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Scapular Dyskinesia, the Forgotten Culprit of Shoulder Pain and How to Rehabilitate?

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Abstract

This review describes about Scapular Dyskinesia. Pathology, stages and mechanism developing scapular dyskinesia is elaborated. Assesment and description of rehabilitation of scapular dyskinesia is explained in this review.

Keywords: Scapula; Exercise, Strength.

INTRODUCTION

The scapular waist comprises the scapula, clavicle, humerus and outer, together constitute the shoulder, a joint formed by 5 joints. The scapula moves in the following ways: abduction, adduction, upward rotation, downward rotation, elevation, and depression can be used to define scapular girdle movements. The scapuloumeral rhythm must remain intact because a synergy of joint motions is necessary for the shoulder complex to perform to its full capacity. If this does not happen, the soft tissues of the complex are vulnerable to overload articular and consequently to various diseases. Therefore, the current review aimed to review the Scapular Dyskinesia, from the point of view of pathology, evaluation and, finally, the physiotherapeutic treatment.

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SCAPULOTHORACIC BIOMECHANICS

The scapula serves four biomechanical roles:

- It is the centre of rotation of the humerus.
- It is the anchor of the humerus onto the thoracic wall.
- It keeps the acromion from obstructing the movement of the humerus both in abduction and in flexion, thus there is no impingement.
- It is the means by which forces are transmitted from the core to the arm.

Given the scapula's integral part of the upper arm's kinematic chain, the scapular position and thus the glenoid position dictate the degrees of freedom within each plane of shoulder movement.

To permit this, the scapula can move in the following ways:

- Elevation/Depression
- Protraction/Retraction
- Internal/External rotation
- Superior/Inferior rotation
- Anterior/Posterior tilt

The movement of elevation of the scapula is approximately 60°, depression from a resting position, only 5 to 10° can be achieved, this movement is important, as it stabilizes the scapula and elevates the shoulder and the body. Retraction is roughly 25°, while the rotation in both the uphill and downward directions is roughly 60°. 30 to 40° anterior to the frontal plane, the shoulder abducts in the scapular plane.

The scapulo-humeral rhythm occurs when the scapula moves in unison with the humeral head while maintaining the humerus's axis of rotation. The joint action of the glenohumeral and scapulothoracic joints, being less evident in the first 30°, such relation of elevation of the humerus on the scapula generally ranges from 1.5:1 to 2:1. Depending on the degree of internal or external rotation of the humerus, the glenohumeral joint contributes 90 to 120 degrees to shoulder abduction. The scapula elevates to fill in the remaining 60 degrees; this movement of the scapula and humerus together is referred to as the scapuloumeral rhythm. Scapular elevation plays no role in the first 30 degrees of glenohumeral abduction and is not coordinated with the humerus. During this phase, which is known as the accommodation phase, the scapula tries to find a stable position on the chest wall in relation to the humerus.

Scapular Pathophysiology/Pathomechanics

The causes of scapular dyskinesis can be split into three groups:

a. Shoulder related

b. Neck related

c. Posture related

a. Shoulder related causes of scapular dykinesia The common characteristic of all these pathologies is the disturbance of the scapulohumeral rhythm. The most common pathologies that are associated with some form of scapular dyskinesis are:

(1) Acromioclavicular instability, (2) Shoulder impingement, (3) Rotator cuff injuries, (4) Glenoid labrum injuries, (5) Clavicle fracture (6) Nerve related.

b. ***Neck related:*** There are two subtypes of neck pathologies that can affect the shoulder: (1) "mechanical neck pain" syndromes and (2) cervical nerve root related syndromes.

