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# Effects of Scapular Motor Control Training versus Scapular Retraining Along with Mobilization on Pain and Functional Status among Construction Workers

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## ABSTRACT

Repetitive or sustained shoulder elevation during occupational tasks has been identified as a significant risk factor for shoulder tendinitis or non–specific shoulder pain. Dysfunction in any of the structure that surrounds shoulder joint can cause shoulder pathology. Impingement is thought to be due to inadequate subacromial space for clearance of the rotator cuff tendons as the arm is elevated. In Construction workers, abnormal motion during arm elevation may lead to impingement syndrome. Aim of the study was to analyze the effects of Scapular motor control training versus Scapular retraining along with mobilization on pain and functional status among construction workers. According to the inclusion criteria, a total of 20 subjects were selected and divided into two groups, Group A subjects received Scapular motor control training and Group B subjects received Scapular retraining, in addition both the group received mobilization over 6 weeks period. The subjects were assessed for Pain and Functional status using Numerical Pain Rating Scale and Disabilities of the Arm, Shoulder and Hand Score. Scores were evaluated before and after 6 weeks of duration. There was a difference between the groups with post test means 2.4 & 3.5 for NPRS and 46.1 & 55.3 for DASH respectively. A statistically significant improvement was obtained in Group A on Pain and Functional status in construction workers with Shoulder impingement syndrome ($p<0.05$). The result concluded and suggests that the Scapular Motor Control training when compared to the Scapular retraining was effective on improving Pain and Functional status among constructional workers.

***Key words:*** Shoulder impingement syndrome, Scapular motor control training, Scapular retraining, NPRS, DASH, Construction workers

## INTRODUCTION

'Impingement Syndrome' is a generic term for rotator cuff lesions encompassing all stages of tendon disease. [1] Shoulder impingement can be defined as compression and irritation of the rotator cuff structures as they pass beneath the coracoacromial arch during elevation of the arm and is commonly referred to as painful arc syndrome, subacromial impingement syndrome, supraspinatus syndrome, swimmer's shoulder or thrower's syndrome. It is characterized by pain and functional restrictions, mostly during overhead activities. [2] It is believed to be the primary mechanism of occupational related shoulder pain. Repetitive impingement can result in shoulder tendonitis, if not alleviated, can progress to tear of the rotator cuff tendons. Impingement is thought to be due to inadequate subacromial space for clearance of the rotator cuff tendons as the arm is elevated. Therefore, motion abnormalities that further minimize this space are believed detrimental to the condition.

Systematic reviews have provided moderate evidence for the association between shoulder diseases and physical work-related factors especially arm elevation and shoulder load. [3] Various theories exist regarding additional factors that may interact with occupational exposure and contributes to the development of shoulder pain that includes Construction workers, farmers, painters and meat processing workers. [4] Construction workers in many trades, by the nature of their work, have substantial exposure to awkward postures, repetitive and forceful muscular contractions and overhead work. Prevalence rates in various construction trade ranging from 25% to 71%. [5] In Construction workers, abnormal motion that brings the humeral head and rotator cuff tendons in closer contact with the coracoacromial arch during arm elevation is particularly problematic in impingement syndrome. These motions includes decreased scapular upward rotation about an axis approximately perpendicular to the scapular plane, decreased posterior tipping about an axis approximately parallel to the scapular spine and decreased external rotation about the humeral axis.

Additionally, increased humeral anterior or superior translations as the arm is elevated are believed to compromise the available subacromial space. [6] The alterations in scapular and humeral motions during arm elevations were linked to decrease in muscle activity of serratus anterior and increase in activity of lower and upper trapezius. [7] Chronic shoulder pain in these workers could result in a tendency to decrease in the use of painful shoulder, leading to disuse atrophy and de-conditioning or adhesive capsule. Changes in the scapular positioning and motor control are considered important factor for developing shoulder impingement syndrome.

Various techniques in the treatment of shoulder pain includes, shoulder stretching for capsular abnormalities, [8, 9] Scapular retraining programme, [10] taping, [11] manual therapy for gleno humeral and thoracic spine. [12, 13] The ability to control the orientation and movement of the scapula is essential for optimal arm function and pain reduction in subjects with shoulder impingement signs. [14] Motor control is the process of initiating, directing, and gradual purposeful voluntary movement. Motor control theories include production of reflexive, automatic, adaptive and voluntary movements and the performance of efficient, coordinated, goal-directed movement patterns which involves multiple body systems (input, output, and central processing). Evidences suggest exercise program mainly focusing on motor control principle for the scapulo-thoracic joint has been a promising treatment option for shoulder impingement. [15, 16] So this study aim is to find the effects of Scapular Motor Control training and Scapular Retraining programme along with mobilization in the treatment of Pain and Functional status among Construction workers.

