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EFFECTIVENESS OF ANTERIOR GLIDE WITH INTERFERENTIAL THERAPY VERSUS PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION WITH ULTRASOUND THERAPY ON PAIN AND RANGE OF MOTION IN ADHESIVE CAPSULITIS

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ABSTRACT

Background: Adhesive Capsulitis is one of the most common self-limiting disorders of the musculoskeletal system. The clinical diagnosis made from a history of the gradual onset of severe shoulder pain with the progressive limitation of active and passive glenohumeral movements. The most significant loss of movement is in the external rotation of the joint. This can impact a patient's ability to participate in self-care and occupational activities. Conservative management, including therapeutic exercises and Electrotherapy, is the standard approach. **Objectives:** To find out the effect of anterior glide mobilization with Interferential therapy versus Proprioceptive Neuromuscular Facilitation with ultrasound on pain, range of motion and shoulder functional disability in patients with Adhesive Capsulitis of Shoulder. **Methods:** An experimental study was conducted on a total of 30 subjects with adhesive capsulitis were divided into two groups randomly by lottery method each group containing 15 subjects. Group 1 and Group 2 treated as per the protocol and outcome measures are pain, range of motion and shoulder functional disability measured with VAS, Goniometer and Shoulder disability index scale (SPADI) scale. **Duration:** Total duration of 4 weeks, 5 treatments sessions in a week **Outcomes:** Pain – Visual Analogue Scale ,Range of motion- Goniometer and Shoulder functional disability - Shoulder disability index scale **Result:** Both groups showed improvement following intervention. Group 2 demonstrated statistically significant improvement in Visual Analogue Scale, External Rotation and Shoulder Pain and Disability Index Scale [P>0.05], whereas No significant difference was observed in shoulder abduction [P<0.05]. **Conclusion:** The Proprioceptive Neuromuscular Facilitation technique with Ultrasound was more effective than Anterior Glide with Interferential Therapy in improving Shoulder External Rotation, Functional Activity and decreasing pain intensity levels in Adhesive Capsulitis patients. During the study No significant improvement was observed in shoulder abduction.

KEYWORDS

Vas- Visual Analogue Scale, Spadi- Shoulder Pain And Disability Index, Pnf- Proprioceptive Neuromuscular Facilitation

INTRODUCTION

Adhesive Capsulitis is a condition of shoulder pain and limitation of motion due to progressive fibrosis and Contracture of glenohumeral joint capsule. It is brought on by inflammation and adhesion formation in the Synovium and capsule, which results in pain, stiffness and restricted glenohumeral joint function. Adhesive Capsulitis has been typically classified into 2 forms primary and secondary. [1,2,4.] Primary Adhesive Capsulitis, which refers to the idiopathic form of a painful and stiff shoulder and secondary Adhesive Capsulitis, indicated loss of motion resulting from many predisposing factors such as trauma, diabetes, stroke, upper extremity fractures or surgeries with immobilization. The prevalence of Adhesive Capsulitis is 2% to 3% of general population it starts between ages of 30-50 years. It is more commonly seen in females than males. The clinical identification of adhesive capsulitis is grounded on a history of progressively limiting passive and active glenohumeral motions together with the gradual development of significant shoulder discomfort. External rotation of the joint has the most loss of motion. According to cyriax, the thickening of the joint capsule results in partial restriction of the joint movements, particularly by affecting external rotation and abduction [5,4,3,8].

Total functionality of the upper limb is closely tied to the shoulder complex's architecture. The limbs joint mechanics enable to positioning, use and hand control immediately anterior to the body, where the actions can be observed easily. The clavicle, scapula and humerus all moves as the position of the arm is altered. Sternoclavicular, acromioclavicular, glenohumeral and scapulo-thoracic gliding mechanisms work together to produce these motions. Sternoclavicular, acromioclavicular, glenohumeral and scapulo-thoracic joints that make up the shoulder complex move precisely, in unsion, and simultaneously [7,3].

The treatment of the adhesive capsulitis may be either conservative or surgical. Conservative treatment includes various exercise methods and physical therapy modalities such as hot-cold therapy, transcutaneous electrical nerve stimulation (TENS), ultrasound (US), acupuncture, and laser. Exercise programs consist of active and passive ROM exercises, stretching's exercises guided by a Physiotherapist, self - stretching, manipulation and mobilization techniques, strengthening exercises, patient education, and home exercises

According to Arthrokinematics “convex on concave” theory of joint humeral head on the glenoid technique to extend range of motion for external rotation. On the other hand, used a posteriorly directed glide correction based on the capsular constraint mechanism to restore both exterior and interior rotation range of motion [3]. Intra articular injections like corticosteroids, oral medications and Arthrography distention, manipulation under anesthesia, arthroscope release and open surgery are the other treatment options are used in adhesive capsulitis [8,7,6].

