthy shoulder should include scapular elevation, upward rotation, posterior tilting and end range external rotation. During this same motion clavicular elevation, retraction and posterior tilting should occur. The coordinated movement of the scapula, humerus and clavicle is complex. However, having an appreciation and understanding of the required movements (especially during shoulder flexion) is necessary to effectively treat patients with faulty scapular patterning.

CLINICAL PRESENTATION

Scapular dyskinesis (Fig. 2) is most often seen in the overhead athlete, but can be found in any patient presenting with shoulder pain.[9-11] Dyskinesis alone may or may not accompany other findings such as shoulder and neck pain, neural tension and/or shoulder and arm weakness. A common finding that accompanies dyskinesis is shoulder impingement.[15,16] Other diagnoses that commonly present with scapular dyskinesis include labral pathologies, rotator cuff tears, and nerve palsies of the long thoracic and suprascapular nerves.[7,8] Given the likelihood that scapular dyskinesis will not present alone, a proper differential diagnosis including screening for the above pathologies is warranted to help best direct treatment.

Patients with scapular dyskinesis typically complain of an insidious onset of shoulder pain with no specific incident related to the onset of pain. However, as previously mentioned, patients who present with GH joint pathologies (e.g. labral tears), and rotator cuff pathologies, will often also demonstrate dyskinesis.[8,17] In both instances, it is important to take a thorough history and rule in or rule out other possible contributing factors. Patients with scapular dyskinesis may complain of coracoid pain, anterior and posterior shoulder joint pain, referred pain down into the deltoid musculature, and/or periscapular pain.

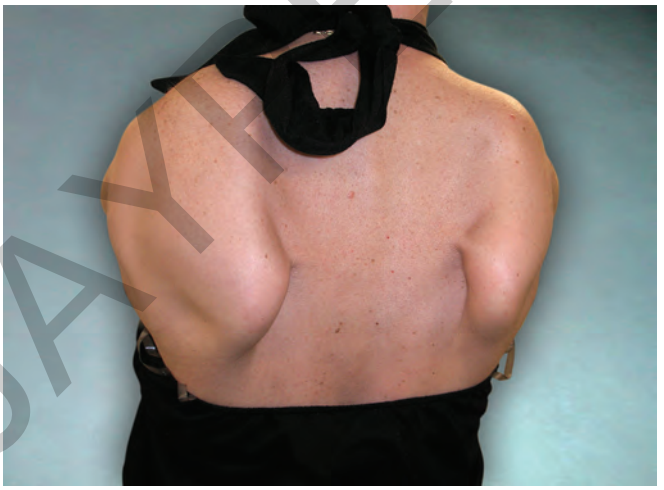

FIG. 2: Patient with bilateral scapular dyskinesis[14]
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CLINICAL EXAMINATION

Observation

Observation of the normal resting alignment of the shoulder complex is the starting point of the physical examination, as this is the starting point of shoulder movement. The clinician assesses the scapulae and clavicle for any gross bony abnormalities. Abnormalities may indicate a fracture or dislocation and significantly impact the treatment plan. In some cases, such findings will require a referral to an orthopedic surgeon.

Once assessment of the scapulae and clavicle is complete, the clinician's focus will shift to appreciating the overall appearance of the scapulae. The normal slope of the shoulder is slightly downward in regards to the angle of the upper trapezius (UT). Struyf et al. describe normal scapulothoracic alignment as scapula's medial border sitting approximately 3 inches from the nearest thoracic spinous processes, in approximately 5° of upward rotation, with 30–40° of internal rotation, with 10° of anterior tilt, and sitting with the spine of the scapulae approximately at the level of the second thoracic vertebra.[18] In a patient with long thoracic nerve palsy (affecting the serratus anterior muscle), a resting alignment of scapular winging may be seen. In nerve palsies of the spinal accessory nerve (affecting the trapezius muscle), a resting alignment of scapular protraction and elevation may be seen. The dorsal scapular nerve, which innervates the rhomboids, can also contribute to scapular winging, if compromised. Isolated weakness of any of these muscles is unlikely, except in the case of nerve palsies, with a typical resting alignment being a combination of both of these positions.