1. "Mechanical neck pain" syndrome are defined as a group of pathologies affecting the joint (degenerative changes) and muscles (e.g. fatigue or imbalance) of the neck. It has not yet been established how the symptoms get referred to the shoulder, but one can appreciate the proximity of such structures to the area. In fact, because of the western style of living and the extensive use of computers, patients acquire a "slouched" posture. As a result, the cervical and upper thoracic spines lose their naturally occurring curvatures.
2. Conversely, the link between nerve pathologies (e.g. nerveroot compression or avulsion) at the neck and shoulder related complaints is well established. All the nerves that provide sensory and motor supply to the shoulder originate from the brachialplexus, especially from the C5 and C6 roots, and the accessory nerve (it transverses from the upper portions of the spinal cord and the lower parts of the brain towards the sternocleidomastoid muscle). Pathologies arise when the nerves inappropriately activate one or more nerves around the scapula and consequently disorganize the rhythm of scapular movements relative to the main skeleton or the upper limb. The pattern of muscle activation is an important part of clinical assessment and rehab as explained later.

c. Posture related causes of scapular dyskinesis: Excessive thoracic kyphosis and cervical lordosis alter theresting position of the scapula. Athletes are more susceptible to these changes. Depending on their sport, they develop coremuscle imbalances that alter spinal curvatures and soft tissue tensions.

SCAPULAR DYSKINESIS

Scapular dyskinesia are changes in the position and scapular movements that predispose to shoulder injuries, as they modify the relationship of strength and tension of muscles and affect their efficiency. Scapular dyskinesia may be a consequence of many factors such as biomechanical

and physiological abnormalities, bone anatomy altered by posture or bone lesions, muscle injuries due to direct trauma, microtraumas that lead to imbalances, fatigue and pain. Scapulothoracic dysfunction, impact syndrome, frozen shoulder, glenohumeral instability are different shoulder pathologies.

Several factors can create changes in the position of the scapula such as poor posture, excessive rest posture, thoracic and cervical kyphosis, lordosis that can result in excessive scapular and acromial protraction, clavicle fractures, acromioclavicular joint injuries, instabilities, osteoarthritis, changes in the function of the muscles that control the scapula, lesions along the long thoracic nerve (which may alter the muscle function of the anterior serratus), spinal nerve injuries (may alter trapezius muscle function, causing abnormality in stabilization, which occurs in approximately 5% of cases). The muscles that stabilise the scapula are typically affected by microtrauma from direct trauma, which causes muscle weakening and movement inhibition from painful shoulder disorders. The anterior serratus and trapezius are more frequently engaged in the first phases of shoulder disease and are therefore most vulnerable to the effects of inhibition.

Defective Scapular Posture, caused by muscular imbalances, also generates imbalances of length and muscular strength in the umeral muscles, altering the mechanics of the glenohumeral joint. A forward bending of the scapula is associated with a retracted minor pectoral muscle and possibly anterior serratus weakness or trapezius. This scapular posture alters the humeral posture on the glenoid, assuming a relatively abducted and internally rotated position, resulting in retracted gleno-humeral internal rotators and elongated or weak lateral rotators.

Muscle Imbalance is the difference in strength and flexibility between muscle groups acting on the same joint, that is, when a given muscle group is stronger and/or more stressed than its respective antagonist. The imbalance can be a causal factor or be associated with several factors, such as: improper use, excessive repetition, poor posture, antalgic posture, joint pathologies, muscular pathologies, contractures or adhesions, neurological deficits, disuse or atrophy, indiscriminate practice of sports activities, among others.

The scapulothoracic pathology develops in conditions that are chronically uncomfortable and in which the glenohumeral joint has been immobilised for an extended period of time or whose glenohumeral movement has been gradually restricted. The scapulothoracic joint typically develops into a secondary issue. Muscle spasms in the supraspinatus, trapezius, rhomboids, big dorsal, and subscapularis may be brought on by increased shoulder discomfort. The range of passive and active abduction will be significantly reduced if a scapulothoracic joint is not functioning properly, with just 100° to 120° of passive abduction possible.

Additionally, 68% of patients with rotator cuff abnormalities, 94% in the glenoid lip, and 100% with glenohumeral instabilities exhibit scapular dyskinesia, a nonspecific response to a painful shoulder condition rather than a specific response to a glenohumeral pathology. Inhibition is characterised by a reduction in the muscles' capacity to generate torque and maintain scapular stability as well as a disarray of the muscles surrounding the shoulder. Uncertainty surrounds the actual nature of this restriction. An altered activation of muscle spindles, contractures, or shortening of muscles and ligaments surrounding the shoulder, affecting the position and mobility of the scapula, is thought to be caused by a proprioceptive motor pattern based on direct or indirect muscular injury, exhaustion, or tension.

