RESEARCH ARTICLE

Empowering recovery: A case study on conservative management of scapular dyskinesia

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Abstract:

Scapular dyskinesia, often overlooked in athletes, significantly affects shoulder function and performance. This case study focused on a 23-year-old male badminton player who experienced moderate shoulder pain and limited range of motion after a traumatic injury during a game. The objective was to alleviate pain and improve scapular function through physical therapy approaches. Scapular joint mobilization and strengthening exercises were administered, resulting in reduced pain and increased shoulder joint range of motion. The study demonstrated that conservative management of the scapular joint and muscles had a beneficial effect on athletes with shoulder pain. Addressing scapular issues is crucial to enhance overall shoulder function and support athletes' performance. This research highlights the importance of recognizing scapular dyskinesia as a significant contributor to shoulder pain and advocates for holistic management strategies to aid athletes in their recovery.

Keywords: Joint mobilization; Motor control training; Shoulder pain; Scapular dyskinesia

1. INTRODUCTION

The improper movement of the scapular during shoulder movement is often forgotten cause of pain and dysfunction among athletes. It is frequent among athletes who engage with repetitive in overhead movement, with a prevalence of 61% (Burn et al., 2016). Dyskinesis is a comprehensive term that refers to the inability of the scapular physiology, mechanics and motion to function normally (Benjamin Kibler et al., 2012). It can be caused by a variety of circumstances, for example, thoracic kyphosis, clavicular fracture non-union, high-grade AC instability, glenohumeral joint internal derangement and cervical radiculopathy (Benjamin Kibler et al., 2012; Longo et al., 2020; Panagiotopoulos & Crowther, 2019; Sattasuk et al., 2021). However, the most common causes of scapular dyskinesis are soft tissue changes, including inflexibility or intrinsic muscle pathology (Gorji et al., 2022; Longo et al., 2020).

Alterations in periscapular muscle activation are observed in scapular dyskinesis patients (Benjamin Kibler et al., 2012; Longo et al., 2020; Panagiotopoulos & Crowther, 2019). Inflexibility and stiffness of pectoralis minor and short head of the biceps muscles create a pull on the coracoid which results in anterior tilt and protraction of scapular. Reduced serratus anterior activation and strength contributing to a loss of posterior tilting and upward rotation of scapular (Benjamin Kibler et al., 2012; Longo et al., 2020). Hence, the imbalance of scapular position and motion impacted the degree of freedom within each plane of shoulder mobility, resulting in shoulder pain (Benjamin Kibler et al., 2012; Panagiotopoulos & Crowther, 2019).

There are a wide range of physiotherapy approaches for patient with shoulder pain, however, the objective of this case study was to provide relief to the patient in terms of pain as well as the range of motion of the shoulder joint, which help in turn enhances the scapular function and overall shoulder function.

2. CASE DESCRIPTION

2.1 Case History

A 23-years-old male badminton player presented himself at Physiotherapy UiTM Clinic, reporting right shoulder pain and right scapular aching following a traumatic injury during playing badminton. During the smash, a loud click sound was heard. The patient immediately stopped playing badminton and applied ice to the shoulder to ease the pain. Since then, the discomfort persisted for 3 months, and he had difficulty using his right hand.

Prior to the onset of shoulder pain, the patient did not have any shoulder pain and actively participated in sports, for example badminton, futsal, and gym. Unfortunately, since experiencing shoulder pain, he was unable to play badminton and had limitation in lifting heavy objects. Patient was a

student from the Faculty of Hotel and Tourism Management, UiTM. He found his shoulder injury caused limitation in lifting heavy object during practical class and he needed to avoid certain movements during the class. However, he had no difficulty in managing his daily activities such as bathing, wearing clothes and other functional activities. His family was aware of his condition and advised him to get treatment as soon as he could.

The patient presented with mild C-shaped scoliosis at lower thoracolumbar level, with right concavity and left convexity. He reported that he only suffered lower back pain when sitting for lengthy periods of time (NRS: 2/10), which he said was tolerable with stretching exercises (NRS: 0/10). He received physiotherapy treatment for scoliosis from late 2018 till early 2019 at Sultanah Bahiyah Hospital. He was not aware he had scoliosis until he received the X-ray report for Universiti Teknologi MARA (UiTM) entry procedure.

2.2 Patient Understanding of their own problem

He acknowledged and understood that the shoulder pain symptoms highly correlated with sport injury and might have contributed to his scoliosis. Since then, he took a break from sport activities and avoided heavy lifting as it might improve the recovery process of his shoulder.

