Case report

Sub Acromial Debridement Surgery with Acromioplasty for Chronic Shoulder Pain - Biomechanical Challenges in Physical Rehabilitation

Leonard JH (✉)[1], Siti Salmiah MD[2], Das S[3], Vikram M[4], Ayiesah HR[1]

[1]Program Physiotherapy, Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur
[2]Department of Physiotherapy, Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur
[3]Department of Anatomy, Universiti Kebangsaan Malaysia Medical Centre, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur
[4]Department of Physiotherapy, Faculty of Health Sciences, Universiti Teknologi Mara, Puncak Alam, Selangor

Abstract

Arthroscopic sub acromial debridement surgery with acromioplasty is one of the shoulder surgeries performed to treat chronic shoulder pain. This surgical procedure is usually indicated in sub acromial impingement syndrome of shoulder, degenerative rotator cuff tears, severe functional limitation of shoulder joint and often surgery was performed in cases where all the conservative management had failed in the treatment of chronic shoulder pain. Even though the patient would be referred for early rehabilitation, post operative management of this surgical condition is highly challenging. Movement of the shoulder joint is often related with scapulo-thoracic joint, acromio-clavicular joint and sternoclavicular joint and the shoulder movements are governed by various different muscular forces from these joints. Failure to understand this biomechanical complexity of shoulder joint during post operative rehabilitation results in failure of the surgical outcome and might cause severe functional limitation with recurrent shoulder pain. Often in clinical practice, greater emphasis is given to achieve and regain movements in shoulder joint at the expense of the joint stability. However, inadequate scapular stability might further predispose the shoulder joint to excessive loading and results in repetitive injuries leading to chronic shoulder pain. This might affect the surgical and clinical outcome of the acromioplasty and result in surgical failure. Hence, surgeons and clinicians need to understand the biomechanical contributions in the post operative rehabilitation of the shoulder joint. The present case report emphasises the biomechanical model of post operative rehabilitation of a patient who had arthroscopic sub acromial debridement with acromioplasty.

Keywords: Shoulder, pain, impingement syndrome, biomechanics, rehabilitation, scapular instability

Correspondence:

Mr. Leonard Joseph Henry, Lecturer, Program Physiotherapy, Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia,, Jalan Raja Muda Abdul Aziz, Kuala Lumpur 50300
Tel: +6030196781935 Fax: +0326898199 Email: leonardjoseph85@hotmail.com

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Introduction

Shoulder pain is a frequent complaint in the population with the prevalence ranging between 70-260/1000 (1). Arthroscopic subacromial debridement and acromioplasty are well accepted surgical techniques for the management of chronic shoulder pain and impingement syndromes (2). However, followed by the surgical procedure, the clinical outcome and rehabilitation is very challenging due to the biomechanical complexities of the shoulder joint and related structures. More frequently, patients complain of high recurrences of shoulder pain in spite of shoulder surgery due to inadequacies among clinicians in understanding the biomechanics of shoulder-scapulo-thoracic joint and its role in post operative rehabilitation.

This case study discusses the biomechanical complexities of scapulo-thoracic and shoulder joint related to post operative rehabilitation of subacromial debridement and acromioplasty and outlines a biomechanical approach for clinicians for the post operative management.

Case report

A 48-year-old male construction worker presented with pain in the right shoulder joint. There was no radiation of the pain. History revealed no prior injury or trauma to the shoulder. To begin with, 4 years ago, he experienced the pain for the first time. He first experienced shoulder pain in 2006 and the pain progressively increased, since then. This pain aggravated over the past four years. He was prescribed with analgesics, anti-inflammatory, steroids and physiotherapy by the local physician. The pain did not subside rather it progressively worsened. Four months ago, the evaluation of the pain by an Orthopedician revealed Visual Analogue Scale (VAS) 8/10. The patient complained of severe pain in the anterero-lateral aspect of the right shoulder joint during head activities. He complained of the inability to lift a bathing mug filled with water due to severe muscle weakness on the right arm which completely ceased his daily living activities. It made him discontinue his work and forced him to seek medical advice. Patient was referred for ultrasound scanning of the shoulder joint. The report showed severe degeneration of the supraspinatus tendon with calcification and development of secondary osteophytes at the subacromial joint space. As there was no previous history of any injury, the nature of the construction work which involved repetitive overhead activities might have contributed to the symptoms of the patient. Eventually, it worsened t to a degenerative tear of the supraspinatus tendon. The movements in the right shoulder diminished, which compelled the patient to undergo surgery. One month later, arthroscopic subacromial debridement with acromioplasty was performed and the patient was referred to physiotherapy for rehabilitation.

