Effectiveness of Scapular Proprioceptive Neuromuscular Facilitation (PNF) Techniques in Adhesive Capsulitis of the Shoulder Joint

K Jothi Prasanna^{*}, Rajeswari R and Sivakumar VPR

Department of Physiotherapy, SRM Institute of Science and Technology, SRM University, Kattankulathur, Kancheepuram, Tamil Nadu, India

*Corresponding author: K Jothi Prasanna, Department of Physiotherapy, SRM Institute of Science and Technology, SRM University, Kattankulathur, Kancheepuram, Tamil Nadu, India, Tel: 044-27417833; E-mail: jothiprasanna.k@ktr.srmuniv.ac.in

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Abstract

Background: Adhesive capsulitis is a benign, self –limiting condition of unknown etiology characterized by painful and limited active and passive glenohumeral range of motion at least two directions most notably shoulder abduction and external rotation. The treatment of adhesive capsulitis aims at reducing pain, and improvement in the shoulder range of motion, scapular dyskinesis, and functional activities. Therapeutic ultrasound, LASER, wax therapy, Interferential therapy and joint mobilization has long played an important role in the treatment of adhesive capsulitis; however treatment involving Scapular PNF techniques for management of adhesive capsulitis are limited to this date.

Objectives: To compare the effectiveness of Scapular PNF with conventional physiotherapy in subjects with adhesive capsulitis.

Study design: Experimental study design and comparative type. Procedure: 24 subjects, 12 subjects in group a received Scapular PNF along with wax bath therapy, stretching, and shoulder mobilization exercises with pre and posttest. And 12 subjects in group B received only the wax bath therapy, stretching and shoulder mobilization exercises with pre and posttest.

Outcome measures: Visual Analogue Scale (VAS), Lateral Scapular Slide Test (LSST), Goniometer, and simple shoulder test questionnaire.

Results: statistical analysis was done by using paired "t" test which showed more significant improvement in group A.

Conclusion: Scapular PNF techniques with wax bath therapy, stretching and shoulder mobilization exercises has shown significant result in reduction of pain and improvement in the shoulder range of motion, scapular

dyskinesis and functional activities in subjects with adhesive capsulitis.

Keywords: Scapular PNF techniques; Scapular dyskinesis; Range of motion

Introduction

Adhesive capsulitis is a painful musculoskeletal disorder characterized by glenohumeral range of motion with limited passive and active range of motion mostly the external rotation and abduction of shoulder joint. Primary Adhesive capsulitis is an insidious onset of painful stiffness of gleno humeral joint whereas as the presence of previous pathology in the shoulder has been associated with the secondary adhesive capsulitis, for example dislocation, avascular necrosis, fracture, and cerebrovascular accident. In general population of about 40 to 70 years of age, about 2% to 3% of patients who were affected with primary adhesive capsulitis were found to have pain and dysfunction of shoulder. Shaffer et al., found that symptoms that seen in adhesive capsulitis were not related to age, menopause, hand dominance, nature of onset, duration of the condition or associated medical conditions. Prevalence is more in women, individuals with age around 40-70 years, the rate of occurrence in general population is around 3-5% and diabetic population is of about 10-20%. Primary adhesive capsulitis is a syndrome which is characterized by global restriction of both passive and active range of motion (ROM) of gleno humeral joint with external rotation usually being most restricted and spontaneous recovery of pain and improvement in functional activities over months to years.

There are commonly 3 stages of Adhesive Capsulitis; The Painful stage: in which there is pain in both active and passive motion which is diffuse and lasts one to two months. The Frozen stage: Gradual loss of range of motion which persists from several months to years with minimal pain throughout the range except at the end range of motion. The Thawing stage: Improvement in range of motion (ROM) over several months to years [1]. Variety of Physiotherapy interventions such as hot packs or applicatilnterferential therapy, Laser therapy, Ultrasound therapy(US), Transcutaneous Electrical Nerve Stimulation (TENS) were commonly used. The Aims of Therapeutic regimen such as Range of motion (ROM) strengthening, mobilizing techniques, Proprioceptive Neuromuscular facilitation (PNF), stretching exercises are used to alleviate stiffness and pain which aids to increase glenohumeral range of motion (ROM) [2-5].