In addition to assessing the winging of the scapula, assessment of elevation and depression is warranted. An easy way to assess this is by assessing the location of the root of the spine of the scapulae. A depressed scapulae will be one in which the root of the spine of the scapulae sits below the third thoracic vertebra. Assessing the

slope of the shoulders may also be helpful. An increased slope, specifically on the effected side may also indicate a depressed scapula.

Next, the examiner's attention should be directed toward muscular assessment. Any obvious muscle atrophy, specifically in the superior or inferior spinous fossa, could indicate suprascapular nerve pathology and should be examined closely. Comparisons should be made bilaterally and any asymmetries noted.

Consideration should be paid to the resting alignment of the shoulders and cervical spine. A cervical spine alignment of upper cervical extension with lower cervical flexion can coincide with excessive forward shoulders. This can accompany abduction of the scapulae with a thoracic kyphosis. These patients will also tend to present with a shortened resting length of the pectoralis minor. Secondary to its attachment on the coracoid process, the pectoralis minor causes the scapulae to anteriorly tilt.[19,20] This restriction interferes with upward rotation of the scapulae during shoulder flexion,[21] and needs to be corrected to treat scapular dyskinesis.

Range of Motion Assessment

As discussed previously, the shoulder complex allows for large amounts of motion. The motion is a result of the interaction of the GH joint, the scapulothoracic joint, the AC and the SC joints. At the GH joint alone, the shoulder has approximately 100–120° of flexion and abduction, 60–80° of external rotation, 80–90° of internal rotation and between 10–90° of shoulder extension.[2] Assessing both active and passive range of motion (ROM) in all planes of movement is important to determine if any limitations exist. Specifically, assessing the true GH joint motion is important in that deficits in motion through this joint may result in increased motion through the scapulothoracic joint, contributing to dyskinesis.

The examiner must assess the patient's true GH internal rotation ROM (Fig. 3). Measurement of internal rotation is completed in supine. The patient is placed in the supine position, the scapula is blocked by depression of the examiner's hand, and the passive internal rotation range is then measured at 90° of shoulder abduction.[22-24] The clinician must take care to assess isolated GH motion without concurrent scapular motion. Monitoring for movement of the scapula through the coracoid process and body of the scapula is imperative to ensure this. The measurement should be taken when the scapulae begin to move, as this indicates that all the motion through the GH joint has been reached. If restrictions in ROM are found, addressing these may be necessary to completely resolve the dyskinesis.

FIG. 3: Shoulder internal rotation range of motion testing

Glenohumeral internal rotation deficit (GIRD) is a common finding in overhead athletes and has been associated with numerous shoulder pathologies.[8,25,26] The true cause of GIRD is likely multifactorial.[22,27] Research has consistently demonstrated that there are likely both soft tissue and bony changes that contribute to this loss of motion found in overhead athletes. Soft tissue changes in both the muscles surrounding the shoulder (for example, the posterior rotator cuff, and the latissimus dorsi) and the posterior capsule and capsular ligament have been implicated in GIRD.[22,27] Bony changes, specifically changes in the degrees of torsion, have also been found to contribute to GIRD.[28] In this instance, the excessive and repetitive rotational stress across the bone as it develops/creates changes in humerus that result in a decrease in internal rotation.

Additional ROM measures of the shoulder should include passive shoulder external rotation (Fig. 4) and horizontal adduction. To accurately measure GH joint external rotation, the patient is placed in the same position as if measuring internal rotation, and the arm is passively externally rotated until the patient's scapula begins move into the fingers of the examiner.[22-24] To measure horizontal adduction, the patient again should be placed in supine, the lateral scapular border is blocked and the arm is passively brought across their body. The measurement should be taken by placing the center of the goniometer as the AC joint with the stationary arm vertical, and the movement arm following the humerus.[22-24]

FIG. 4: External rotation shoulder ROM testing

As mentioned above, contributions throughout the kinetic chain should be assessed. In the context of ROM measurements, this should include cervical, thoracic, lumbar and hip. As alluded to earlier, the attachment of the levator scapulae muscle onto the scapula can affect scapular positioning and cervical motion. Forward head posturing can limit cervical motion and potentially result in shortening of the levator scapulae, further altering scapular positioning. While this will likely not be the main focus of the treatment, screening cervical motion may assist in developing the overall treatment plan. Additionally, assessing thoracic flexion and extension will also assist in guiding the intervention. A general screen of thoracic motion can be completed by asking the patient to flex and extend in the seated position. A more detailed segmental motion assessment can be completed in prone, with a posterior-anterior joint assessment. In this instance, having adequate thoracic extension is imperative to allow pain-free shoulder flexion.[29] Research has demonstrated that a decrease in thoracic extension coincides with a decrease in shoulder flexion motion.