A common electrotherapeutic technique for treating pain is interferential treatment. It is characterized by the interferential of two medium-frequency currents, which combine to create a new medium-frequency current whose amplitude is modulated at low frequency. Proprioceptive neuromuscular facilitation is an exercise modality defined to facilitate the responses of the neuromuscular mechanism by stimulating proprioceptors. Effect mechanisms of PNF technique are stimulating postural reflexes using gravity force to facilitate muscles, using eccentric contractions for muscle activation and utilizing diagonal movement patterns in activation of bi-articular muscles. Both stabilization and movement of scapula are essential for appropriate and smooth function of upper extremities [1,2]. Ultrasound therapy commonly used for adhesive capsulitis treatment is known to create molecular vibration, which helps to break down dense collagenous tissues within the capsule. A recent study by Jung Ha Sung et.al, suggests that ultrasound therapy, especially when combined with end-range mobilization, effectively reduces pain in patients with adhesive capsulitis. It also improves joint mobility and functional ability, whether used alone or with other treatments [9].

Therefore, Purpose of the study is to compare the effect of interferential therapy with anterior glide versus ultrasound with proprioceptive neuromuscular facilitation technique on shoulder external rotation ROM in patients with adhesive capsulitis .

MATERIALS AND METHOD

An experimental study was conducted at KKC College of Physiotherapy; Andhra Pradesh state. Complete assessment was done for the 30 subjects who were found eligible for the participation in this study. Following the Institutional Scientific review Board approval was initiated and Informed concern forms were obtained from all the

participants, and the study was explained to them. The pre-participation evaluation consisted range of motion asses with goniometry, pain asses with visual analogue scale and shoulder functional evaluation asses with SPADI scale. The subjects were randomly allocated into group 1 and group 2 by the lottery method each group containing 15 subjects. Pre-intervention outcome measurements were recorded before starting treatment and post - intervention outcome measurements were recorded after 4 weeks.

Inclusion Criteria

- Patients with 4-5 months duration of adhesive capsulitis.
- Both male and female genders.
- Age group 30 to 50 years.
- Pain with restricted range of motion not more than 50%.
- Unilateral condition.

Exclusion Criteria

- Rheumatoid, Osteoarthritis or Polyarthritis
- Hemiplegic , Fractured or Dislocated shoulder
- Cardiovascular disease
- Osteoporosis
- Cervical Spondylosis
- Brachial neuralgia
- Neurological disorders like stroke, Parkinsonism
- Shoulder deformity
- Any Surgery to Shoulder

Intervention for Group 1

Group-1 includes Anterior Glide and Interferential Therapy.

Anterior Glide

Patient is prone with shoulder at edge of table and abducted to 90 degrees, elbow flexed to 90 degrees; mobilizing hand on posterior humeral head while stabilizing hand holds mid humerus mobilization, anterior force applied by mobilizing hand to humeral head while stabilizing hand applies gentle traction.

Duration: - This technique was repeated for 5 times in 1 treatment session. 5 days in a week for 4 weeks

Interferential Therapy

Four electrodes were used, in one channel, 2 electrodes were placed onto infraspinatus and anterior deltoid muscles, and in the other channel, and 2 electrodes were placed in posterior deltoid and supraspinatus muscles. The electrodes were positioned around the shoulder so that each channel was run perpendicular to the other, and the two current crossed at a midpoint in the center. Setup and interference of currents of these electrodes together constructed a clover leaf pattern. So, IFC was conducted with following characteristics: vector field with carrier frequency of 4KHZ; base100HZ, and sweep frequency of 150HZ.

Duration: 20 minutes treatment period 20 sessions in the span of 4 weeks.

Group 2

Group-2 includes Proprioceptive Neuromuscular Facilitation and Ultrasound Therapy

Proprioceptive Neuromuscular Facilitation:

Starting Position:

Patient is in sitting position and therapist is sitting at the side of the patient. Therapist will passively move the shoulder joint in external rotation until the stretch begin to feel "uncomfortable" to the subject. Then subjects will be asked to perform a maximal isometric contraction for 6 seconds followed by 10 seconds of relaxation. During the 10 seconds of relaxation a tester slowly externally rotates the subjects shoulder joint, if the subjects still consider the stretch to be uncomfortable; it is kept as previous position. The subjects then perform 2 more 6 seconds maximal contraction (total 3 contractions) with 10 second relaxation period in between. Same procedure is done to improve shoulder abduction. In this patient is in sitting position and therapist stands at the back of the patient on the affected side.