Effects of Scapular Dyskinesia

1. the loss of retraction that causes the loss of stability at the time of raising the arm.
2. the lack of scapular protraction around the chest wall increases the deceleration of the forces at the shoulder joint.
3. increase tensions over the anterior stabilizers, glenoid lip structures and glenohumeral ligaments, thus increasing the risk of injury.

Losing the capacity to lift the acromion could have a secondary effect on other shoulder issues, like glenohumeral instability. The first muscles implicated in preventing muscular dysfunction are the lower fibres of the trapezius and anterior serratus. Numerous other shoulder conditions, such as rotator cuff inflammation and glenohumeral instability, might be seen to start with it. This can contribute to the emergence of further symptoms. Forces generated by the lower extremity and trunk will not effectively pass to the upper extremity if scapular mobility is compromised.

Classification of Scapular Dyskinesis

According to Kibler & Kibler *et al*. the three-

dimensional biomechanical analysis of scapular movements shows that the scapula moves around three axes of movement simultaneously. The simplest way to spot abnormal movement patterns in scapular dyskinesia is to first locate the scapula with the patient's arms at their sides, then watch the scapula move when the arms are raised and dropped in the scapular plane. They can be broken down into three kinds of dyskinetic patterns, which correlate to the three thoracic planes of motion. By identifying the kind of improper scapular movement, they help with muscle rehabilitation and recovery by restoring the necessary flexibility. Kibler classifies scapular dyskinesia in 3 types, they are:

Type I is characterized by the inferior and medial prominence (lower angle) of the scapula. Type II is characterized by representing of all scapula medially; Type III (Fig. 1) is characterized by the prominence of the upper and medial scapula border.

Fig. 1: 4A Type I, with emphasis on the lower and medial part of the left scapula; B Type II, with prominence of all the medial part of the left scapula; C-Type III, with prominence of the upper and medial part of the left capula.

Scapular dyskinesis evaluation The clinical assessment of the scapula is divided into three stages: (1) Direct observation; (2) Manually Assisted Movements and (3) Assessment of surrounding structures:

1. Scapular assessment should include normal scapular movements, assessment of movement dynamics, muscle activation, and corrective maneuvers should be made. To perform direct observation of the scapula the patient's resting scapular position is assessed followed by the observation of active movements; stands and holding a 1 kg bag and is asked to perform simple active movement; shoulder flexion and abduction, whilst the examiner observes for winging, early elevation, rapid downward rotation and shoulder shrugging. The findings are noted as a yes/no answer, followed with a description of the best performance.
2. Assessment of surrounding structures: the structures around the scapula (thoracic spine, the acromioclavicular joint, rotator cuff muscles, two heads of the biceps and the glenoid labrum) are assessed. It is important to assess these structures thoroughly in order to exclude or confirm alternative causes of the symptoms. The assessor is looking for symptoms (pain, loss of function) in other structures, soft tissue laxity and muscle power. Lumbar lordosis, pelvic tilt and hip rotation should be checked. Since the existence of scoliosis and an increase in thoracic kyphosis may directly affect the movement of the scapula, resulting in an irregular contour of the scapular movement, the thoracic and cervical posture should also be assessed. Excess cervical lordosis can affect scapular retraction and protraction. Evaluation of the scapula by itself should be done mainly from the posterior aspect.
3. Trigger points The musculature of the scapulothoracic joint should be evaluated in order to verify the presence of spasm in the rhomboid, large dorsal, upper and lower trapezius, subscapular, minor round, infra-spinal and supraspinal muscles. These areas should also be evaluated for active trigger points. The evaluation of trigger points in these muscles can radiate pain to the middle deltoid and elbow bundles and, in severe cases, through the arm.
4. The lowering arm experiences scapular dyskinesia related muscle weakness more frequently. Perform an isometric contraction of the scapula in retraction to evaluate the strength of the scapular muscles. While the typical scapula generates a contraction in this position for 15 to 20 seconds without causing discomfort or muscular weakness, the scapular muscle weakness can appear as a burn like pain in less than 15 seconds.

Push-ups against a wall are a useful test for determining the anterior serratus's muscle strength.

