Review Article

# A Current Concept of Scapular Dyskinesia and Scapular Algorithm

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## ABSTRACT

The shoulder is the ultimate movable joint in the human body its anatomical construction permits a broad range of motion in multi directions. On the other hand, leads to an insubstantial balance between stability and mobility. Therefore, shoulder pain is a very common complaint in clinical practice and there are numerous conservative treatments suggested however, this condition can be overlapped by various other clinical findings. Thus, systematically analyzing individual's shoulder motion is central to design the unbeatable rehabilitation regimen to overcome functional suffering is related to shoulder pain by restoring the harmonious motion of scapula humeral and also it prevents the associated problems. Therefore, this scientific script illustrates biomechanical evaluation and pathomechanics based on the alteration of their scapulohumeral rhythm and follow up a standardized rehabilitation algorithm to regain pain-free shoulder functional ability.

## ABBREVIATIONS

AC: Acromioclavicular joint; SC: Sternoclavicular joint; GH: Glenohumeral joint; SLAP - Superior Labrum Anterior and Posterior; SICK: Scapular Syndrome –Scapular malpositioning, Inferior medial border prominence, Coracoid pain and malposition and DysKinesis of scapular

## INTRODUCTION

There has been an increasing interest in investigating the biomechanics of the scapula motion and its role in shoulder pathologies. Many studies report that one-third of the population suffers from shoulder symptoms during their lifetime and it is associated with a negative impact on both personal and national levels. It decreases the quality of life due to personal suffering and subsequent economic impact on health care services. The resultant cost and absence from work associated with shoulder pain are a social concern [1]. The incidence of shoulder pain in general medical practice increases with age, however, it depends on the subject's work-related activities, which involve the upper extremity repetitive motion [2]. 'Scapular dyskinesis' the condition refers to changes of the normal static or dynamic position of the scapula and alteration of coupled scapulohumeral movements [3]. The term 'dys' indicates alteration and 'kinesis' refers to motion. Scapular dyskinesis is not necessarily a pathological term, because it is possibly noticed not only in symptomatic shoulder regions but also in asymptomatic patients. Although it is evidenced that scapular dyskinesia contributes more often in symptomatic shoulder pain and is a predictive

factor in developing other associated problems such as SICK scapular syndrome, shoulder impingement, and adhesive capsulitis [4]. The purpose of this article is to describe common musculoskeletal alteration of complex shoulder anatomy and biomechanics leading to pathomechanics clinical characteristics of the scapular dyskinesis and explain how to focus on the applicable standardized conservative physical therapy interventions algorithm, which can be easily incorporated into the scope of physiotherapist practice to gain successful outcomes in linked to scapular dyskinesis.

## ANATOMY

The scapula; triangular and only bony articulation is with the clavicle at the AC joint which acts as a bony beam for the shoulder. There is no articulation between the posterior thoracic wall and the scapula. The movements are elevation, depression, retraction, protraction anterior and posterior tilt. These movements occur via a gliding motion of the scapula on the thoracic cage by contraction of attached muscles to the scapula [5]. Several muscles surround and insert to the scapula, which can be divided functionally into three groups [6]. First, muscles such as the trapezius, rhomboids, levator scapulae, and serratus anterior contribute to scapula stability and rotation; Second, extrinsic muscles of the glenohumeral joint; deltoid, biceps, and triceps; Third group of intrinsic muscles comprising the rotator cuff muscles, supraspinatus, infraspinatus, teres minor, and subscapularis.

## BIOMECHANICAL CONCEPTS

Shoulder joint full range of movement is brought by contributing all four joint play motion [7]. This joint play movement is described as arthrokinematics, which contain rolling, spinning, and sliding in different directions at the joint surfaces according to their concurrent articular surfaces [8]. Ultimate joint play motion occurs only in the availability of normal periarticular connective tissue, integrity, extensibility and tension relationship muscles function [9]. Thus, the biomechanical analyzing of the shoulder accentuates the coordinated motion of shoulder girdle joints. This scapulohumeral rhythm has an average ratio of approximately 2:1 between the glenohumeral rotation and scapulothoracic rotation. The moments described are resultant forces from muscle activation of the muscles around the shoulder. The static stabilizer is built up from glenoid labrum, joint capsule, glenohumeral ligaments and intrinsic negative pressure of the joint. The dynamic stabilizer includes rotator cuff muscles, long head of the biceps tendon and other scapulothoracic muscles such as pectoral is major, rhomboid, latissimus dorsi and serratus anterior [10]. Three parts of the trapezius and serratus anterior facilitate upwards rotation of the scapula with glenohumeral elevation, while supraspinatus, infraspinatus, and subscapularis assist centering of the humeral head within the glenoid via the concavity compression mechanism. The rotator cuff muscles afford dynamic stabilization to the humeral head onto the glenoid fossa, forming a force couple with the deltoid to permit elevation of the arm. This force couple provides about 45% of abduction strength and 90% of external rotation strength [11]. A stiff shoulder present inadequate capsular flexibility and altered muscle function, therefore the therapist must rehabilitate the connective tissue extensibility and restore normal muscle function to re-establish harmonious glenohumeral movements within the shoulder complex [12].