Lastly, a brief screen of lumbar and hip ROM should be completed. Performing standing lumbar flexion and extension and noting any abnormalities allows a quick screen of the patient's spinal movement. Hip ROM can be quickly assessed in standing by asking the patient to perform a single-leg stance and rotating fully over the stance leg into internal and external rotation. If gross limitations are noted, placing the patient prone and assessing true internal and external rotation may be warranted. As with all ROM measurements, comparisons should be made bilaterally. Deficits in motion should be noted and corrected as part of the treatment plan.

Strength Assessment

Muscle testing of the scapulothoracic and scapulohumeral muscles is an important part of the examination process. When examining faulty movement patterns, differentiating between apparent muscle weaknesses versus poor motor control or recruitment patterns is helpful. For instance, if a patient has difficulty performing active scapular retraction correctly, the cause may be faulty movement patterning (e.g. excessive UT recruitment when trying to retract), or the cause may be related to inherent weakness in their scapular retractors.

Proper positioning during muscle testing is important to isolate the correct muscles. Testing of the lower trapezius (LT) and middle trapezius (MT) should be completed in prone. The serratus anterior is tested with the patient in supine. Kendall describes the proper positioning for these tests in detail.[19] In addition to muscle testing of the LT and MT muscles, a quick test of isometric scapular retraction can be performed in sitting. The patient is required to hold a position of scapular retraction for 10–20 seconds, any onset of pain as these muscles fatigue should be noted.[11,30] This could indicate extreme weakness of LT and MT muscles. The wall push-up test can also be used to assess for excessive scapular winging, indicating potential weakness in the serratus anterior muscle.[11] With this test, the patient performs 5–10 wall push-ups while the examiner observes the scapular movement. During this test, winging may not be noted initially, but may appear as the patient fatigues. A second test that can be used for suspected serratus anterior weakness is the sitting hand press-up test (Fig. 5).[31] The patient begins in the seated position

FIG. 5: Seated press-up test

with their hands by their sides. They are instructed to press up and support their body weight through their arms while they maintain their hips at a 90° angle. Assessment of medial border prominence should be made bilaterally.

In addition to testing of the scapulothoracic muscles, muscle testing of the scapulohumeral muscles is also important. Studies have shown that poor posture and misalignment of the scapula at rest can result in apparent weakness of the lateral rotators.[11,32] However, with correction of the scapula position, by cueing scapular retraction and better posture, muscle strength can be normalized. The scapular retraction test can be used if this is suspected. The examiner performs a muscle test of the supraspinatus muscles while the patient sits in their normal resting alignment. The examiner then retests the patients after helping to stabilize the scapulae in the retracted position. A positive test is increased strength and/or a resolution of symptoms in the second position.[12] This is an important finding, as it suggests the correction of the faulty scapulae positioning can improve function and/or decrease pain.[33]

Special Tests

There are a number of special tests that may assist the clinician in correctly diagnosing scapular dyskinesis. In addition to making an accurate diagnosis, these tests may also serve as a tool to measure improvement in the patients' scapular movement. The lateral scapular slide test, as described by Kibler,[34] is part of the examination process. In this test, the distance from the inferior angle of the scapula to the nearest vertebral spinous process is measured (Figs 6A to C). Measurements are performed with the patient in a neutral shoulder position; at 40–45° of coronal plane abduction, with hands resting on hips; and with the shoulder at 90° abduction, with the arms in full internal rotation. A bilateral difference of 1.5 cm should be the threshold for deciding whether scapular symmetry is present.[34]

FIGS 6A TO C: The lateral scapular slide test. Measures are recorded from the inferior angle of the each scapula to the nearest spinous process in three defined positions: (A) with the patient's shoulders resting in neutral, (B) with the patient's hands placed on their hips and (C) with the patient's shoulders placed in 90° of abduction and full internal rotation

