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A Customised Protocol for Shoulder - A New Era in Shoulder Rehabilitation

Leeladhar Kaushik[1], Prashant Singh[2], Parshuram Shukla[3]

[1]MPT Neurology, Incharge Physiotherapy at Yashoda Medicenter, Karkardooma

[2]MPT Neurology, Team Leader at Yashoda Superspeciality Hospital, Kaushambi

[3]Heart - Lungs Transplant Physiotherapist, MPT Cardiopulmonary, Assistant Professor, Department of Physiotherapy, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun

Abstract: ***The shoulder emphasizes the synchronized movement of four joints: glenohumeral, scapulothoracic, sternoclavicular and acromioclavicular. As the humerus moves into elevation, movement must occur at all four joints. This joint movement has been described as the joint arthrokinematics, or the intricate movement of the joint surfaces. Normal arthrokinematic movements occur only in the presence of normal periarticular connective tissue, extensibility, and integrity and muscle function. A stiff shoulder has limited capsular flexibility and altered muscle function. In order to re - establish harmonious movement within the shoulder complex the therapist must rehabilitate the connective tissue by restoring its extensibility, and restore normal balance of muscles. The deltoid muscle is often forgotten when it comes to the evaluation and planning of treatment in shoulder conditions. Shoulder dysfunction, rotator cuff tendinopathy, and frozen shoulder are the conditions that affect functioning in major cases. This study involved an exploration of possible causes of dysfunction, especially pain and overhead activities. The patient presented with acute pain and decreased shoulder function. A suitable shoulder rehabilitation program was designed keeping the deltoid muscle denervation into consideration. The shoulder pain, range of motion, strength, and function were evaluated on day one, followed by weekly assessment for seven weeks. The results were correlated and explored to identify the involvement of the deltoid muscle. There was a clinically significant improvement observed in the patients' function. Hence, the study hypothesized that along with scapular stabilization, it is important to consider deltoid equally during the assessment and treatment plan in shoulder rehabilitation program.***

Keywords: shoulder movement, joint arthrokinematics, deltoid muscle, shoulder rehabilitation, scapular stabilization

1. Introduction

The shoulder complex, muscles provide a stable base for the upper limb movements, it is important that the stability of scapula is essential to carry out an efficient function. When there is a loss of stabilization factors due to various reasons, the shoulder complex is susceptible to instability and dysfunction.

Rotator cuff tears are the most common cause of shoulder disability, and the muscles of the rotator cuff are some of the most common injured tendons in the human body. The rotator cuff is comprised of supraspinatus, infraspinatus, teres minor, and subscapularis muscles. These muscles are responsible for various movements of the upper extremity (UE). The force applied by these muscles provide stability to the shoulder joint by holding the humeral head in the glenoid fossa of the scapula. The supraspinatus tendon is the most commonly torn rotator cuff tendon.

Shoulder pain is the third most common musculoskeletal complaint worldwide.

1) India, with its 1.3 billion population, represents a potential caseload of rotator cuff (RC) tears in the millions.
2) The prevalence of rotator cuff tear in the general population was 21%, which increased with age. Asymptomatic tear was twice as common as symptomatic tear.

A RCT may be a result of an acute injury or may be caused by the normal wear down of the tendon. Repetitive overhead motion, poor posture, and failure of the subacromial bursa to protect the supporting tendons results in a progressive injury from acute inflammation, to calcification, to degenerative thinning, and lastly, to a tendon tear.

Rotator cuff tears are labeled as either partial or full - thickness. Partial rotator cuff tears can be classified by location (articular or bursal), the tendons involved (supraspinatus, infraspinatus, subscapularis, and teres minor), and the size of the tear (represented in millimeters and percentage of tendon thickness). A grade I tear is defined as 6 mm (>50%). Identifying the appropriate classification and understanding the interplay of ligaments, joints, and muscles of the shoulder complex is crucial for guiding treatment.

2. Case Report

The patient was a 69 - year - old right hand dominant female referred by her primary care physician Dr. Avnet, Yashoda Super Specialty Hospital Kaushambi, Ghaziabad to physical therapy department of Yashoda Medicenter, Karkardooma with a medical diagnosis of right partial rotator cuff tear as a result of fall at home with magnetic resonance imaging (MRI) performed, revealing a moderate tendinosis of supraspinatus, subscapularis and infraspinatus tendons with areas of fraying and low grade interstitial tear without full thickness tear. She presented with chief complaints of right shoulder pain, specifically with overhead activities, sleeping (worst pain), and while performing activities of daily living (ADL's). The patient also reported tenderness over the gleno - humeral joint. The patient altered her sleeping position which meant that she avoided sleeping on right side due to pain.