## METHODOLOGY

Experimental study design was used, prior to the conduct of the study it was submitted to the Institutional Ethical Committee KG Hospital and PG medical institute, Coimbatore. A total of 34 subjects were screened for shoulder impingement syndrome and only 20 subjects were selected based on the criteria, ie., Age between 25 to 40 years, Both male and female Construction workers were included, Shoulder Impingement Syndrome with stage III, positive Hawking's Kennedy & Neer's test, NPRS range between 4-7/10, Symptoms more than 4 weeks and if they are having Shoulder dislocation and subluxation, Neurological involvement with sensory and motor deficit, Those who underwent steroids injection within past 6 month, Primary scapular thoracic dysfunction due to paresis were excluded. Written consent was obtained from the individuals and the permission was obtained from the Head of the institutions.

A detailed instruction was given to all the subjects. They were randomly divided into two groups; both group received Glenohumeral mobilization, Ultrasound therapy and Cryotherapy as a common intervention. Group A received Scapular Motor Control training programme and group B received Scapular Retraining Programme for 6 weeks with 4 sessions per week. Scapular Motor control training used to correct alignment and coordination, which involve a learning optimal scapular orientation at rest and then controlling optimal orientation during active arm movements with the help of visual, auditory and kinaesthetic cues. The subjects were asked to control the orientation of the scapula whilst lifting their arm to 90° humeral elevation in the frontal, sagittal, and scapular planes. Movements were performed at a slow, controlled pace and repeated for 2 minutes (i.e. 10 times). Scapular retraining includes scapular bracing techniques and resisted exercises. Baseline assessments for Pain and Functional status in subjects with Shoulder impingement were assessed with Numerical Pain Rating Scale (NPRS) and Disabilities of the Arm, Shoulder and Hand Score (DASH) respectively. And the post treatment scores of the same were taken after 6 weeks. To test for differences between the groups on Pain and Functional status independent samples t-test were used at $p<0.05$

## RESULTS

The collected data were analyzed using descriptive statistics using SPSS 20.1.

**Table I Demographic Variables**

| S.N | Characteristics | Mean ± SD |
|---|---|---|
| 1 | Age | 34.8 ± 3.75 |
| 2 | Male subjects | 35 ± 3.27 |
| 3 | Female subjects | 34.5 ± 4.59 |

**Table II Analyses of Pre and Post test scores of NPRS and DASH among groups**

| Scales | Post Test Mean (Group A) | Post Test Mean (Group B) | SD | Calculated t value | p value (<0.05) |
|---|---|---|---|---|---|
| NPRS | 2.4 | 3.5 | 1.1279 | - 2.1807 | 0.04271 |
| DASH | 46.1 | 55.3 | 2.7180 | - 7.8532 | 0.00001 |

Figure 1

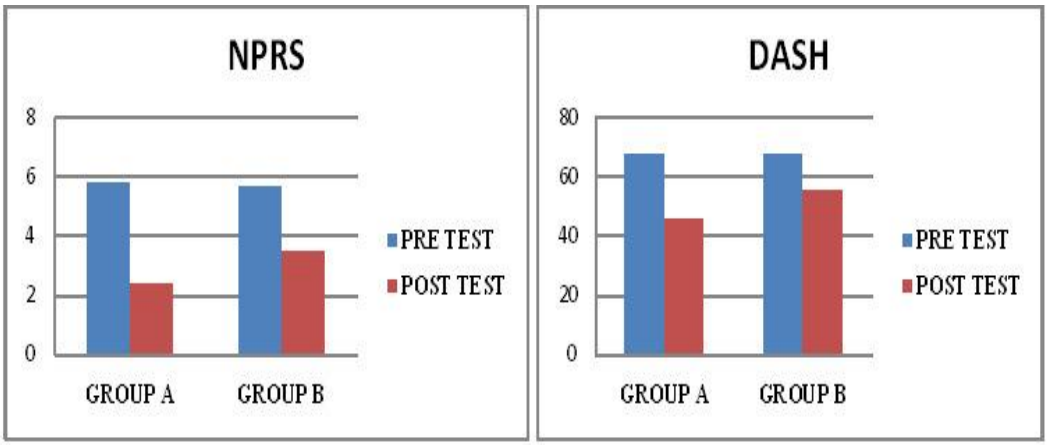


**Figure 1: Comparison of Pre-test and Post-test scores of NPRS and DASH of both groups**

## DISCUSSION

This study shows that symptoms of pain and functional status among construction workers with Shoulder impingement syndrome were improved when comparing the pre test and post test scores of both groups. Table II shows that there were differences between the group with post test means 2.4 & 3.5 for NPRS and 46.1 & 55.3 for DASH respectively. Mean differences in the NPRS were 3.4 & 2.2 and DASH scores were 21.3 & 12.4 in group A & group B respectively. Research evidences show Exercise therapy reduce pain and improve functional loss associated with shoulder impingement syndrome. [17-20]