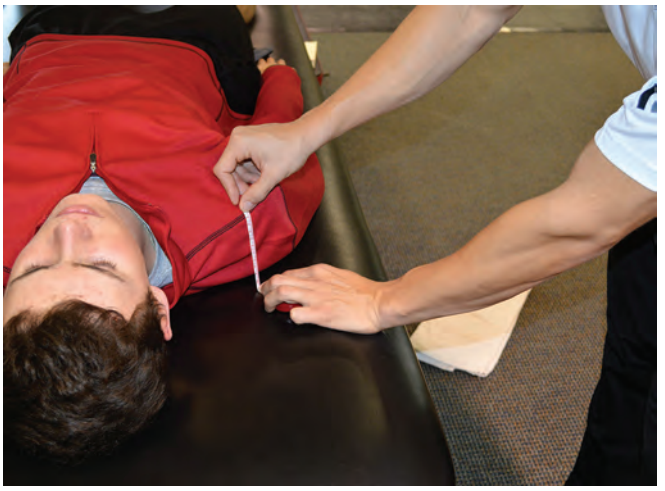


FIG. 7: Pectoralis minor length measurement

A second test that may assist the clinician in both diagnosis and monitoring for improvement is a test of the pectoralis minor length. To assess pectoralis minor length, the patient should be positioned in supine (Fig. 7). The distance from the table to the posterior aspect of the acromion on the affected and unaffected side is measured.[35] A measurement greater than 2.54 cm on the affected side has been suggested to indicate tightness through this muscle.[21] Following the measurement at rest, the clinician assesses whether the shoulder can be lowered to the table with the use of overpressure by stabilizing the contralateral shoulder with one hand while a posterior force is applied to the affected shoulder in an attempt to correct the position of the scapula. This test of pectoralis minor length will indicate whether or not the shortening can be easily corrected with proper scapular alignment and cueing, or if direct soft tissue work to the pectoralis minor is needed to allow proper scapulae retraction.

In addition to the assessing the static position of the scapulae, thoracic and cervical spine, the effect of dynamic movement on these areas needs to be evaluated. Scapulohumeral rhythm is the synchronized movement of the scapula together with the humerus as the arm is elevated overhead. This relationship allows for the increased motion, while decreasing stress on the articular surfaces and soft tissue. Scapulohumeral rhythm is typically a 2:1 ratio. During the first 60° of shoulder flexion, the movement comes primarily from the humerus. Past this point, the motion becomes a 2:1 relationship between the humerus and the scapula allowing for a complete 180° of motion.[1,36] Observing this movement for alterations in this pattern is imperative. As discussed above, when the humerus is moved into shoulder flexion the scapulae must elevate, upwardly rotate, posteriorly tilt and externally rotate. Identifying irregularities in this pattern is important to better appreciate alterations in muscle firing patterns and/or restrictions in movement.

To test for faulty scapular movements, the scapular dyskinesis test described by Mcclure[37] should be used (Figs 8A and B). In this test, the patient should stand with scapulae exposed and perform active shoulder flexion to end range, then slowly return to the starting position. The therapist should observe the movement of the scapulae for winging, anterior tilting, or any obvious impairment. If no deficits are found, the use of 3- to 5-pound dumbbells may be needed to expose underlying movement faults or muscle weakness.

FIGS 8A AND B: Scapular dyskinesis test: (A) starting position and (B) maximum elevation prior to return

FIG. 9: Scapular assist test

The scapular assist test (Fig. 9) may also be useful during this portion of the examination. The patient performs active shoulder flexion. The therapist monitors for reports of pain as the arm is raised overhead. If pain is noted, the therapist places his or her hand on the medial and inferior border of the scapulae and assists the scapulae into upward rotation. If this abolishes the patient's complaint, then addressing the lack of scapular upward rotation will likely be beneficial. Specifically, patients who present with impingement syndrome have been shown to demonstrate decreases in scapular upward rotation, a decrease in posterior tilting and a decrease in scapular external rotation. As such, a positive finding on this test may help to make the diagnosis of shoulder impingement secondary to scapular dyskinesis.[18] Conversely in a patient with instability, a decrease in upward rotation with an increase in internal rotation is typically found. In this case, simply improving upward rotation with the scapular assist test may not resolve their symptoms.