On static observation of the shoulder joint, the right shoulder joint was resting at higher level than the left side. Shoulder movements examination revealed that the patient was using abnormal motor control of the right shoulder joint. He elevated the shoulder girdle prior to the onset of movement in the glenohumeral joint. This abnormal motor pattern indicated a lack of muscle control of scapular stabilisers and rotator cuff muscles. Range of motion examination of the right glenohumeral joint indicated that the patient had marked restrictions of movements in right shoulder joint with flexion and abduction (Table. 1). Muscle power assessment by Oxford muscle power grading showed reduced muscle power (2/5) in all the right rotator cuff muscles.

Examination of scapula thoracic joint was considered after identifying abnormal biomechanics of shoulder girdle and scapula. Static examination of the scapular position on the thorax showed that the right scapula presented with winging and anterior tipping/tilting of the superior border of scapula. The scapula was positioned more laterally on the thorax. The distance between the spine and medial border of scapula was 4.7 cm on the right side, while it was 3 cm on the left side. The above scapular findings prompted led to the examination of the motor control of scapula. Therefore, muscle length and strength examination of the scapula stabilizers was performed. It showed reduced strength in the rhomboids, mid and lower trapezius on right side with a tight right upper trapezius. Movement examination of the scapular mechanics during shoulder movements showed that the axis of rotation at the scapula was shifted more laterally towards the acromion. Reversed scapular humeral rhythm was noted whereby two thirds of movements occurred in scapula-thoracic joint rather than in the gleno-humeral joint. Hence, this abnormal biomechanics of scapula and poor motor control of scapula thoracic joint in relation to the glenohumeral joint might contribute to the shoulder pathogenesis. If not corrected, it also could affect the outcome of the surgery for this patient. Therefore, considering the treatment, it was decided to focus on scapular neuromusculoskeletal control followed by movement rehabilitation for the shoulder joint.

Date	15 Aug 2010				5 Sep 2010				20 Oct 2010			
	Right		Left		Right		Left		Right		Left	
Active/Passive motion	A	P	A	P	A	P	A	P	A	P	A	P
Shoulder:												
Flexion	0-30	0-90	N	N	0-110	0-135	N	N	0-117	0-140	N	N
Flexion	0-15	0-30			0-30				0-45	0-60		
Abduction	0-25	0-40			0-75				0-85	0-90		
Internal rotation	0-10	0-10			0-50				0-78	0-80		
External rotation	0-10	0-15			0-50				0-60	0-75		
Elbow:												
Flexion-extension	N	N			N	N	N	N	N	N	N	N

Table 1. Post operative range of motion assessment of shoulder joint

Exercises were taught to the patient to actively contract the scapular in the plane of scaption (abduction in 30-45 degrees forward in the horizontal plane). As the patient was not able to isolate the correct motor pattern of scapular muscle contraction, proprioceptive tapping was applied with scapula held in the infero-medial and caudal position. Patient was also taught to perform isometric holding of the scapula in caudal position as part of home exercises programme. Tapping was removed after 48 hours as the kinesthetic sense of the scapula improved. Then, the patient was able to selectively perform scapular movements in the infero-medical-caudal plane. With the proprioceptive control achieved, rhythmical stabilisation exercises for the scapular stabilising muscles were started. The result was that the patient was able to actively glide down and hold the scapula to the thoracic wall with no scapular winging and tipping.

Meanwhile, shoulder joint mobilization was started with the main emphasis to improve flexion and abduction movements. The treatment progressed with emphasis to the isometric holding of the glenohumeral joint in multiple planes and ranges while the scapular control was carefully maintained. As the patient`s scapula was getting more stable in the joint, a larger range of shoulder movements were started. The scapula started to disassociate itself from the glenohumeral joint and remained stable on the thoracic wall indicating a normal scapula humeral rhythm. It was also observed that the axis of rotation at the scapula started to initiate at the root of the spine of scapula similar to normal scapular mechanics. Also, the range of movements in the glenohumeral joint increased without any elevation of the shoulder girdle during shoulder movements. It showed good motor control and biomechanics of the shoulder joint.

The pain during movement was much reduced (VAS 2/10). Also, the range of motion of the shoulder joint improved progressively. Therefore, the exercises progressed by adding resistance to the movements using theraband and sand bags. During the movements with resistance, the scapular control was monitored. The patient was also given verbal cues to improve motor control of scapula-humeral mechanics. After the resistance exercises, specific movements which are similar to daily functional activities were given to the patient. The movements further progressed to increased repetitions and resistance. The patient did not report any swelling or increased pain in the shoulder joint during these exercises. Hence, the patient was discharged with advice to continue the exercises at home.