In the relaxed position, abnormalities of elevation and rotation should be examined. The super medial prominence of the scapula and depression of the acromion are caused by weakening of the anterior serratus muscle, whereas the lower prominence and elevation of the acromion are caused by weakness of the trapezius muscle. Due to the small head of the biceps and minor pectoralis muscle's attempt to adapt, there may be pain when the anterior coracoid process is palpated over the shoulder. The scapula and trapezius lift might cause the super medial portion (upper angle) to hurt when touched or moved. Both phases of the shoulder's movement and the shoulder depression should be examined for movement and scapular posture.

To assess scapular dyskinesia, they are:

1. Scapular assistance test (Fig. 2): This procedure evaluates the activity of the anterior serratus and inferior trapezius muscles. Elimination or modification of the symptoms of these muscles indicates the focus of rehabilitation;

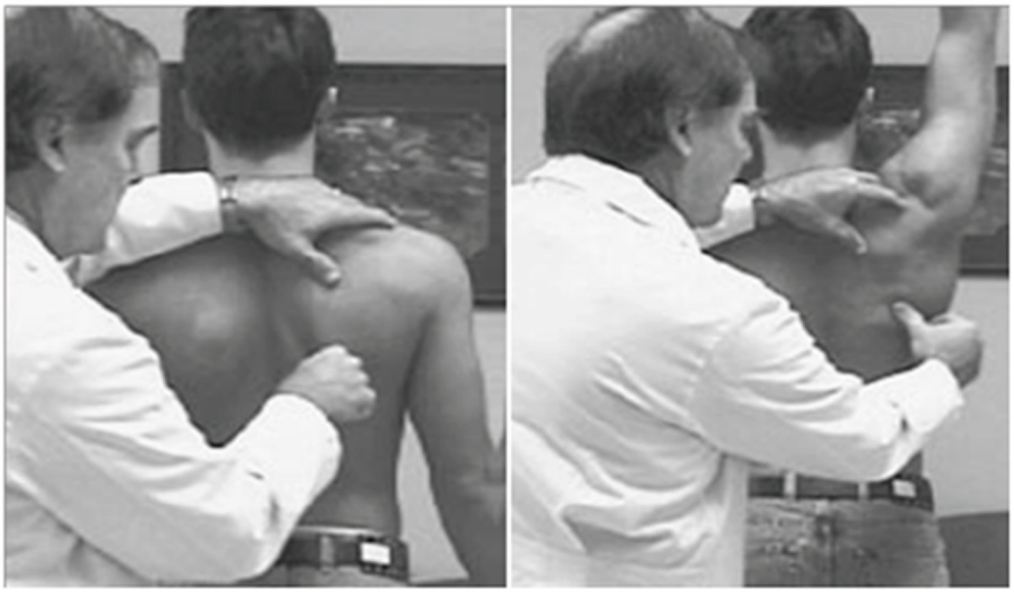

Fig. 2: The examiner observes the actitity of the anterior serratus muscle and the inferior trapezius when the arm is raised. When there is relief of symptoms the test is positive. The examiner with his right hand at the position at the beginning of the test. Afterwords elevation of the arm. scapular rotaiton.

Fig. 3: Scapular retraction test. The examiner stabilizes the scapula medially and the arm is raised or rotated eernally. When there is relief of symptoms, the test is positive.

2. Scapular retraction test (Fig. 3): Manually wraps the scapula stabilizer in a closed position over the thorax. The scapular retraction test also demonstrates the impact of the scapula and the involvement with the glenoid.
3. Slip test of the lateral scapula. A 1.5 cm asymmetry is the limit of abnormality and is most commonly seen in abduction of the shoulders at 90°. In the first position, the patient has relaxed arms at the side of the body (Fig. 4A). In this position, the lower medial angle of the scapula is palpated and marked on both sides. The reference point is on the backbone is the next thorny process. The reference measurements from the spine to the medial aspect of the scapula are measured on both sides. The same is done with arms equal to or less than 90° abduction

