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The effects of Anterior versus Posterior Glide joint Mobilization in Improving Functional Activity of the shoulder in Patients with adhesive capsulitis

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Abstract

Primary adhesive capsulitis is a term used to describe an insidious onset of pain and movement restriction in the glenohumeral joint. The objective of this study is to compare the effectiveness of anterior versus posterior glide mobilization techniques for improving functional activity of the shoulder in patients with adhesive Capsulitis. In this study a total number of 20 subjects were randomly selected. Samples were selected into experimental group and control group. Both groups received ultrasound therapy, joint glide mobilization and shoulder exercises, treatment differed in the direction of glide. Experimental group received posterior glide and control group received anterior glide. Functional activity is measured by using Shoulder Pain and Disability Index (SPADI) score, Pain is measured by VAS Score, and Range of motion is measured by Goniometer initially before treatment and after 5, 10 and 15 sessions. Statistical analysis was performed to know the significant effects of parameters in pre and post and also to compare posterior mobilization and anterior mobilization groups with respect to parameters external rotation range of motion, VAS score and SPADI Score. To know the significant effects in pre and post of each parameter we have used paired sample 't' test and to compare groups we have used independent sample 't' test. Group comparison was made by considering the differences between pre and post values of each parameter in both groups and found significant in external rotation range of motion and SPADI score in posterior mobilization compared to anterior mobilization group ($P < 0.05$) but for VAS (Pain) there was no significant difference between posterior mobilization group and anterior mobilization group. ($P > 0.05$). In conclusion posteriorly directed joint glide mobilization technique was more effective than anteriorly directed mobilization techniques in improving functional activities in patients with shoulder adhesive capsulitis.

Keywords: Adhesive capsulitis, joint mobilization, physiotherapy, ultrasound, goniometer, functional activity..

Introduction

Primary adhesive capsulitis is a term used to describe an insidious onset of pain and movement restriction in the glenohumeral joint[1,2]. The shoulder is a complex anatomical structure that allows movement in many planes and is crucial for activities of daily living. Decreased shoulder mobility is a serious clinical finding[3]. The various synonyms for Adhesive Capsulitis are frozen shoulder, pericapsulitis, scapula-humeral periarthritis, humeroscapular fibrositis, periarthritis, stiff and painful shoulder[4].

Duplay in 1872 was first credited with describing the painful stiff shoulder referring to the condition as humero-scapular periarthritis secondary to subacromial bursitis[4]. The term adhesive capsulitis was first used by Nevaiser is 1945[5]. Codmann in 1934 coined the term frozen shoulder[4]. Primary Adhesive Capsulitis affects from 2% to 3% of the general population, it affects female slightly more than males and is seen in ages 40-70 years. Bilateral involvement occurs in 10% to 40% cases[5]. Adhesive Capsulitis is a syndrome defined in its purest sense as idiopathic painful restriction of shoulder movement that results in global restriction of the glenohumeral joint[6].

The term Adhesive Capsulitis is used to refer to primary idiopathic condition, the term secondary Adhesive Capsulitis should be applied to condition that is associated with or results from a known predisposing cause Eg: Humerus fracture, shoulder dislocation, avascular necrosis of humerus, Stroke. Most authorities agree that Adhesive Capsulitis is caused by inflammation of the joint Capsule and synovium that eventually results in the formation of capsular contractures[7]. Clinically there is global loss of both passive and active range of motion of the glenohumeral joint with external rotation being the most restricted physiological movement, thus leading to functional limitation[7]. Even though this condition is considered self limiting with most patients having spontaneous resolution within 3 years some patients suffer long term pain and restricted shoulder motion well beyond 3 years. A disability of this duration places severe emotional and economical hardship on the afflicted person. Most patients are unwilling to suffer this pain, disability and sleep deprivation without seeking treatment[8].