The patient has medical history of hypertension since 2018 and is also a left kidney donor in 2013. History of cancer, thyroid disorder, diabetes mellitus (DM), and psychological factors were denied as per the patient intake form. She also denied any previous mechanism of injury to her right shoulder or neck.

Patient Evaluation and Treatment Planning

The Patient was interviewed with detailed subjective evaluation before starting of the exercise program. The client could not perform activities of daily living involving reach to the back by the right hand, and she complained about the difficulty in overhead activities and pain limiting the function. The initial evaluation of pain assessment, postural deformity, muscle strength, and ROM evaluation was recorded and documented. The sensation over the neck and upper limb was intact. In the outcome measure, the Shoulder Pain and Disability Index (SPADI) of 92.3% was reported. In pain level, initial intensity of the pain was VAS 9 out of 10, the characteristics were acute sharp shooting pain and most of the time patient experienced pain in the morning time, aggravating factor was due to stretch, weight lifting, sleeping on the affected side, and relieving factors were rest and heat application.

On observation, marked swelling was present around the shoulder joint. The posture assessment on the postural grid depicted a protracted and elevated shoulder on the right side, also winging of the scapula was noticed. The shoulder ROM during flexion, extension, abduction, and external and internal rotation was limited with a empty end feel. Special tests for the shoulder were done to identify the underlying pathology. Empty can test, akimbo test, were considered positive, these were in turn the interpretation of patient and the impingement of supraspinatus and biceps were possibly confirmed, with joint capsule involvement. Correlating the finding of special tests and kinetics, possibly a compression at the quadrilateral space may be considered for further evaluation. The presenting symptoms of the patient were acute pain and weakness in the shoulder–glenohumeral abduction and external rotator, without numbness to the lateral shoulder area. Thus, leading to a hypothesis of the involvement of the middle deltoid and the AN, this may be caused due to primary shoulder impingement syndrome, caused due to faulty shoulder position.

Baseline tests and follow - up were conducted before the start of the exercise program. The tests are joint ROM, muscle strength, VAS, SPADI Scaling. The follow - up tests were conducted every week for seven weeks, the exercise program was changed for consecutive sessions based on the assessment using the same test methods.

Rehabilitation Program

Visual Analog Scale

The level of subjective pain was measured using VAS when the shoulder joint was moved, with 10 as the highest level of pain. Pain at the shoulder joint before the exercise was 9, and the pain level reduced to 7 in 7 days and to 5 in 4 weeks at the maximum joint range.

Muscle strength and function

The significant improvement in muscle strength was noted in shoulder flexors (anterior fibers of deltoid, long head of biceps, and supraspinatus) with a difference of 01 grade (Manual muscle testing) and similarly in biceps muscle. However, the strength of shoulder extensors, abductors, internal rotators, and external rotators showed improvement, it was negligible as the difference was 0.5 grade. The results of the strength measured by manual muscle testing. Improvement in function was achieved; SPADI outcome was noted at 92.3% in the baseline and 21.5% in the posttest.

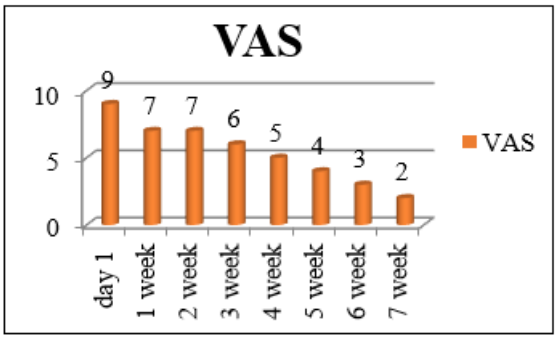
The measurements were taken in the following order: shoulder flexion, extension, abduction, internal and external rotation. Joint motion observed an increased range in all movements with an evident increase in shoulder internal and external rotation. The results of the ROM of shoulder joint are shown in Table 1.