In addition to the objective measures of the examination, it is important to determine when during the overhead motion the patient complains of pain. For instance, dyskinesis in a thrower who complains of pain during the late cocking phase (maximal abduction with external rotation) may indicate a lack of adequate posterior tilting of the scapulae. However, dyskinesis in a thrower who complains of pain during release (maximal internal rotation with horizontal adduction) may indicate—among other things—excessive scapular abduction with deficits in eccentric control of the scapular adductors and retractors. In addition to complaints of pain, patients with scapular dyskinesis may report weakness through their arm. This may be evident to the patient during activities requiring them to reach out away from their body or lift an object overhead.

Understanding the functional needs of the patient is also important. In a throwing athlete, it is obvious that the patient needs to be able to throw without pain. However, an electrician may need to maintain shoulder flexion at or above 90° while working overhead for extended periods of time. Gathering the full picture of the symptoms and impairments will better help to better guide the treatment.

Differential Diagnosis

Scapular dyskinesis can be missed and can be confused with other conditions. Other pathologies the clinician should consider in the examination and treatment of scapular dyskinesis are:

- Rotator cuff pathology
- Labral pathology
- Thoracic outlet syndrome
- Subacromial impingement
- Internal impingement
- Nerve palsies involving long thoracic nerve, suprascapular nerve, dorsal scapular nerve, or spinal accessory nerve.

PHYSICAL THERAPY TREATMENT

During the rehabilitation of scapular dyskinesis, it is important to address all the potential causative factors. This will allow for restoration joint motion and of muscle imbalances, allowing proper positioning and movement of the scapula.[11] The examination of the patient enables the therapist to decide what factors are potentially contributing (Box 1) to the dyskinesis, and to create a well-designed treatment plan to address each factor.

Box 1: Potential contributing factors to scapular dyskinesis

- Nerve palsies: Long thoracic, dorsal scapular and spinal accessory nerves[38]
- Internal joint derangement: For example, labral tears or rotator cuff pathologies[12]
- Bony factures: Scapular or clavicular fractures[39]
- Hypomobility of the shoulder joint and inflexibility of upper extremity musculature: For example, glenohumeral internal rotation deficit (GIRD) and pectoralis minor muscle tightness[40,41]
- Muscular function: For example, weakness or altered firing of the trapezius and serratus anterior muscles[39,42]
- Kinetic chain: Alterations in lower extremity balance, range of motion (ROM) and neuromuscular control[43]

Box 2: Principles of scapular dyskinesis treatment

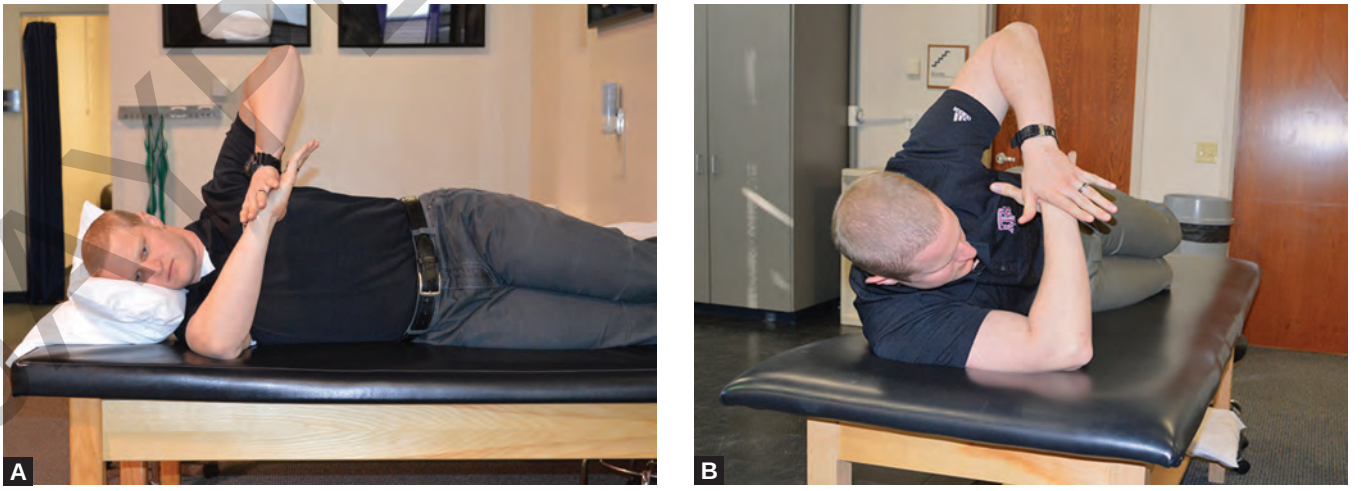
- Address posture and flexibility
- Proper progression is key
- Implement the entire kinetic chain
- Modalities help to compliment the treatment, they are not the treatment