The disturbance in the scapulohumeral rhythm creates the alterations in alignment of scapula and interferes with the function of upper limb which in turn leads to the reversal of rhythm [6-8]. PNF is the therapeutic approach that works under the means such as stress relaxation, pain gate theory, autogenic inhibition, stress relaxation that improves muscle activation and range of motion [9,10].

The greatest potential for muscle activation is the reciprocal activation of both agonist and antagonists which involved in proprioceptive neuro muscular facilitation [11-13]. For good functioning of the upper limb, the position of the scapula forms the basis [14,15]. The pattern of scapula defined in proprioceptive neuro muscular facilitation is facilitated with the pattern of upper limb scapula movements together [16].

Methodology

Approval from the Institutional Ethical Committee was obtained before starting the study. The Study design was experimental study and the study type was comparative type, Sampling method was convenient sampling with the sample size of 24 subjects and study duration of 6 weeks, Study setting was on SRM Medical College Hospital and Research Centre, Kattankulathur. Inclusion criteria were both men and women with Pain in the shoulder for at least 3 months, age between 40 to 70 years of Primary adhesive capsulitis.

Exclusion criteria were subjects with history of shoulder surgery or manipulation under anesthesia, Neurologic deficits affecting shoulder functioning during daily activities, Pain or disorders of the cervical spine, elbow, wrist, or hand and other pathological conditions involving the shoulder rotator cuff tear.

Procedure

Applying inclusion and exclusion criteria, 24 subjects are taken and they were divided in to two groups. In Group A 12 subjects were treated with Scapular Proprioceptive Neuromuscular Facilitation (PNF) techniques and Conventional physiotherapy such as wax bath therapy by dip and wrap method.

After the application of wax bath, stretching exercises and shoulder mobilization exercises performed. Stretching exercises including anterior and inferior capsule stretch of the shoulder, wand and Codman pendulum exercise was performed with 20 repetitions for each exercise. In Group B=12 Subjects were treated with only conventional physiotherapy.

Inferior capsule stretch

Patient standing next to the wall with arm nearest the wall, stretch the arm overhead, bend the elbow as an attempt to place the hand on back of the head, lean on to the wall with the back of head.

Hold 30 secs, repeat 3-10 times per set. Do 1 set per session and do 1-2 sessions per day.

Anterior capsule stretch

The patient has to stand facing the window with reachable distance in walk standing position and grasp the hand on the window bar by extending the shoulder now the patient has to lunge forward and down until the patient feels stretch, Then Scapular PNF was applied in two diagonals, (elevation anteriorly and depression and posterior elevation with anterior depression) with patient positioned in normal side.

In all patterns of facilitation techniques, repeated contractions and rhythmic initiation were applied in all patterns with rest period between 20 repetitions was 20 seconds. The rhythmic initiation technique helps to improve active range of motion and coordination and the technique of repeated contraction increases both the strength and range of motion (Figure 1,2).

- Outcome measures.
- The Visual Analog Scale for pain.
- The Lateral Scapular Slide Test was used to assess scapular dyskinesis.
- Universal goniometer for shoulder ROM.
- The Simple Shoulder Test for the functional limitations of the affected shoulder.



Figure 1 Scapular PNF techniques.



Data analysis

The collected data were tabulated and analyzed by using IBM SPSS version 20.0 software. Independent t-test was adopted to find out the effectiveness of scapular proprioceptive facilitation techniques and wax bath therapy between group-A and group-B. Paired t- test was used to test the results between group A and group B (Table 1,2).

Figure 2 Wax bath therapy.

Table 1 Comparison of pre-test and post-test values of PNF group of VAS, LSST, Active shoulder range, Passive shoulder range and Simple shoulder test.