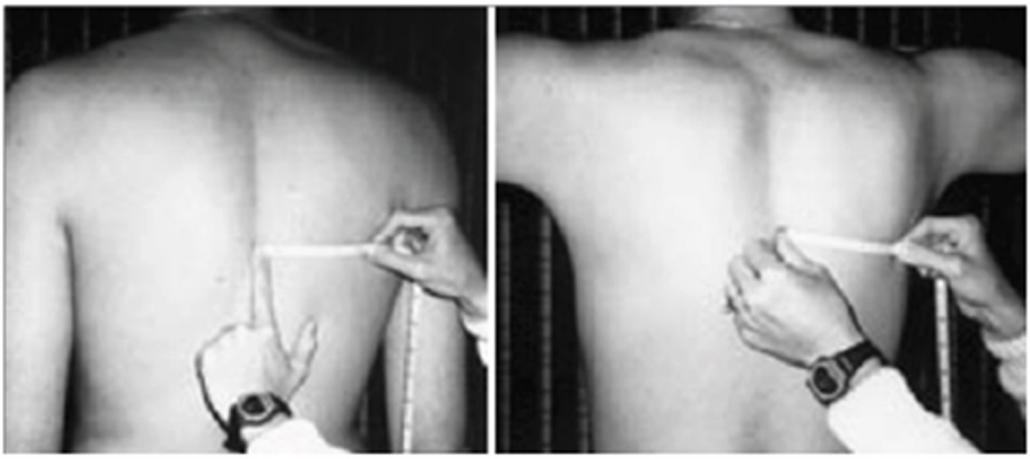

Fig. 4: A-Position: arms at rest; B-Position: both arms abducted at 90° with maximum internal rotation. ***Source:*** Kibler et al.

of the arm with maximum internal rotation of the glenohumeral joint (Fig. 4B).

TREATMENT

Physical therapy can be used to treat the majority of scapular irregularities, easing the feelings of stiffness and reestablishing the usual pattern of muscle strength and activation. In order to correct muscular imbalances, the muscular chains must be lengthened where they are short and strengthened where they are weak.

The synchronisation of forces between the scapulothoracic muscles should be included in shoulder rehabilitation, with a focus on strengthening the shoulder's depressor muscles (subscapular, infrascapular, and minor round), scapular stabilisers (trapezius upper and lower fibres, anterior serratus, and rhomboids), and muscles that act primarily on the scapula. The anterior serratus and trapezius muscles play an important role in the scapula's proper alignment during arm elevation, synergistic movements when the deltoid muscle is active, and are crucial for the scapula's movement over the rib cage, especially when the arm is raised.

Starting with analytical work and progressing into more functional and targeted exercises, scapular rehabilitation will treat muscle retractions and imbalances and restore good dynamic stability. Glenohumeral movement is directly impacted by muscle spasm, weakness, and poor neuromuscular synchronisation of the stabilising muscles. The asynchronous movement in the shoulder complex will eventually result in injury if the scapula does not move appropriately over the rib cage, if muscle length and tension are not maintained, or if the glenoid fossa is not correctly oriented with the humeral head. Therefore, the scapular stabilisers can and should be strengthened by asking the person to carry out surveys, horizontal abduction exercises in the ventral decubitus, scapular retraction exercises, and neuromuscular control manoeuvres. Kibler & McMullen state that the rehabilitation of scapular dyskinesia is based on a programme that emphasises movement and scapular coordination as well as complementary trunk and hip movements from proximal to distal:

Acute (often lasting 0 to 3 weeks) (1) Establish the facilitation of scapular movement by avoiding movements and painful arm positions; (2) If there is restriction of movement, mobilise soft tissues and stretch the minor pectoral muscles, levator scapula, superior trapezius, large dorsal, and infra-spiny. Active, active assisted stretching, passive stretching, and proprioceptive neuromuscular facilitation are all useful stretching treatments for regaining muscle flexibility and glenohumeral joint range of motion; Deficits in flexibility include different muscle groups and joint components. The mainstay treatment is stretching of the affected structure to increase the working length. The pectoralismuscle is best stretched by the technique "unilateral cornerstretch", a technique that involves the passive abduction of the humerus at 90 degrees from the resting position.

The posterior capsule of the glenohumeral joint best responds to techniques such as "sleep stretch" and "cross bodystretch" which improve the mobility of the joint.