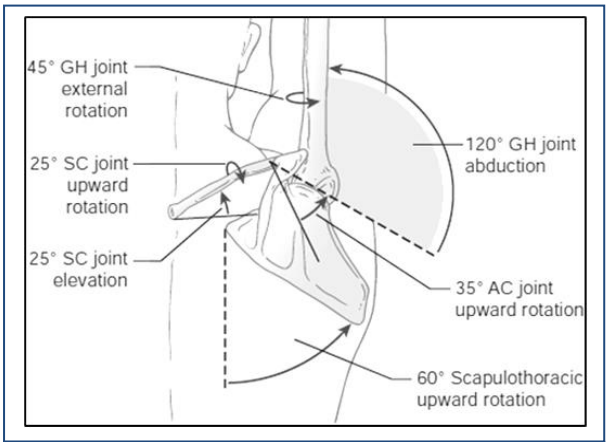


Figure 1: Biomechanics of Glenohumeral joint [13].

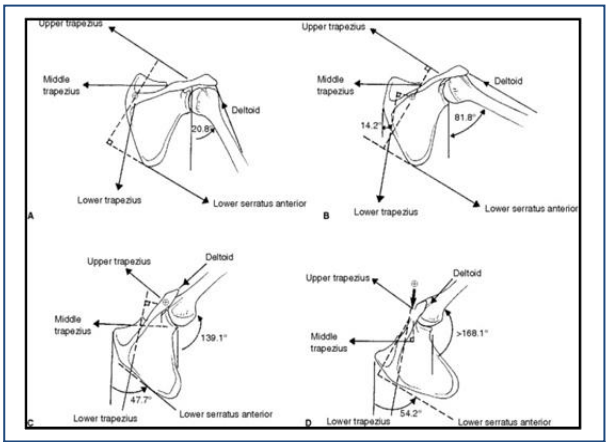


Figure 2: Force couples for scapular motion [14].



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## CLINICAL FEATURES

### Etiology

Postural abnormality eventually develops cervical lordosis or disproportionate thoracic kyphosis which changes the typical resting position of the scapula resulting in increasing protraction and acromial depression [15]. The most collective origin is the muscle imbalance between the shoulder girdle agonist and antagonist muscles causing to vary the anatomical position and coordination of scapular movements timing due to muscular inhibition and glenohumeral proprioception [16]. In few cases, anatomical disruption due to clavicular fractures or resections can shorten or angulate the position of the clavicle that disturbs the ability of scapula humeral rhythm because posterior clavicular rotation allows the initial and final 30° to complete overhead motions. In addition to that, tightening of the pectoralis major can restrict posterior clavicular motion. Moreover, acromioclavicular joint injuries and acromial morphology can cause abnormal scapula humeral rhythmic motion. Pectoralis minor or short head of biceps muscular contracture or tightness can anteriorly move the scapula over the top of the thorax due to their attachments to the coracoid process. Lack of capsular flexibility, especially, posterior capsule shortening prevents anterior and superior translation of the humeral head arthrokinematic joint play motion and loss of internal rotation to cause scapular dyskinesia [17].

### History

The main cause of shoulder pain among scapular dyskinesia subjects is an alteration of scapular anatomical position due to rotator cuff dysfunction and consequently leads to subacromial impingement syndrome along with pain and stiffness. The pain may be quite severe on abduction and internal rotation of the glenohumeral joint and last for several hours as a dull pain. The shoulder pain from musculoskeletal disorders is most often described as symptoms of insidious type but they may not offer any previously reported trauma and no history of radicular-like symptoms along the upper extremity of the affected shoulder side. In a significant number of symptomatic scapula dyskinesis, subjects may complain of pain in the anterior and/or the posterosuperior aspect of the shoulder region, surrounding the deltoid tuberosity, also intermittent pain along with the upper trapezius. The pain is triggered by reaching and lifting in overhead functional activities.

### Classification Patterns

The shoulder region pain patient should be observed posterior to anterior view in anatomical position to investigate the pattern of scapula dyskinesis. It is generally referred when the subject shows one or more abnormal positions of the scapula compared to the sound side. It is classified into three dyskinetic patterns [18]. Type I is characterized by at rest, the inferior angle of the scapula may be prominent dorsally and during arm motion, the inferior angle tilts dorsally and the acromion tilts anteriorly over the top of the thorax. The axis of the rotation is in the horizontal plane. Type II is described at rest, the entire medial border may be prominent posteriorly and during arm motion, the medial scapular border tilts dorsally off the thorax. The axis of the rotation is vertical in the frontal plane. Type III displays at rest, the superior border of the scapula may be elevated and the scapula can also be dorsally displaced and during arm movement, a shoulder shrug initiates movement. The axis of this motion occurs in the sagittal plane.