Duration: once in a day for 5 days in a week for 4 weeks.

Ultrasound Therapy:

The UST group received continuous US with 1MHZ frequency and 1.5 W/cm2 intensity for 10 min. after coating the skin with an aqua sonic gel, US was delivered by moving the applicator over the anterior, superior and posterior regions of the target joint in slow, overlapping strokes

Duration: once in a day for 5 days in a week for 4 weeks.

Table: 1 Mean of Visual Analogue Scale [VAS] in Group-1 & Group-2.

	Paired t test			
Group 1	Mean	SD	t value	P value
Pre Test	6.60	1.30	14.2221	<0.001
Post Test	3.67	0.82		
Group 2	Mean	SD	t value	P value
Pre Test	6.47	1.13	15.3709	<0.001
Post Test	2.00	0.65		

Descriptive Statistics

Both groups showed significant improvements, Group 2 demonstrated a greater reduction in VAS compared to Group 1($p = 0.001$, $p < 0.05$)

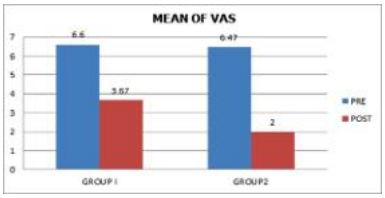


Fig 1: Mean of Visual Analogue Scale [VAS] In Group-1 & Group-2

Table: 2 Mean of Shoulder Range of Motion In Group-1 & Group-2 Descriptive Statistics

	Paired t test						
	External Rotation			Abduction			
Group 1	Mean	SD	t value	Mean	SD	t value	P value
Pre Test	54.67	11.52	16.3152	117.13	12.28	14.2781	<0.001
Post Test	60.33	10.93		131.53	14.32		
Group 2	Mean	SD	t value	Mean	SD	t value	P value
Pre Test	55.67	10.93	16.8014	114.53	15.20	16.7102	<0.001
Post Test	68.93	11.04		136.53	13.34		

Both groups showed significant improvements, Group 2 demonstrated a greater increase in Shoulder ROM compared to Group 1 ($p = 0.001$, $p < 0.05$).



Fig 2: Mean of Shoulder Joint Rom in Group-1 & Group 2

Table: 3 Mean of Shoulder Pain and Disability Index Scale in Group-I. Descriptive Statistics

	Paired t test			
Group 1Shoulder Pain and Disability Index Scale	Mean	SD	t value	P value
Pre Test	64.7040	7.6881	11.4454	<0.001
Post Test	54.2733	5.0869		
Group 2 SPADI	Mean	SD	t value	P value
Pre Test	61.6000	6.2634	16.8900	<0.001
Post Test	40.8733	3.1558		

Both groups showed significant improvements, Group 2 demonstrated a greater reduction in SPADI compared to Group 1($p = 0.001$, $p < 0.05$)

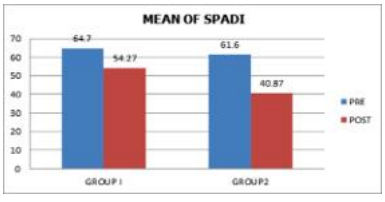


Fig 3: Mean of Spadi in Group-1 & Group 2

Table 4: Post Analysis Comparision Between Group-1& Group-2.

Parameter	Group-1 Mean±SD	Group-II Mean±SD	P Value

VAS	3.67±0.82	2.00±0.65	<0.001
E.R	60.33±10.93	68.93±11.04	<0.04
ABDUCTION	131.53±14.32	136.53±13.34	<0.033
SPADI	54.2733±5.0869	40.8733±3.1558	<0.001

The table depicts post analysis comparison of all outcomes of Visual Analogue Scale, External Rotation, Shoulder Pain and Disability Index Scale P values shows<0.05 after post analysis comparison. So, this study shows the findings for statistically significant and abduction P values shows >0.05 which is not statistically significant after post analysis comparison.

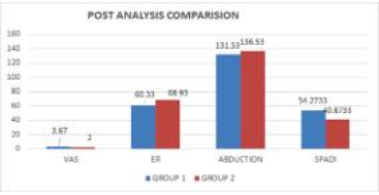


Fig 3: Post Analysis Comparison Between Group-1& Group-2

DISCUSSION

According to the cyriax the thickening of joint capsules in partial restriction of the joint movements particularly effecting External Rotation and Abduction. The pain is worse at night and exacerbated by lying on the affected side, and also present in extreme movement of the shoulder joint [4, 8, 10].

Pre and Post Intervention Values of Vas Between Group-I And Group-II.