(3) Start from the upper end by shifting the weight, swinging the exercises. The exercises should be rhythmic with the stabilizing ball and weight support to promote isometric contraction. Use closed loop kinetic (CCF) exercises where the hand is supported or has weight applied to it, at different planes and altitude levels if scapular positioning is adequate. These can begin with minor degrees of external rotation and abduction before being increased to 90 degrees as long as the patient is able to tolerate it; (4) Commenced exercises for scapular mobility without arm elevation. Scapular protraction can be aided by trunk flexion and medial rotation. Use active trunk rotation, lateral extension, and hip extension to help the scapula retract; (5) combine arm movement with scapular mobility exercises to help the scapula become more mobile. Keep the arms close to the body at first to lessen the inherent load. The low row, which combines arm extension, scapula retraction, and trunk/hip extension, is a great place to start with scapular stabilisation;

B) In the recovery phase (3 to 8 weeks) the activation of proximal and muscular stability is necessary for proper movement and strengthening of the scapula. Force is dependent on movement, and movement is dependent on posture; (1) In CCF, begin with heavier load movements including modified prone push-ups, wall push-ups, and table push-ups. Additionally, strengthening CCF elevating exercises at a higher intensity enhances scapular control. (2) Increase the usual scapula movement exercises' elevation and rotation till the patient can tolerate it. Exercises involving active axial movement, in which the hand is freely movable the wall slide is one such exercise are employed if intrinsic loads are extremely high when active lifting is introduced; (3) Hip and trunk flexion exercises with scapular protraction and scapular retraction, respectively. Pull in a variety of directions and planes of motion. They are employed to mimic the scapula's natural activities;

C) Maintenance phase (6 to 10 weeks): Plyometric exercises can be started when there is good control of scapular movement throughout the shoulder elevation. Exercises like overhead dumbbell presses and dumbbell punches also call for good muscle control throughout the full range of glenohumeral movement.

Electrothermotherapy and kinesiotherapy were employed in a rehabilitation plan to reduce discomfort, restore range of motion, and increase muscular strength. The protocol was broken down into 4 phases with various objectives and actions:

1. **Phase I:** Involves reducing inflammation and relieving pain and swelling. Currently, supraspinatus active stretching, brief waves, pendant Codman exercises, and weights weighing 1 kg are being used as resources.
2. **Phase II:** Maintain or improve flexibility while slowing muscle loss. Exercises for WMD, using a stick, and isometric strengthening were added in this phase.
3. **Phase III:** Restore range of motion without discomfort and strengthen muscles. At this point, the devices were employed, and strengthening exercises and electrotherapeutics, when needed, were added; The main concept of this stage is concurrent activation of muscles in order to perform activities of daily life. The prescriptionshould include both "open chain" and "closed chain" activities. The exercises should be repeated under different weightbearing conditions. "Open chain" activities include "lowrow", "inferior glide", "lawnmower" and "robbery" exercises, that re-engaged the rhomboid muscle. "Closed chain" activities aim to promote the awareness of the joint inspace (proprioception) and coordination of the rotator cuff muscles Moreover, muscle strength can be achieved by engaging the deficient muscles in isolation whilst minimizing the activity of the stronger ones.
4. **Phase IV:** To improve muscular performance, functional recovery and proprioception.

CONCLUSION

The scapula is an under appreciated component of the shoulder kinematic chain. The importance is highlighted by the significant improvements in functional ability after rehabilitation. Clinical evaluation of the scapular resting position and function is paramount for the prescription of the necessary physical therapy exercises Based on the studies, it can be concluded that, in order to obtain the synchronism of forces between the muscles that act primarily on the shoulder (deltoids, pectoralis

major, and dorsal), scapular stabilisers (upper and lower inferior, anterior serratus, and rhomboids), scapulothoracic muscles, as well as the shoulder depressor muscles (subscapularis, infrascapular, and teres minor round). The current study described a few workouts that are used to treat the shoulder and scapular girdle joint as a whole. Due to the difficulties in locating studies on scapular dyskinesia, the types, and suggested therapies, there were a number of limitations in the study.

REFERENCES

1. Sanchez *et al.* Scapular dyskinesis:biomechanics, evaluation and treatment. *Int Phys Med Rehab J.* 2018;3(6):514520.
2. A.C. Panagiotopoulos and I.M. Crowther: Scapular Dyskinesia, the forgotten culprit of shoulder pain and how to rehabilitate SICOT-J 2019, 5, 29.