Bridgman reviewed the medical records of 800 diabetic subjects and found evidence of periarthritis in 10.8 % compared with 2.3% in a control group of 600 non diabetic subjects. Diabetic

patients much more likely to have problem with their shoulder than others some studies showing that they are six times more likely to have this problem than the rest of the population[9].

Siegel et al said that the range of motion impairments associated with primary adhesive capsulitis can impact a patient ability to participate in self care and occupational activities[10].

Currently no standard medical surgical or therapy regimen is universally accepted as the most efficacious treatment for restoring motion in patients with shoulder adhesive Capsulitis[11, 12]. Physical therapy is commonly prescribed for this condition some studies have found little treatment benefits. Rehabilitation programs consists of interventions like heat or ice applications, ultrasound, tens, active and passive range of motion exercises and mobilization techniques have been shown to improve shoulder range of motion in all planes thus increasing the functional activity of the person[13]. Mobilization is a low velocity passive movement performed by the clinician to an affected joint within or at the limits of joint range of motion at a speed slow enough that the patient can stop the movement[14]. The optimal direction of force and movement application for the joint mobilization to restore external rotation however is not clear.

Traditionally physical therapists have used an anterior glide of the humeral head on the glenoid technique to improve external rotation range of motion a choice based on 'convex on concave' concept of joint surface motion[15]. In contrast Roubal et al. used a posteriorly directed glide manipulation based on the 'capsular constraint mechanism' to restore external as well as internal rotation range of motion

The purpose of this study was to determine the direction of force application (anterior versus posterior) for glenohumeral joint mobilization that would result in the greatest improvement in shoulder external rotation range of motion and the functional activity in individuals with primary Adhesive Capsulitis.

The outcome of this study could potentially guide clinical decision making regarding the most effective direction of mobilization to improve functional activity of the patients.

AIM: To determine the effectiveness of direction of mobilization (anterior / posterior) in improving external rotation range of motion and functional activity in patients with adhesive Capsulitis.

Material and Methods

Subject Recruitment: The subjects were recruited from the patients that attended physiotherapy outpatient department of Sri Venkateswara Institute of Medical Sciences (SVIMS) and Balaji Institute of Rehabilitation and Research for Disabled (BIRRD) Hospitals, Tirupati, Andhra Pradesh, India.

Selection Criteria: A total number of 20 subjects were randomly selected and assigned to two groups, posterior mobilization group and anterior mobilization group.

Study Design: Experimental design

Materials: Therapeutic ultrasound, universal goniometer

Methodology: Twenty subjects who are diagnosed to have primary adhesive capsulitis were selected and randomly assigned to one of the two treatment groups: i. Posterior mobilization group, ii. Anterior mobilization group.

All subjects received two weeks of therapy consisting of therapeutic ultrasound, joint mobilization, and shoulder exercises. Treatment differed between the groups in the direction of mobilization technique performed.

Inclusive Criteria: i. Diagnosed primary idiopathic adhesive Capsulitis/Frozen Shoulder, ii. Age group 40 to 60 years, iii. Patients having painful stiff shoulder at least for three months, iv. Unilateral condition, v. Both male and female patients, both left and right handed peoples.

Exclusive Criteria: i. Previous shoulder surgeries to the affected shoulder, neck and elbow, ii. secondary adhesive capsulitis Eg: Fractures around shoulder, iii. Shoulder girdle motor control deficits associated with neurological disorders (eg. Stroke, Parkinson's disease), iv. Injection with corticosteroids in the affected shoulder in the preceding four weeks.

Orientation of subjects: The purpose of the study has been explained before the commencement of the study to the subjects. Informed consent has been taken from all the subjects. Subjects were instructed to come to physiotherapy outpatient department of SVIMS or BIRRD regularly; Subjects were clearly explained about the interventions before starting the treatment.

Evaluation procedure: Evaluation was carried out for all the subjects, shoulder external rotation range of motion was measured by universal goniometer, pain was measured by visual analogue scale and functional status of the patient by shoulder pain and disability index scale.