GROUP A		PRE- TEST		POST- TEST		T-VALUE	SIGNIFICANT	MIM EE A-A- NN
VAS		7.83	0.835	3	0.853	16.26	P<0.0001	
LSST	1	9.17	1.043	7.08	0.996	7.244	P<0.0001	
	2	1.435	1.403	0.853	0.996	4.69	P<0.001	
	3	11.17	1.528	10.42	1.24	3.447	P<0.005	
ACTIVE	FLEXION	57.08	19.01	100.33	7.785	9.17	P<0.0001	
	ABDUCTION	47.33	21.72	114.17	17.559	9.091	P<0.0001	
	EXTERNAL ROTATION	21.75	9.946	39.17	13.114	8.069	P<0.0001	
PASSIVE	FLEXION	64.75	21.71	111.67	5.774	8.026	P<0.0001	
	ABDUCTION	53.83	20.9	127.75	17.131	11.22	P<0.0001	
	EXTERNAL ROTATION	25.08	11.87	46.17	14.031	8.997	P<0.0001	
SIMPLE SHOULDER TEST	YES	2.17	0.718	9.17	0.577	25.43	P<0.0001	
	NO	2.17	0.718	9.17	0.577	25.43	P<0.0001	

Table 2 Comparison of pre-test and post-test values of WAX therapy group of VAS, LSST, active shoulder range, passive shoulder range and simple shoulder test.

GROUP B		PRE- TEST		POST- TEST		T-VALUE	SIGNIFICANT
		MEAN	S.D	MEAN	S.D		
VAS		7.42	0.9	3.42	0.9	10.276	P<0.0001
LSST	1	8	1.279	7.33	1.371	4.69	P<0.001
	2	8.75	1.357	8	1.279	4.18	P<0.002
	3	9.58	2.275	8.25	1.422	2.861	P<0.015

ACTIVE	FLEXION	51.67	20.817	99.92	6.694	9.899	P<0.0001
	ABDUCTION	52.5	18.89	110.92	20.362	24.172	P<0.0001
	EXTERNAL ROTATION	21.92	7.609	41.42	4.379	12.871	P<0.0001
PASSIVE	FLEXION	56.67	21.865	109.58	7.217	9.843	P<0.0001
	ABDUCTION	56.42	18.667	126.75	16.344	29.894	P<0.0001
	EXTERNAL ROTATION	26.42	9.876	46.08	4.481	9.79	P<0.0001
SIMPLE SHOULDER TEST	YES	3.08	0.793	9	0.426	30.657	P<0.0001
	NO	8.92	0,793	3	0.426	30.657	P<0.0001

Results

Group-A

The pre-test mean value of visual analogue scale of group A was 7.83 and the post-test was 3.00 P (<0.0001). This table shows that there is a statistically significant difference between pretest and post - test measure of VAS among Group A. The pre-test mean value of Lateral scapular slide test LSST-1-3 of group A was S9.17, 1.425, 11.17 and post-test was 7.08, 0.853, 10.42 P (<0.0001). This table shows that there is a statistically more significant difference between pre-test and post-test of scapular dyskinesis among Group A. The pre-test mean value of shoulder Active flexion, abduction, external rotation of group A was 57.08, 47.33, 21.75 and post-test was 100.33, 114.17, 39.17 P(<0.0001). This table shows that there is a statistically more significant difference between pre-test and post-test of range of motion among Group A. The pre-test mean value of shoulder Passive flexion, abduction, and external rotation of group A was 64.75, 53.83, 25.08 and posttest was 111.67, 127.75, 46.17 P (<0.0001). This table shows that there is a statistically more significant difference between pre-test and post-test of range of motion among Group A. The pre-test mean value of Simple shoulder test questionnaire YES and NO of group A was 2.17, 2.17 and post-test was 9.17, 9.17 P (<0.0001). This table shows that there is a statistically more significant difference between pre-test and post-test of shoulder function among Group A.