WEEK	Flexion	Extension	Abduction	Internal Rotation	External Rotation
Day 1	0 - 20%	0 - 10%	0 - 20%	0 - 10%	0 - 10%
1 week	0 - 30%	0 - 15%	0 - 30%	0 - 15%	0 - 15%
2 week	0 - 45%	0 - 20%	0 - 45%	0 - 20%	0 - 20%
3 week	0 - 70%	0 - 30%	0 - 70%	0 - 30%	0 - 30%
4 week	0 - 90%	0 - 45%	0 - 90%	0 - 40%	0 - 40%
5 week	0 - 110%	0 - 50%	0 - 110%	0 - 50%	0 - 50%
6 week	0 - 115%	0 - 50%	0 - 115%	0 - 55%	0 - 55%
7 week	0 - 120%	0 - 55%	0 - 120%	0 - 60%	0 - 60%

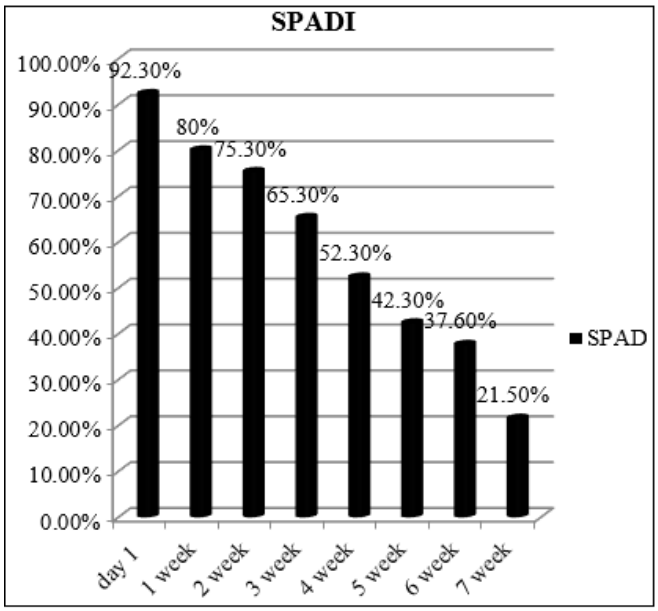
The exercise program was composed of 8 weeks, planned in seven phases, which included the baseline tests and every week follow - up tests.

1) Cryo - therapy using cry - master (co2 based) was applied for two - three minutes daily for 2 weeks
2) To reduce the pain at right shoulder combination therapy (ultrasound therapy (3 MHz) + TENS) around the shoulder joint for 10 minutes, passive electrode placement was over the deltoid tuberosity of the humerus.
3) For posture re - education kinesiology taping was initiated over the clavicle and spine of the scapula for posture re - education for 2 - 3 days and then corrective measures were taken for winging of scapula.
4) Strengthening exercises comprised.
   - Muscle setting exercises (isometrics)
   - Passive and active stretching of pectorals and biceps muscle
   - Horizontal abduction was planned to improve eccentric contraction of retractors and active stretching of pectorals (10reps × 3 sets)
   - Shoulder Active range of motion exercises in supine and sitting
5) Exercises were progressed to PNF (Proprioceptive neuromuscular facilitation) D1 - D2 pattern. (10reps × 2 sets)
6) Progression for postural re - education after swelling subsidy was done for anterior and middle deltoid muscle.
7) Home exercise program with plans to improve the retractor strength and shoulder mobility and strength was planned for 5 days/week
8) Safe lifting techniques and ergonomic measures were advised

3. Results



1) The VAS Score drastically reduced from 9 at the baseline to 2 at the end of 7 weeks. Though it remained stagnant at 7 at the end of week 1 & 2 due to swelling at the injury site as the injury was acute. Followed by reduction by 1 point each as the therapy progressed with initially cryo - therapy, Ultrasound and combination therapy for pain and swelling.



2) SPADI SCORE: The SPADI score was calculated following calculation of Pain and Disability Score. The score was 92.3% at the baseline and 21.5% at the end of 7 weeks. The therapy sessions included pain management, Tapping, ROM Exercises to limit Disability followed by advancement in exercises to improve strength and combining sessions with Activities of Daily Living (ADL).

4. Conclusion

The study showed a positive test of deltoid muscle involvement, which was identified through the Empty can and akimbo test. There was a clinically significant improvement observed in the patients' function which is proved via the ROM analysis and the SPADI Score. Hence, the study hypothesized that along with scapular stabilization, it is important to consider deltoid equally during assessment and treatment plan in shoulder rehabilitation program.

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