### Associated Problems

Scapular dyskinesia is a widespread term used to label the loss of scapulohumeral rhythmic motion. Many shoulder pathological conditions may result from abnormal scapular control and motion and can have shoulder pain and possibly discomfort at rest or with activity. In particularly, subacromial impingement syndrome is the most commonly associated problem with scapular dyskinesis. Impingement in the shoulder occurs when the soft tissues such as the supraspinatus, long head of biceps brachii tendon, subacromial bursitis, and superior joint capsule have impinged in the subacromial space between the humeral head and coracoacromial arch. Symptoms involving shoulder impingement can become functional impairments in the chronic term. In addition to that, adhesive capsulitis and SLAP lesion can be developed among overlooked or poor rehabilitation scapular dyskinesia in the long run [19].

## CLINICAL EVALUATION

There are various ways of assessing scapula dyskinesis using clinical test and objective measurement. The clinical test is the scapula dyskinesis test, scapula assistance test, lateral scapular slide test, and scapula repositioning test. Objective measurement is possible to assess scapular dyskinesia movements using a goniometer. Three objective static



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measurements are taken such as the inferior, lateral displacement, and scapula abduction. Most patients with scapular dyskinesis will have positive results in all three categories. A scoring system has been devised by imputing the data attained from the goniometry into a table to give a quantitative assessment of scapular dyskinesis [20].

## SCAPULAR REHABILITATION ALGORITHM

The goal of the scapular dyskinesis rehabilitation regimen is restoring the scapular muscular imbalance and abnormal glenohumeral rhythm. The scapular dyskinesis takes in higher activation of the upper trapezius and levator scapulae muscle, and simultaneously, a decreased switch of the middle and lower trapezius and serratus anterior muscles [21]. The objective is ensuring the balance ratio between the three parts of the trapezius. Cools et al recommended an algorithm, which includes a set of four exercises (prone extension, side-lying external rotation, side-lying forward flexion and prone horizontal abduction with external rotation). These probably encourage high activation of the middle and lower trapezius. Other exercises such as wall slide, push-up exercises and shoulder elevation in the scapular plane specifically improve the activation of theserratus anterior, furthermore, these exercises minimize the activation of the upper trapezius and levator scapulae [22]. Also, the rehabilitation regimen contains exercises that aim to stretch the posterior capsule and the pectoralis major and minor muscles. The posterior capsule to be stretched in a side-lying position with internal rotation, abduction of the arm with the elbow at 90° and also to lengthen the pectoralis muscles in the supine arm and elbow at 90°horizontal abducted position by pushing the shoulder posteriorly. Many kinds of literature emphasize that not only the middle and lower trapezius but also the rotator cuff muscles need to be strengthened with progressive resistance after adequate stabilization of the scapula under the physiotherapist's supervision [23,24]. The majority of subjects capable to understand the exercises, which move the scapula to facilitate posterior tilt and upward rotation after attending a few supervised physiotherapy sessions to follow them without the assistance of the therapist [25]

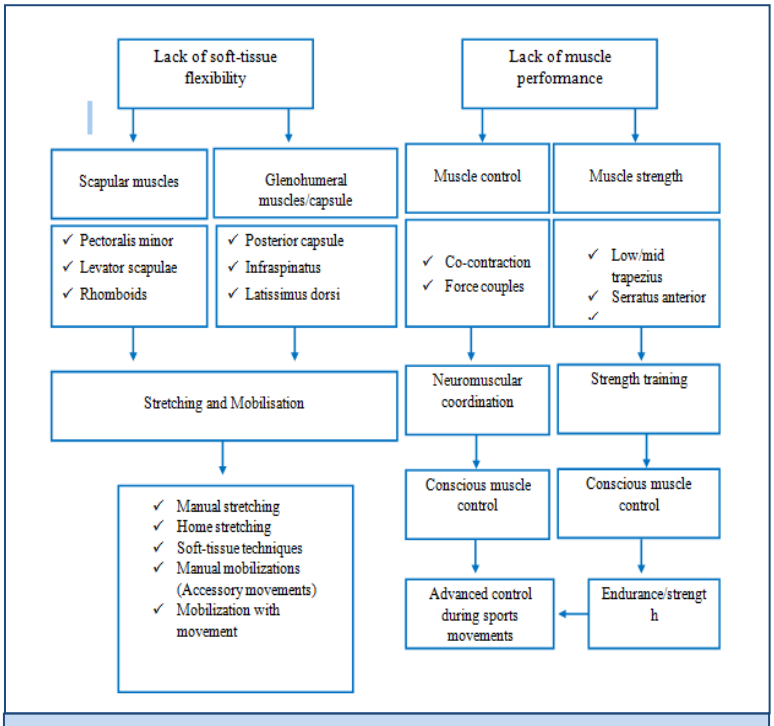


Figure 3: Scapular dyskinesia rehabilitation algorithm [22].

## CONCLUSION

This article highlights the rehabilitation of scapular dyskinesis by following are liable rehabilitation algorithm and focuses on the precise diagnosis by detailed knowledge of the regional anatomy, the biomechanical analysis, comprehensive physical examination and accurate interpretation of the pathology according to an individual case for regaining pain-free functional livings.



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