A recent consensus statement from 2013 recommended that scapular kinematic deficits should be addressed with specific exercises in the rehabilitation of SIS. [21] This recommendation included specific exercise strategies aimed to restore normal scapular kinematics by improving the muscle activity, strength, flexibility and balance in muscle force couples that control scapular position and motion.

Recommendation for specific rotator cuff and scapular retraining includes muscle activation sequencing, force couple activation, concentric and eccentric control, strength, endurance and avoidance of unwanted movement patterns. These specific strategies have key principles include obtaining flexibility in the muscles to reduce inhibition of activation and execution of specific functional movement or activity. [22, 23] These thought to improve scapular kinematics and thereby ameliorate biomechanical conditions in the shoulder that may reduce symptoms caused by SIS.

All the studies showed significant effects of exercise on pain and disability regardless of type of exercises. Also there was significant decrease in pain after exercise and manual therapy in patients with impingement syndrome. It is claimed that shortening of surrounding connective tissue of the shoulder may be one of the reasons for pain in SIS. [5] Therefore stretching exercises decreases pain and disability indirectly by exercise induced improved muscle function. Ludewig & Cook reported reduced activity of serratus anterior in addition to altered scapular kinematics in patients with Shoulder Impingement Syndrome. Hence, strengthening/stabilization exercises can logically reduced pain and disability in individuals with SIS by improving muscle strength.

Before beginning a corrective strengthening program, the clinician must regain normal flexibility of the muscles about the scapula, if identified, as tightness or adaptive shortening can inhibit activation of opposing muscle groups. It is common to find tightness of pectoralis minor and posterior glenohumeral capsule in patients with scapular dyskinesis. Borstad and Ludewig found increased internal rotation and anterior tilting of the scapula in subjects with a short pectoralis minor. [5, 24] Therefore manual therapy and stretching of tight structures can be employed early in the rehabilitative process. Shoulder performance and scapular muscle strength are important factors which are equally important for the betterment of Upper Extremity function. Individuals with reduced shoulder performance, their assessment of scapular muscles can be useful to plan a treatment program, which includes scapular muscle training. This might be helpful in order to improve their overall shoulder performance. [25]

A recent study suggests, when Scapular oriented exercises were employed, we can expect a significant improvement in scapular position and motion. It also concludes that scapula oriented exercises reduce pain and disability in individuals with SIS and may improve scapular position and motion both in SIS patients and in asymptomatic individuals. [26] Once normal flexibility has been achieved, a conscious motor control-strengthening program can be initiated to help normalize the scapular resting posture. As the patient is progressed through the program, emphasis will shift to dynamic control in order to restore muscle balance with various arm movements. Once muscle balance is achieved, the final emphasis is on scapular muscle strengthening within sports specific movement patterns. [27]

During the motor control exercises, scapular position was optimized in relation to thorax, initially by being altered manually by the therapist on a subject specific basis. [28] The recovery mechanism appears to involve neuro physiological and biomechanical changes, with significant changes seen in muscle recruitment patterns previously shown to optimize scapular kinematics during humeral movements.

According to Worsley, Delayed muscle onset has been shown during arm elevation [16] and significant co-activation of middle trapezius and serratus anterior has also been shown during the arm lowering in shoulder impingement syndrome. [29] Also there is early termination of muscle activity found in serratus anterior and lower trapezius during arm lowering, despite the apparent altered muscle recruitment. This early switching off of activity could cause loss of scapular control and potential mechanical impingement. Motor control intervention for shoulder impingement can alter muscle recruitment pattern in both of these key muscles. This showed that these regimes had link with change in scapular movement pattern and motor control. Thus influences scapular kinematics during arm movements to 90 degree elevation, seen in upward rotation of scapula during sagittal plane arm elevation and scapular posterior tilt during frontal plane arm elevation. These could be helpful in the improvement in pain and functional status of shoulder among construction workers with shoulder impingement syndrome

## CONCLUSION

This study concluded that when comparing Scapular motor control training with that of Scapular retraining along with mobilization is effective, in order to maintain the scapular orientation, thereby reduces the pain and improves the functional status of the shoulder joint among construction workers with Shoulder Impingement Syndrome.

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