There are multiple treatment approaches to the management of scapular dyskinesis, and the efficacy of the approach may vary, depending on the patient. However, there are underlying principles (Box 2) that need to be considered and will help in the design of an appropriate treatment plan. First, addressing flexibility before strength will improve outcomes.[7] Tightness through antagonist muscles can inhibit strength activation in the agonistic muscle. Restrictions in flexibility will also limit the patient's ability to achieve and maintain correct posturing, and as such, this must be where treatment is initiated. Second, proper progression is imperative. Research has demonstrated that scapular muscular activation is improved when activated in functional patterns.[44] However, if the patient lacks the neuromuscular control to activate the appropriate muscle, they will struggle with functional movements. Focus early on during exercise should be on proper scapular retraction.[30,32] Third, trunk muscle strength and use of the kinetic chain must be included. This will assist in restoring coupled scapular muscle forces and help to create proximal stability, allowing the patient to maintain postural control during exercise.[45,46] Additionally, it will allow improved force generation of the posterior musculature—a goal of the treatment of scapular dyskinesis is facilitation of this musculature. Lastly, modalities should be used sparingly to help assist in the overall treatment plan. They should never be the focus of the treatment plan.

While the above principles will help to guide the treatment, it is important to understand that correcting scapular dyskinesis is not as easy as simply following these principles. Many patients have long-standing postural and flexibility deficits, and altered muscle activation patterns, including UT substitution with inhibition of the LT.[7] Correction will take time and a focused effort on the part of the patient and therapist to correct these impairments.

Flexibility and Mobility

If, during the clinical examination, restrictions in the patient's flexibility were noted, these must be addressed early on. When the patient is in the clinic, they should be put through a stretching routine including hands-on stretches by the physical therapist. In order to mobilize the GH joint into internal rotation, place the patient in the same position described to measure internal rotation in the examination portion of this chapter. The sleeper stretch (Figs 10A and B) and cross body horizontal adduction stretch should be implemented as part of a home program.[27] To perform the sleeper stretch, the patient lies on the involved side with the humerus abducted to 90° and the elbow bent to 90°. They will then use their contralateral hand to push the involved arm down into internal rotation until a stretch is felt on the posterior aspect of the shoulder. The cross body stretch



FIGS 10A AND B: Sleeper stretch: (A) front view and (B) coronal view

can be performed in the same position; however, instead of levering the forearm to induce internal rotation, the patient grasps the elbow of the involved arm and lifts it upward, in a horizontal adduction movement across their body. This stretch can be performed in standing as well with the use of a wall. In both instances, it is important to block the ipsilateral scapulae from sliding out.

In addition to limitations in internal rotation, the patient may have demonstrated pectoralis minor shortening. Improving flexibility in this musculature can again be done in the position that was described in the examination section. However, in this instance, overpressure is applied bilaterally, and a sustained stretch is held.[47] The use of a posterior buttress over which to stretch may be needed such as a towel roll or wedge.

If, during the examination, restrictions were found through the thoracic spine and ribs, this will also need to be addressed. The use of posterior to anterior (PA) mobilizations through the thoracic spine may be indicated.[48,49] This can be performed in prone or in a seated position. If the patient can tolerate more aggressive treatment, thoracic manipulations may also be used.

Posture

In addition to the directed physical therapy interventions, proper patient education is imperative. The patient must understand the role their posture is likely playing in their symptoms. This means that constant verbal cueing may be necessary during the treatment session to assist the patient in maintaining proper posture. Additionally, it may be necessary to devise a plan to assist the patient in maintaining better posture throughout the day. For instance, instructing the patient to take a break from their work every hour to perform active thoracic extension and scapular retraction may be a way to assist the patient in maintaining proper posture throughout the day.