Three tools have been used for evaluation: i. External rotation range of motion by universal goniometer, ii. Visual analogue scale, iii. Shoulder pain disability index scale.

Shoulder external rotation range of motion measurement: The patient was in supine position, the shoulder was placed into full available abduction for each individual before actively externally rotating the shoulder. At the initial evaluation the mean shoulder abduction angle of the subject was measured. Each subject base line shoulder abduction angle was recorded and the glenohumeral joint was passively placed at the base line abduction angle prior to the measurement of shoulder external rotation at each subsequent session. This method was chosen because there is a wide variation in range of motion deficits in patients with adhesive Capsulitis.

Visual analogue scale: Pain was quantitatively measured by visual analogue scale, here the subject was shown a 10 cm line where one end is marked "0" and the other end is marked "10". They were explained that "0" represents no pain and "10" represents maximum pain and they were instructed to mark their level of pain over that 10 cm line scale.

0----------10

Shoulder pain and Disability index: It is a self administered instrument that measures pain and disability associated with shoulder disease.

It consists of 13 items divided into2 subscales, pain (5 items) and disability (8 items).
The questions are asked, patient mark the responses where 0 = No pain and 10 = worst pain imaginable for 5 pain items
For disability 0 = No difficulty and 10 = so difficult that he/she requires help.
SPADI is scored 0 to 130 by averaging the scores from the two subscales.

Treatment protocol: Posterior mobilization group: i. Ultrasound - frequency 3 MHz, intensity 1.5 W/Cm^2, Duration 10 Min, rate of rotation 4 Cm/Sec, ii. Mobilization techniques : Kalternborn mobilization grade III at end range position which is held for at least 1 min., Stretch mobilizations for a total of 15 min. Glides used are posteriorly directed glide, iii. Exercise program: Codmann pendular exercise, finger stepping exercise, wand exercises, active range of motion exercises.

Exercises repeated 10 to 15 repetitions 2 to 3 sets with a rest interval of 30 to 60 Sec between sets.

Anterior mobilization group: i. Ultrasound - frequency 3 MHz, Intensity 1.5 W/Cm^2, Duration 10 Min, Rate of rotation 4 Cm/Sec, ii. Mobilization techniques: Kalternborn mobilization grade III at end range position which is held for at least 1 min., stretch mobilizations for a total of 15 min. Glides used are Anteriorly directed glide, iii. Exercise program: codmann pendular exercise, finger stepping exercise, wand exercises, active range of motion exercises.

Exercises repeated 10 to 15 repetitions 2 to 3 sets with a rest interval of 30 to 60 Sec between sets.

Procedure: All subjects were evaluated before giving treatment. Therapeutic ultrasound with the frequency of 3 MHz was administered to all the subjects for about 10 min, with an intensity of 1.5 w/cm^2 before doing the mobilization. All the subjects are asked to do shoulder exercises after mobilization.

Posterior mobilization group: The initial position for posterior mobilization group is patient in supine lying with arm in resting position support the forearm between trunk and elbow place one hand at the lower end of humerus and one hand in the subjects proximal end of humerus just below the articular margin. Maintain a lateral humeral distraction while the posterior stretch mobilization was performed at the end range of abduction and external rotation. The position chosen for the progression of the posterior mobilization takes the humerus into flexion with the intend to provide the greater stretch to the posterior capsule.

Anterior mobilization group: The initial position for anterior mobilization group was patient in supine position with arm abducted, the therapist holds proximal end of the humerus and maintain a lateral humeral distraction in its mid range position while the anterior stretch mobilization was performed to end range, at the end range of abduction and external rotation.

Progression of the anterior mobilization is by placing the patient in prone position and at end range of abduction and external rotation lateral humeral distraction is given and stretch mobilizations were performed by utilizing the subjects body weight and gravity to generate the mobilizing force, an anterior gliding is given.

During the joint mobilization the subjects were instructed to describe his/her sensation so that the therapist can modify the force or position as necessary to maintain a moderate stretch on the targeted tissue.