2.3 Patient's expectations and goals

The patient sought therapy to rehabilitate his shoulder injury before starting an internship involving heavy lifting and managerial duties. Proper rehabilitation, targeting specific impairments, and early planning for appropriate exercises were emphasized to ensure a successful recovery and fitness. The goal was to correct muscle stiffness and weakness, allowing him to return to the gym and prepare adequately for his upcoming responsibilities.

2.4 Body chart

During his first visit, he complained of sharp pain at right shoulder joint (referred to as P1) with numeric pain rating scale (NPRS) score as 6 out of 10 when completing any overhead motion and the pain increased during physical activities like badminton, workout, any overhead motion and heavy lifting during practical session of hotel management course with NPRS score of 8 out of 10 and side lying on right shoulder with NPRS score of 7 out of 10. He did not consume any pain killers but only rested or repositioned his shoulder to ease the pain. The pain would reduce immediately to a score of 2 out of 10 upon repositioning, however, it would remain consistent. He also complained of aching pain at right scapular (referred to as P2) upon prolonged sitting (3 hours) with NPRS score of 4 out of 10 and he would lie down to ease the pain, with NPRS dropping to 0 within 10 minutes. Figure 1 provides a detailed overview of the pain assessment findings.

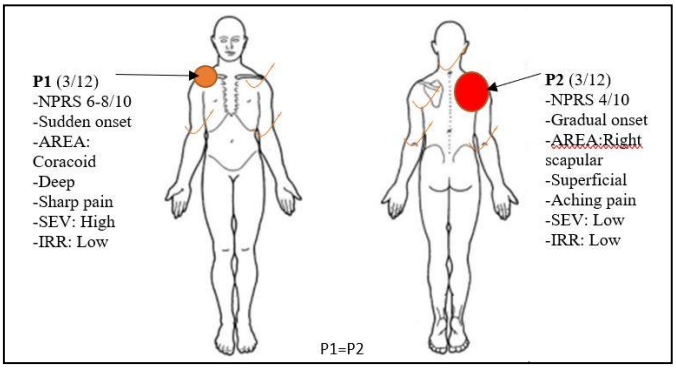

Figure 1: Body Chart

2.5 Objective examination

The patient was presented with a normal gait upon entering the physiotherapy department. However, patient had a faulty posture while sitting. It was observed that patient had a forward neck with a slouched posture. When he was in standing position, it was observed that he had dropped right shoulder, right scapular winging, a C-shaped scoliosis, hyperlordosis at lower thoracolumbar level, and his right hip tilted and rotated to left. Due to the C-shaped scoliosis and hyperlordosis, he prone to lean his body weight to the right side. There was no redness, contusion, or swelling observed on the shoulder joint. Following that, the range of motion of the shoulder joint was accessed using goniometer and the details are recorded in Table 1.

Next, accessory motion was assessed in the glenohumeral (GH) joint, acromioclavicular (AC) joint, and scapulothoracic (ST) joint. The GH and AC joints showed normal mobility without any symptoms. However, the ST joint, particularly its inferior and medial glide on the right scapula, exhibited reduced mobility. Muscle power assessment was performed using manual muscle testing (MMT) on the upper trapezius, middle trapezius, lower trapezius, rhomboid, and serratus anterior. Grade 3/5 was observed on the right side compared to the left side (grade 5/5). Specifically, the upper and middle trapezius showed weakness, accompanied by aching pain in the anterior region of the right shoulder. The lower trapezius weakness caused nagging pain in the scapula area. Additionally, weakness was noted in the rhomboid and bilateral serratus anterior, although no symptoms were reported.

During the palpation assessment, no tenderness was observed in the shoulder muscles, but bilateral upper trapezius muscles showed spasms, and the right pectoralis major and minor muscles were tight. To measure the length of the pectoralis minor, the patient was positioned supine, and measurements were taken from the acromion to the plinth. The right pectoralis minor measured 10.5 cm, while the left side measured 8 cm, indicating greater tightness in the right side.

Table 1. Range of motion of right shoulder

Range of motion (ROM)	Active ROM			Passive ROM	
	Range	OP	Findings	Range	Findings
Flexion (F)*	0 - 175°	0 - 180°	NPRS 4/10 at 175°	0 - 180°	NPRS 4/10 Click at ER
Extension (E)	AFROM	-	-	-	-
Abduction (Ab)*	0 - 130°	0 - 150°	NPRS 5/10 at 130°, NPRS >130°+	0 - 150°	NPRS 6/10
Internal rotation (IR)*	0 - 70°	0 - 90°	NPRS 2/10 at 90°	PFROM	NPRS 2/10
External rotation (ER)	AFROM	-	-	-	-
Combine movement* (F, Ad, ER)	-	-	-	F: NPRS 4/10 + Ad: NPRS 4/10 + ER: -	

- AFROM of left shoulder at all planes.
- OP: Overpressure;
*evaluate the movement after the treatment and following visit