Neuromuscular Re-education

Early on in the rehabilitation process, neuromuscular re-education should take precedence over general strengthening or high-level functional exercise. While functional patterns and the use of the kinetic chain are important, this will likely be too difficult for someone with long-standing dyskinesis. The patient must first learn how to properly position their scapulae by recruiting the appropriate musculature, and only then can they be progressed. Increased activation of the LT, MT and serratus anterior muscles, with a decrease in recruitment of the UT muscle, should be the goal.[50] For patients with long-standing complaints of pain or long-standing movement impairments, this can be very difficult.

The most basic starting position for initiating scapular proprioceptive exercises is sidelying. With the patient in sidelying (unaffected side down), the therapist stands behind the patient, cups the patient's scapula between the web spaces of the clinician's hands, sandwiching the inferior and superior scapular borders (Fig. 11). From this position, the therapist uses manual cues to have the patient elevate and depress their scapula. With a change in hand position (therapist places their hands on the medial and lateral borders), the therapist can cue the patient to retract and protract the scapulae (Fig. 12). When the

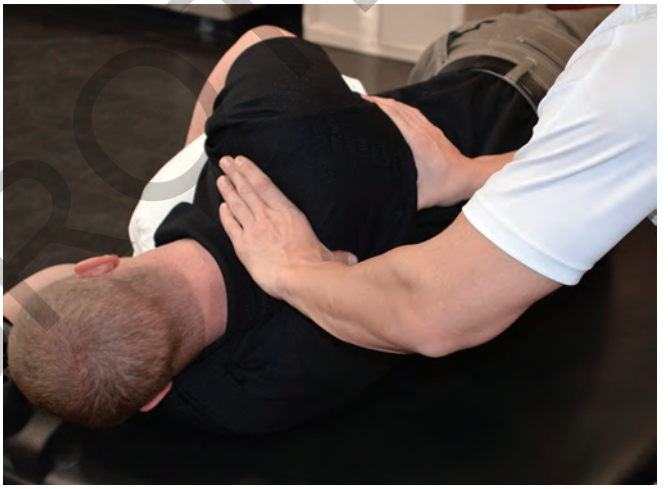


FIG. 11: Sidelying scapular positioning, with the hands positioned superiorly and inferiorly

FIG. 12: Sidelying scapular protraction and retraction, with the hands positioned medially and laterally

patient can actively achieve the desired positions, manual resistance can be used to resist movements into these planes and/or perform isometric contraction in each position. While remaining in the sidelying position, the patient can be advanced to more dynamic exercises while still working on activating the appropriate musculature. Sidelying external rotation and sidelying flexion have demonstrated good middle to UT muscle activation ratios. Meaning that while performing these exercises, there is an increase in MT activation with a decrease in UT activation.[50,51]

From the sidelying position, the patient can be transitioned to the prone position. In prone, performing scapular retraction becomes more difficult as gravity plays a bigger role. Having the patient work on pure active scapular retraction (without UT substitution) is a good starting point. Have the patient lay prone with their affected arm off of the table in a dependent, flexed starting position. From here, the patient can be progressed to more challenging exercises like shoulder extension (Fig. 13) and horizontal abduction (Fig. 14). These movements have demonstrated favorable muscle activation ratios.[50,51]

A basic rowing movement performed in prone is not recommended. This is because electromyography (EMG) studies have shown that the prone row does not demonstrate favorable muscle activation ratios of the LT and MT to UT.[50] This is important to note, especially for patients who continue to struggle with appropriate muscle firing. It may be more advantageous to begin with exercises like sidelying external rotation or prone shoulder extension, knowing that there is a higher likelihood of the patient correctly performing these exercises. In patients who demonstrate good scapular retraction patterns, the row may be used safely and effectively.[45,46]

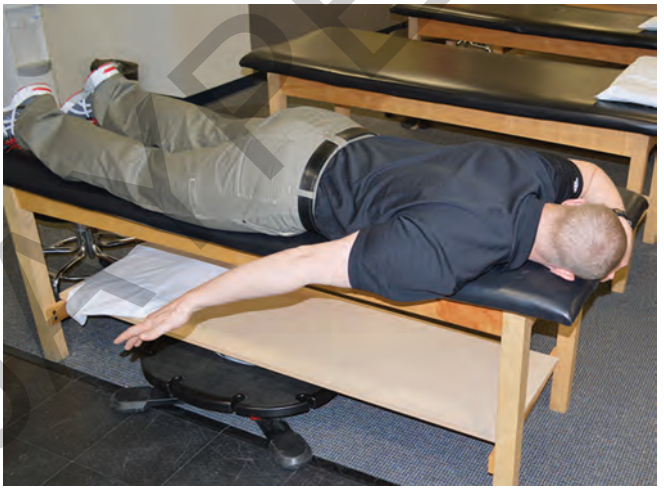


FIG. 13: Prone scapular retraction with shoulder extension from a flexed starting posture