Pain levels associated with adhesive Capsulitis varied among subjects and the force of mobilization was modified if the subject requested, however each subject was encouraged to tolerate pain to allow a moderate stretch sensation at each bout of mobilization.

Results and Discussion

Statistical analysis was performed to know the significant effects of parameters in pre and post and also to compare posterior mobilization and anterior mobilization groups with respect to parameters external rotation range of motion, VAS score and SPADI Score. To know the significant effects in pre and post of each parameter we have used paired sample't' test and to compare groups we have used independent sample 't' test. Entire analysis was done using SPSS 16.0 package and MS excel 2007.

In table 1 Group comparison was made by considering the differences between pre and post values of each parameter in both groups and found significant in external rotation range of motion and SPADI score in posterior mobilization compared to anterior mobilization group ($P < 0.05$) but for VAS (Pain) there was no significant difference between posterior mobilization group and anterior mobilization group. ($P > 0.05$). In table 2 pre and post comparison was made in posterior mobilization group for external rotation range of motion, VAS score and SPADI score with respect to week wise comparison and found significant between week 0 and week 1 ($P<0.05$) week 1 to week 2 ($P<0.05$) and week 0 to week 2 ($P<0.05$) in all parameters and the value of mean and standard deviation are presented.

In table 3 pre and post comparison was made in anterior mobilization group for external rotation range of motion, VAS

score and SPADI score with respect to week wise comparison and found to be significant between week 0 and week 1 ($P<0.05$) week 1 to week 2 ($P<0.05$) and week 0 to week 2 ($P<0.05$) in all parameters the value of mean and standard deviation are presented.

Table-1

	Posterior		**Anterior**		**T**	**Df**	**Sig(2-tailed)**
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**			
Ext. Rot. ROM	39.00	4.595	28.50	5.798	4.489	18	.000*
VAS	4.50	.707	4.40	.516	.361	18	.722
SPADI	38.948	5.7497	46.1940	5.7497	2.993	18	0.008*

Table-2
T – test Posterior group

		Mean	S.D	T	Df	Sig.(2tailed)
ROM	WEEK 0	22.0000	5.3750	-12.6760	9	0.0000*
	WEEK 1	38.5000	3.3750			
	WEEK 0	22.0000	5.3750	-26.8420	9	0.0000*
	WEEK 2	61.0000	6.1460			
	WEEK 1	38.5000	3.3750	-20.1250	9	0.0000*
	WEEK 2	61.0000	6.1460			
PAIN	WEEK 0	7.3000	0.6750	11.1800	9	0.0000*
	WEEK 1	4.8000	0.6320			
	WEEK 0	7.3000	0.6750	20.1250	9	0.0000*
	WEEK 2	2.8000	0.7890			
	WEEK 1	4.8000	0.6320	9.4870	9	0.0000*
	WEEK 2	2.8000	0.7890			
SPADI	WEEK 0	79.1520	5.0466	16.0480	9	0.0000*
	WEEK 1	56.9510	3.9179			
	WEEK 0	79.1520	5.0466	25.4060	9	0.0000*
	WEEK 2	32.9580	2.9344			
	WEEK 1	56.9510	3.9179	14.4880	9	0.0000*
	WEEK 2	32.9580	2.9344			

Table-3
T – test Anterior Group

		Mean	**S.D**	**T**	**df**	**Sig.(2tailed)**
ROM	WEEK 0	20.5000	8.6440	-10.4740	9	0.0000*
	WEEK 1	35.0000	7.4540			
	WEEK 0	20.5000	8.6440	-15.5450	9	0.0000*
	WEEK 2	49.0000	9.0680			
	WEEK 1	35.0000	7.4540	-11.2250	9	0.0000*
	WEEK 2	49.0000	9.0680			
PAIN	WEEK 0	8.0000	0.6670	16.5000	9	0.0000*
	WEEK 1	5.8000	0.6320			
	WEEK 0	8.0000	0.6670	26.9440	9	0.0000*
	WEEK 2	3.6000	0.5160			
	WEEK 1	5.8000	0.6320	16.5000	9	0.0000*
	WEEK 2	3.6000	0.5160			
SPADI	WEEK 0	76.806	5.0533	1.2850	9	0.0000*
	WEEK 1	57.4460	5.4767			
	WEEK 0	76.806	5.0533	1.5780	9	0.0000*
	WEEK 2	37.8580	2.8946			
	WEEK 1	57.4460	5.4767	11.550	9	0.0000*
	WEEK 2	37.8580	2.8946			