Discussion

This case presented a treatment model for post-operative shoulder rehabilitation followed by subacromial debridement surgery and acromioplasty. In general practice, exercise prescription for shoulder pain usually involves mobilisation exercises and strengthening exercises for the shoulder joint. The clinical importance of training the scapular muscles and scapula stability for shoulder mobility may be often missed. It might explain why the present case was not treated with the scapular biomechanical approach prior to surgery. Furthermore, the interaction between flexibility, strength, fatigue, muscle inhibition, proprioception and muscle patterning in the management of shoulder pathogenesis is complicated and poorly understood among clinicians. (3) Therefore, the biomechanical factors that were contributing to the rehabilitation and surgical outcome of the operated shoulder were presented in this case report. Chronic shoulder pain might occur as a result of either primary or secondary impingement in shoulder. Primary impingement occurs when the sub acromial space is decreased due to anatomical anomalies such as os acromiale and osteophytes.(3) On the other hand, secondary impingement in shoulder is caused due to the abnormal biomechanics of scapulo-thoracic and glenohumeral joints (4). This abnormal biomechanics might result in subacromial space crowding and microvascularity deficits on rotator cuff muscles eventually causing shoulder pain and dysfunction (4).

Subjects with shoulder impingement had greater elevation of scapula and lesser peak scapular posterior tipping (5). Furthermore, increased muscle activity of upper trapezius and serratus anterior had been correlated with elevation of the scapula and tipping of the scapula (5). Therefore, assessing scapular elevation during arm elevation might be a useful functional marker for evaluating impingement status and associated muscle function of scapula. In our patient, similarly altered motor patterns and scapular control was identified. The muscle strength of the upper trapezius was stronger and the muscle length was shorter which showed adaptive shortening and compensation. Hence as a part of treatment, balance in the muscle strength and length was restored between upper trapezius and its antagonists i.e. lower trapezius and serratus anterior which also act as the scapular stabilizing muscles (6). Furthermore, the plane of scapula was important in the biomechanical rehabilitation of shoulder impingement. Plane of scapula is often considered to be approximately 30 degrees anterior to the frontal plane and vertical to the horizontal plane (scaption), where the head of humerus lays centre of the glenoid. Therefore, changing the plane of the scapula automatically changes the position of the glenoid and relative position of the humeral head which would affect the shoulder movements.(3) In this context, biomechanical and motor control of scapula was necessary for the safe function of the glenohumeral joint (7).

Retraining of scapular stability was an integral part of rehabilitation of the patients with shoulder pain (8). The stability of scapula was proposed to achieve by four stages such as facilitation of scapular stabilising muscle contractions, isolated shoulder movements in different ranges upon stable scapula, larger range isotonic shoulder movements over stable scapula and finally, progressive loading of shoulder movements with resistance upon stablising the scapula (3). Identifying exercises that produce high levels of serratus anterior activation and low levels of upper trapezius activation might be effective in the prevention of treatment of secondary shoulder impingement (9). Furthermore, shoulder function was a compromise between stability and mobility (10). Adequate scapular stability was prerequisite for an effective mobility of the shoulder joint and for prevention of over loading and injuries to the joint (11). Therefore, adequate stability is important before attempting to work on the mobility of the shoulder joint in the post operative rehabilitation.

It was interesting that the patient gained almost more than three fourth of the range of motion in a period of three weeks (Table 1). The case was presented for the same reason as the recovery process was quicker and faster when the post operative rehabilitation were considered with a biomechanical approach to scapula along with shoulder rehabilitation. It would be difficult to predict that the claimed therapeutic benefits were purely out of surgical intervention or due to the exercise approach used for this patient. However, it needs to be acknowledged that no randomised trials were available to comment on the efficacy of this biomechanical rehabilitative approach adopted in this case. Nevertheless, this case reported a faster prognostic recovery after the surgery and it might induce future research directions for many clinicians. Perhaps, the humble opinion was that the incidence of cases which need shoulder surgery might be reduced if a similar approach was used during the conservative physiotherapy management.

Conclusion

Hence, we opine that the present case threw much light on the understanding of the contribution of biomechanical factors related to scapulo-thoracic joint and glenohumeral joint. Proper understanding of such facts may be beneficial for the clinicians and physiotherapists in planning post operative rehabilitation subacromial debridement and acromioplasty.

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