To have a better understanding of the patient's circumstances, shoulder pain and disability index (SPADI) had been used on the first assessment to measure current shoulder pain and disability. The SPADI contained 13 items that assessed two domains: pain (5 questions) and disability (8 questions) (Agostinho et al., 2020; Breckenridge & McAuley, 2011). SPADI establishes good construct validity, and correlates well with other region-specific shoulder questionnaires (Kromer, 2021). In fact, it has high internal consistency with Cronbach α typically exceeding 0.90 (Breckenridge & McAuley, 2011; Hill et al., 2011). The first assessment revealed that the pain score was 15/50 and the disability score was 12/80. These findings indicate that the score is low, and that the prognosis is favorable.

2.6 Treatment

The case underwent a three-week period, after which the treatment commenced based on the assessment result. The treatment details were presented in Table 2.

On the third visit as in Table 3., patient claimed the pain at the shoulder joint during overhead motion and sleeping on the affected side reduced from 8/10 to 4/10, while the aching pain at scapular during prolong sitting reduced from 4/10 to 0/10, however, there was no significant changes in range of motion of shoulder joint. Therefore, the prior strengthening exercises were supplemented with scapular MWM and soft tissue manipulation (STM).

Upon evaluation, MWM and STM help to improve shoulder joint range of motion. Throughout the session, patient education was provided on good posture, the pathophysiology of the condition, process of healing, and the benefit of exercises. Providing health education for patients is indeed essential in building a good attitude and habits related to exercises. Besides, health education also can identify the barriers to exercises such as time, motivation and types of exercises are suitable for them (Miñana-Signes et al., 2021).

Table 2. Treatment for patient at week 1 & 2

Purposes	**Treatment**
To reduce pain	**ST joint mobilization** Grade: II (Maitland's) Direction: Inferior and medial glide Repetition: 60 oscillations, 3 sets Grade: II (Maitland's) Direction: Inferior and medial glide Repetition: 60 oscillations, 3 sets
To improve mobility of scapular on thoracic plane.	**ST joint mobilization** Grade: III (Maitland's) Direction: Inferior and medial glide Repetition: 60 oscillations, 3 sets
To increase scapular muscular strength	**1. Serratus anterior strengthening exercises – against the wall exercises** Position: standing F: 3x/day I: 10 times, 3 sets T: - T: Closed kinetic chain strengthening exercises

	2. Rhomboid & middle trapezius exercises – wall push up Position: Standing F: 3x/day I: 10 times, 3 sets T: - T: Closed kinetic chain strengthening exercises
	3. Lower trapezius exercises Position: Sitting F: 3x/day I: 10 sec hold, 10 times, 3 sets T: - T: Resistant band strengthening exercise
Home exercise program	1.Serratus anterior strengthening exercise- - against the wall exercises 2.Rhomboid & middle trapezius exercises – wall push up 3.Lower trapezius exercises

Table 3. Treatment and evaluation for patient at Week 3.

Purposes	**Treatment**	**Evaluation (ROM/ NPRS score)**
To improve mobility of scapular on thoracic plane.	**ST joint mobilization (Mulligan's)** Direction: Inferior and medial glide with shoulder flexion. Repetition: 10 times sustain glide, 3 sets.	Flex: AFROM / ERP 1/10 IR: AFROM / ERP 1/10
To improve pectoralis muscle flexibility.	**STM** Type: Deep stroking Area: Pectoralis minor Duration: 10 mins	Abd: 0 – 150° / ERP 1/10
To improve patient awareness	**Patient Education** Educate on a good posture, pathophysiology of the condition, process of healing and beneficial of exercises	Patient understood regarding of his condition and improve in patient's awareness

3. DISCUSSION

From the assessment, the shoulder pain is likely caused by muscle strain due to trauma secondary to right scapular dyskinesis. Even though the incident occurred three months earlier, the pain signals are still firing, which could explain the severity of the pain. Apart from the trauma, the other contributing factor to the shoulder pain is winging of the right scapular, which is known as scapular dyskinesia, indicating a muscle imbalance. In fact, scapular dyskinesis could be the main culprit for experiencing shoulder pain during any overhead motion. The alteration of scapular affects the efficiency of shoulder function in numerous ways, resulting in alteration in 3D GH angulation, AC joint performance, maximal muscle activation and optimal arm position and motion (Benjamin Kibler et al., 2012; Kibler et al., 2021).

Normally, the ratio of GH to ST motion in active arm elevation to 90° is around 2:1(Kolz et al., 2021). As the limb is elevated, the scapular center of rotation migrates proximally and laterally from the midportion in the first 30° of elevation towards the glenoid base in the next 60°. The coracoid and acromion processes shift superior and posterior at the same time, increasing the distance to humeral impingement (Panagiotopoulos & Crowther, 2019). But, during scapular motion, it was discovered that patient had reduced upward rotation and external rotation during arm elevation. It was correlate with scapular accessory motion finding, which it had reduced mobility in medial and inferior glide.