FIG. 14: Prone scapular retraction with shoulder horizontal abduction

The above exercises are all open chain in design and have demonstrated favorable MT and LT to UT ratios, which should be the focus of treatment early on. Additionally, they have placed the patient in a position that allows them to succeed. By minimizing the impact of gravity and starting with basic scapular positioning exercises, the patient should be encouraged by their ability to successfully complete these exercises. Some patients will struggle with these exercises, while others will find them not challenging enough. In either case, these are good exercise choices initially, to help lay the ground work for more dynamic movements.

From these basic open chain exercises, the patient can be progressed to more closed chained movements. Closed chain exercises have demonstrated the ability to help re-establish normal firing patterns of the muscles surrounding the shoulder because they stimulate the normal cocontractions of the scapular stabilizers.[34]

Introductory closed chain exercises that focus on scapular control and positioning. During the low row exercise (Fig. 15), the patient stands facing away from the treatment table and performs shoulder extension with scapular retraction isometrically into the table. This exercise has been shown to elicit favorable EMG activation patterns.[50,51]

In comparison to the open chain exercise, having a stable base in which to place resistance can help facilitate the scapular retractors, and the patient may find this easier than the open chain variation. Progression from

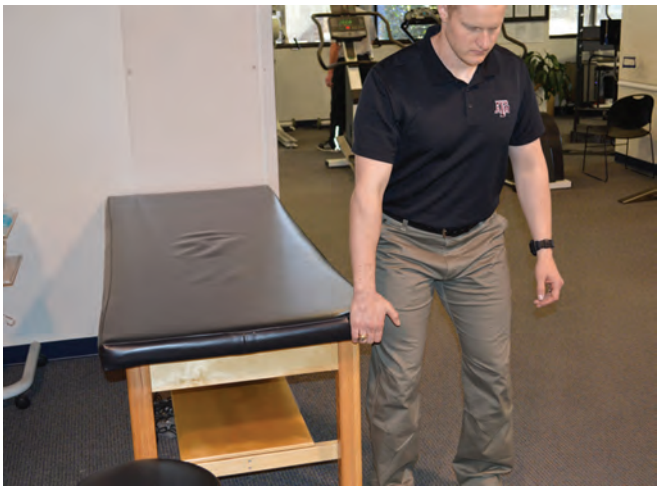


FIG. 15: The low row exercise: Isometric scapular retraction and shoulder extension

FIG. 17: Closed chain scapular positioning with depression

FIG. 16: Closed chain scapular positioning with elevation

FIG. 18: Closed chain scapular positioning in shoulder abduction

exercises with the patient's hand at their side, to exercises with their hands away from their body should ensue.

Once the patient demonstrates good control with their arm at their side, progression to basic scapular positioning with the arms away from their body is next. The patient stands facing the wall, and is instructed to elevate their shoulders to 90° of flexion, placing their hands on the wall. The patient elevates (Fig. 16), depresses (Fig. 17), protracts, and retracts the scapulae when cued with verbal commands. This can be done in a pattern or with isolated movement repetitions. Additionally, this can be performed only on the involved side alone or bilaterally.

Versions of this exercise can also be done in abduction with involved shoulder nearest to the wall (Fig. 18).[34] If the patient struggles or becomes easily fatigued with simple active or weight bearing positioning, it is important that they demonstrate improvement before advancing to more dynamic exercises. It is also important to note that these exercises are being performed in approximately 90° of shoulder elevation. Another basic closed chain exercise is the ABCs (Fig. 19) and manual closed chain perturbations. The patient stands facing the wall with involved hand on a small medicine ball. Keeping the palm open, the elbow extended, the patient performs an isometric protraction into the ball.

Maintaining this positioning, the patient begins to spell the alphabet with the ball. A variation of this exercise involves manual perturbations. The patient begins in the same position as the ABC exercise; however, instead of actively moving through the letters, they are required to

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