The present study result show decrease in Visual Analogue Scale and reducing pain intensity levels in both groups. In the period of 4 weeks after intervention. The post analysis comparison of Mean and SD in between group was 3.67±0.82 in group1, 2.00±0.65 in group2. This shows reduced pain levels in group2 when compared to group 1 with P value <0.05 which is statistically significant. **GUNERI S et.al, 2015**[1] his study shows that Proprioceptive neuromuscular facilitation patterns provide significant contribution in decreasing pain and improving range of motion in patients with adhesive capsulitis. **DOGRU H et.al, 2007**[6] Therefore, the Proprioceptive neuromuscular facilitation technique and ultrasound therapy helps to decreasing pain in Adhesive capsulitis patients.

Pre and Post Intervention Values of Range of Motion Between Group-I and Group-II.

The present study showed that range of motion was improved in both groups in patients with adhesive capsulitis. External rotation demonstrated significant improvement compared to abduction, which may be attributed to the capsular restriction pattern characteristic of the external rotation is typically the most limited movement and shows earlier improvement with intervention. In contrast, abduction involves complex scapula-humeral coordination and may require a longer duration to achieve meaningful changes. Additionally, the small sample size and minimal mean difference may be attributed to the lack of statistically significant.

Post analysis comparison of External Rotation comparison of results shows improve joint range of motion in group 2 when compared to the group 1 with P values =0.40. it indicates p values less than 0.05 which is statistically significant. Post analysis comparison of abduction of results show improve joint range of motion in group 2 when compared to the group 1

This suggest that both interventions where equally effective in improving shoulder abduction and either treatment demonstrated clear superiorly over the other for the specific parameter. Additionally, the interventions may not have been specially targeted towards structures primarily responsible for abduction such as deltoid and supraspinatus muscles. Clinically, the findings suggest that while both treatment approaches are beneficial for improving shoulder abduction no additional advantage was observed with intervention over the other when compared to the external rotation.

Pre and Post Intervention Values of Spadi Between Group I and Group II.

The Present study result show improves shoulder function in SPADI scale and decreases pain intensity levels in both groups in the period of 4 weeks after intervention. The post analysis comparison of results shows reduced pain levels in group2 when compared to group 1 with P value <0.001 which is statistically significant.

Hacer Dogru et.al, 2007: Therefore, the Proprioceptive neuro-muscular facilitation technique and ultrasound therapy helps to decreasing pain in Adhesive capsulitis patients [6]. HARSHITH MAHETA et.al 2013: PNF stretching produced significant improvement in ROM and Shoulder pain disability values in Patients with Adhesive Capsulitis [4]. FUNK DC et.al, 2003: Concluded that PNF stretching produce more tension in muscle and also provide greatest potential muscle lengthening then static stretching [4]. Researchers found that PNF stretching shows greater ROM in Adhesive Capsulitis. PNF stretching is the application of specific and progressive forces allowing for elongation of shortened muscles. HACER DOGRU et.al, 2008: This study suggest ultrasound with exercise intervention are shown to beneficial effects in patients with Adhesive Capsulitis and determined significant improvement in ROM and SPADI values [6]. HARDIK et.al, 2013: This study shows that PNF group add results demonstrated that significant improvement in range of motion and shoulder pain and disability index. The range of motion impairment associated with primary Adhesive Capsulitis can impact a patient's ability to participate in self-care and occupational activities [4].

CONCLUSION

The present study shows that both interventions were beneficial in reducing pain, improving range of motion of shoulder and shoulder functional activity in adhesive capsulitis patients. However, group 2 exhibited comparatively greater effectiveness with statistically significant improvement observed in pain intensity measured by visual analogue scale, shoulder external rotation, range of motion measured by goniometer and functional status as measured by shoulder pain and disability index scale. Although, shoulder abduction showed a trend toward improvement but change did not reach statistically significant. This suggest that both interventions where equally effective in improving shoulder abduction and either treatment demonstrated clear superiorly over the other for the specific parameter. Additionally, complex biomechanical and neuromuscular components involved in abduction.

This study concluded that the intervention administrated in group 2 is more effective in alleviating pain enhancing functional performance. Particularly in movements involving external rotation in subjects with Adhesive Capsulitis.

Recommandations of the Study

- Increasing sample size is essential to enhance statistical power and improve the generalized ability of results.
- Future studies should consider extending the duration of intervention with long term follow up to evaluate the sustainability of treatment effects particularly abduction movement that may require prolonged rehabilitation.
- Include additional outcome measures such as quality of life and functional performance.
- Including of scapular stabilization exercises are more beneficial.

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