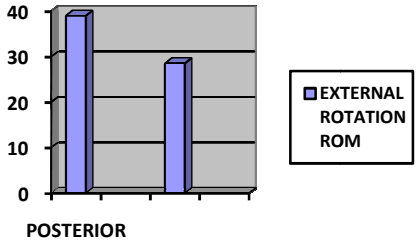

Figure-1
Changes of external rotation ROM in Posterior and Anterior mobilization groups

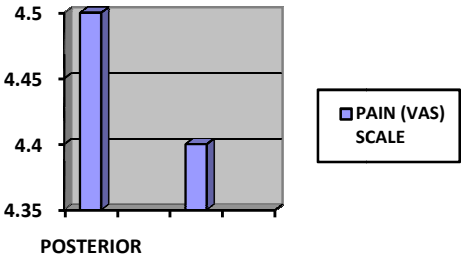

Figure-2
Mean changes of VAS Scale in Posterior and Anterior mobilization groups

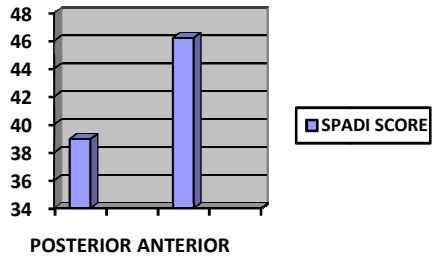

Figure-3
Mean changes of SPADI Score between Posterior and Anterior mobilization groups

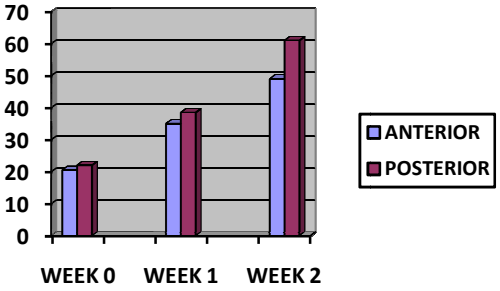

Figure-4
Week wise comparison of external rotation range of motion of posterior and anterior mobilization group. External rotation range of motion in both groups

The graph shows changes in external rotation with respect to weeks within the group i.e anterior group and posterior group and between groups.

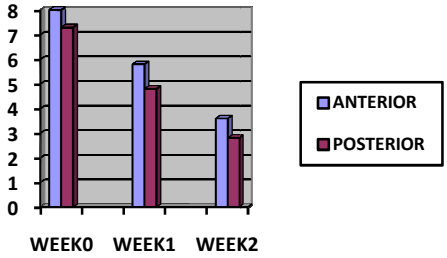

Figure-5
Week wise comparison of VAS scale in Posterior and Anterior mobilization groups. Pain vas scale in both groups

The graph shows changes in Pain (VAS) Score with respect to weeks with in the group's i.e anterior group and posterior group and between groups.

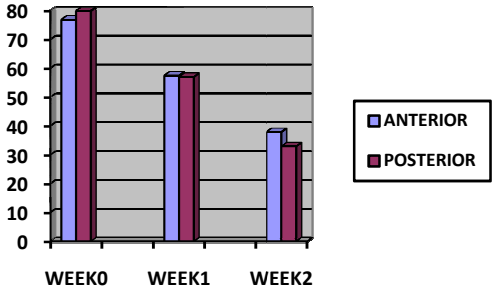

Figure-6
Week wise comparison of SPADI Score in Posterior and Anterior mobilization groups. Spadi scale in both groups

The Graph shows changes in SPADI score with respect to weeks within the group i.e anterior group and posterior group and between groups.