Group-B

The pre-test mean value of visual analogue scale of group B was 7.42 and the post-test was 3.42 P (<0.0001). This table shows that there is a statistically significant difference between pretest and post - test measure of VAS among Group B. The pre-test mean value of Lateral scapular slide test LSST-1-3 of group B was 8.00, 8.75, 9.58 and post-test was 7.33, 8.00, 8.25 P (<0.001). This table shows that there is a statistically more significant difference between pre-test and post-test of scapular dyskinesis among Group B. The pre-test mean value of shoulder Active flexion, abduction, external rotation of group B was 51.67,52.50, 21.92 and post-test was 99.92, 110.92, 41.42 P(<0.0001). This table shows that there is a statistically more significant difference between pre-test and

post-test of range of motion among Group B. The pre-test mean value of shoulder Passive flexion, abduction, external rotation of group B was 56.67, 56.42, 26.42 and post-test was 109.58, 18.667, 46.08 P (<0.0001). This table shows that there is a statistically more significant difference between pre-test and post-test of range of motion among Group B. The pre-test mean value of Simple shoulder test questionnaire YES and NO of group B was 3.08, 8.92 and post-test was 9.00, 3.00 P (<0.0001). This table shows that there is a statistically more significant difference between pre-test of shoulder test questionnaire YES and NO of group B was 3.08, 8.92 and post-test was 9.00, 3.00 P (<0.0001). This table shows that there is a statistically more significant difference between pre-test and post-test of shoulder function among Group B.

Discussion

This study compares the effectiveness of scapular Proprioceptive Neuromuscular Facilitation (PNF) techniques and conventional physiotherapy in adhesive capsulitis patients. Group A subjects treated with scapular Proprioceptive Neuromuscular Facilitation (PNF) techniques shows a pain reduction significantly, scapular dyskinesis, and improvement in range of motion of shoulder and functional activities. (P<0.0001) Proprioceptive Neuromuscular Facilitation (PNF) techniques help in improving range of motion as it elongates the Golgi tendon organ that facilitates relaxation of the antagonist muscles. A study conducted by Gonzalez Rave et al., stated that after the application of PNF techniques there is an improvement in patients shoulder and hip joint range of motion. It has been observed that when compared to other groups the group which received PNF technique was found to have increased functional activities and range of motion along with the reduction in pain. Group B, subjects treated with wax bath therapy and exercises for 6 weeks shows the significant reduction in pain intensity, scapular dyskinesis and improvement in shoulder range of motion and functional activities of subjects with adhesive capsulitis with the statistical value of (P<0.001). Warm paraffin accelerates all of these heat related benefits and is commonly prescribed in the post-traumatic stiffness and painful conditions such as arthritis. Paraffin rejuvenates skin through increased circulation and topical moisturization. The post-test mean value of group A, VAS is 3.00, LSST-1-3 is 7.08, 0.853, 10.42, active range of shoulder abduction, external rotation, flexion is 100.33, 114.17, 39.17 and shoulder passive range is abduction, external rotation, flexion is 111.67, 127.75, 46.17

and simple shoulder test questionnaire YES and NO is 9.17 and 9.17. The post-test mean value of group B, VAS is 3.42, LSST-1-3 is 7.33, 8.00, 8.25, shoulder active range of shoulder abduction, external rotation, flexion is 99.92, 110.92, 41.42 and shoulder passive range of shoulder abduction, external rotation, flexion is 109.58, 18.667, 46.08 and simple shoulder test questionnaire YES and NO is 9.00 and 3.00. Hence, the group A subjects treated with Scapular PNF techniques, followed by wax bath therapy, stretching and shoulder mobilizing exercises showed significant improvement in the scapular dyskinesis, range of motion of shoulder and functional activities and pain reduction as compared to group B subjects who were treated with wax bath therapy, stretching and shoulder mobilization exercises.

Conclusion

The study concluded that subjects who underwent Scapular Proprioceptive Neuromuscular Facilitation techniques along with wax therapy, stretching and shoulder mobilization exercises showed improvement in scapular dyskinesis, increase the functional activities and range of motion of shoulder and reduction in pain at the end of 6 weeks when compared to subjects with group B, who underwent wax therapy, stretching and shoulder mobilization exercises. Therefore, Application of Scapular Proprioceptive Neuromuscular Facilitation along with wax therapy, stretching and shoulder mobilization exercises can be considered beneficial in the pain improvement, scapular dyskinesis, range of motion of shoulder and functional activities in individuals with primary adhesive capsulitis.

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