As a result of faulty scapular position, patient would feel discomfort when executing any overhead motion especially in abduction motion (NRS 5/10 at 130°), as it may increases in anterior capsular tension and shear with increase posterior labral compression (Kibler & Sciascia, 2019a). Besides, because the normal ratio of GH to ST movement in abduction is 5:4 (Jiang et al., 2020; Jildeh et al., 2021), hence, any improper scapular posture produces shoulder abduction motion in pain.

Therefore, joint mobilization for the ST was performed to improve the efficacy of the shoulder joint (Agarwal et al., 2016; Boruah, 2015). Maitland's joint mobilization restores the range of motion by applying a specific, oriented glide manually to a painful joint with a specific force intensity in relation to joint resistance (Lirio Romero et al., 2015; Satpute et al., 2022), while MWM technique is mainly depending on patient response. There is no specific grading system for force and amount of movement in MWM (Wang et al., 2022). MWM is based on the concept that minor position faults occur in articulating surfaces of joints following injury or strains. These faults can lead to movement restriction and pain, which are often worsened by the active contraction of muscles within the incorrect joint position. Hence, by applying accessory glide as corrective technique may correct the faulty position combined with the offending movement being perform actively by the patient and sustained for several repetition, the pain and function should be restored (Rao et al., 2018; Satpute et al., 2022). From the finding, MWM for ST joint improved ROM of the shoulder immediately compared to Mainland's joint mobilization. This suggests that improvement may also related to less force than other manual therapy and neuropsychological influence rather than a mechanical effect on capsular and ligamentous extensibility (Rana et al., 2021; Satpute et al., 2022).

The scapular stability and mobility are maintained by the upper and lower trapezius muscles, as well as the serratus anterior (Benjamin Kibler et al., 2012; Briel et al., 2022;

Jildeh et al., 2021; Panagiotopoulos & Crowther, 2019). When the trapezius and serratus anterior muscles contract, the scapular tilts upward. As the arm elevates above 90°, the lower trapezius activates and maintains scapular upward rotation, while the serratus anterior stabilizes the scapular medial border against the thorax, acting as a scapular external rotator. The lower trapezius muscle eccentrically activates to control excessive anterior tilted and is necessary in the descent of the arm from a position of maximal elevation (Kibler & Sciascia, 2019b; Phadke & Ludewig, 2013; Struyf et al., 2014). Because the patient had weakness in the upper trapezius, lower trapezius, and serratus anterior, it was observed that there was a delay in serratus anterior and lower trapezius activation while lifting and lowering the hand. Therefore, specific muscle strengthening exercises for scapular muscle are essential in shoulder rehabilitation to recorrect the scapula mobility pattern. In fact, strengthening exercises enhance hypertrophy and strength which benefit in tissue remodelling (Ferraro et al., 2014; Wilk et al., 2020), while closed kinetic chain exercises benefit in enhancing joint stability, stimulating co- activation and proprioception (Jaggi & Alexander, 2017; Kobesova et al., 2015).

In addition, the intrinsic muscle, pectoralis minor assists the serratus anterior muscle in anterior tilt, internal rotation, and protraction when the arm is in lower levels of elevation (ie, <60° of abduction). The weakness of the lower trapezius may lead to the excessive anterior tilting of the scapula, which, in turn, can result in inflexibility of pectoralis minor (Benjamin Kibler et al., 2012; Kamonseki et al., 2021; Pascoal et al., 2023). The inflexibility of the pectoralis can also lead to an abnormal humeral position, resulting in reduced humeral mobility (Anneli Lebert, 2017; Benjamin Kibler et al., 2012), as evidenced by the patient's limitations in abduction and internal rotation. Hence, beside than strengthening the lower trapezius, applying STM to the pectoralis muscles can enhance muscle flexibility and contribute to restoring the proper position of the GH joint.

4. CONCLUSION

Scapular dyskinesis, a common cause of shoulder pain and disability, involves limited scapular motion during arm movement. Patients often experience delayed activation of middle and lower trapezius and serratus anterior muscles. Conservative management, including scapular mobilization and strengthening exercises, proved effective in reducing pain and improving mobility in this case study. Health education is also crucial to promote good attitude and habits towards exercises. Nonetheless, this case study had some limitation due to the absence of the numerical result, which implies the potential utility of handheld dynamometer (HHD) and body surface electromyography (EMG) for future study.

ETHICAL CLEARANCE

The patient was informed, and written consent was taken.

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