In this study a total of 47 subjects were selected randomly, of which 17 subjects were excluded as they are presenting with a traumatic history, 4 subjects were excluded as they are associated with neurological disorder (stroke). Remaining 26 subjects were divided randomly into 2 groups, each group consisting of 13 subjects. First group consists of 13 subjects of which 6 were diabetic, they are treated with posterior mobilization along with ultrasound and shoulder exercises. The second group consists of 13 subjects of which 8 were diabetic, they are treated with anterior mobilization along with ultrasound and shoulder exercises. 6 subjects were dropped in the middle of the study due to various reasons, 20 subjects 10 in each group completed the program for 2 weeks.

The statistical analysis of this study shows there is significant improvement in external rotation range of motion and functional activity measured by SPADI score in the posterior mobilization group than the anterior mobilization group. There was no significant difference between pain measured by VAS score before and after treatments between both the groups.

The results are in consistent with the findings of Roubal et al and Placzeck et al. The mobilization positions chosen for the study were taken from physical therapy text books for the initial and progression positions.

Norotny et al studied the glenohumeral joint in vitro using techniques in which only the capsule and articular surface contact controlled the motion of humerus, they found that at low moments the humeral head initially translates across the glenoid surface in the direction opposite to the motion due to joint surface as consistent with concavo-convex rule. Then with increasing moment and angle of rotation the humeral head changes in direction as the capsule tightens pushing the humeral head back along the glenoid surface. Thus it is thought that the tension in the capsular tissue rather than joint surface geometry controls the translatory movements of the humeral head.

Ludwig and Cook found that the patients with shoulder symptoms showed greater anterior translation of the humeral head in 30^0 to 60^0 in the scapular plane elevation of the humerus and a decrease in the mean posterior translation of the humeral head in higher elevations 60^0 to 120^0 as compared to an asymptomatic comparison group.

In patients with adhesive capsulitis capsular contractures develops usually in the area of rotator cuff interval. Roubal et al suggest that these anterior capsular structures may draw the humeral head to its anterior most excursions thus limiting anterior and posterior glide and effecting external and internal rotations. Harryman et al found in their cadaver studies that altering the capsule (tightening) affects the translation of humeral head in the glenoid during physiological movements of the humerus.

The results of this study are not at odds with the concavo convex rule, do the results well support the concept that the capsule plays an important role in dictating the humeral head translation possibly in the opposite direction to the expected effect of joint geometry if restricted. In this study the stretch mobilizations are performed for a total of 15 minutes at the end range external rotation and abduction during each treatment session with the intention to elongate the glenohumeral capsular contracture.

Further studies may determine the optimal duration of stretch mobilization for improving external rotation range of motion. It is not known if posterior mobilization procedures would be effective with secondary adhesive capsulitis future studies should focus on this aspect. From the results of this study we recommend perhaps posterior stretch mobilizations be considered for restoring external rotation range of motion.

The Limitations of the study: Small sample size may effect the external validity of the results, thus care should be taken in generalizing these results to a wider population. A larger multi centered randomized clinical trials would be recommended to improve external validity of the results.

The shoulder exercises prescribed for both the groups were in all directions stretching the capsule, so it may affect the validity of the study. Study can be done by prescribing the shoulder exercises in one direction only.

Considering both diabetic and non diabetic subjects into the two groups which may affect the validity of the study. A study can be done by taking only diabetic or non diabetic subjects having adhesive capsulitis.

Conclusion

In this study two similar groups were treated with translatory gleno humeral stretch mobilizations in two different directions, anterior and posterior. The group treated with posterior mobilization had shown significant improvement in shoulder external rotation range of motion and functional activity over the course of two weeks, when compared to anterior mobilization.

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