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EFFECTIVENESS OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION AND POSITIONAL RELEASE THERAPY WITH MULLIGAN MOBILIZATION AMONG THE PATIENTS WITH CHRONIC FROZEN SHOULDER

***S. Karthikeyan, V. Kamal Raj and P. Senthil Selvam**

School of Physiotherapy, Vels Institute of Science, Technology & Advanced Studies.

***Corresponding Author: S. Karthikeyan**

School of Physiotherapy, Vels Institute of Science, Technology & Advanced Studies.

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ABSTRACT

Background: Shoulder Joint is one of the most mobile joints involving in various functional activities that includes upper extremity. The joint undergoes pathological changes and frozen shoulder is one among the commonest in older adults. The primary structure affected in the frozen shoulder is the inferior joint capsule. The condition can vary from mild to moderate pain, stiffness and causes restriction in the range of motion of the Glenohumeral joint. **Method:** The study is an experimental design with 50 samples for a duration of 6 weeks. The treatment groups were A & B in which group A treated with proprioceptive neuromuscular facilitation and group B with positional release therapy. Mulligan mobilization was given commonly for both the groups. The pre and post test scores were taken for range of motion, pain using numerical pain rating scale and functional ability by shoulder pain arm disability index (SPADI). **Results:** The data were collected and analysed using Mann Whitney U test and Wilcoxon signed rank test. The analysed data shows statistically significant improvement in range of motion of shoulder joint in both the groups. But the mean and standard deviation with analysed data of group B shows statistically significant improvement in pain and functional status comparing to group A. The Mean ± S.D with $p < 0.001$. **Conclusion:** Both Proprioceptive neuromuscular facilitation technique and Positional release therapy shows statistically significant improvement in range of motion but Positional release therapy shows statistically and clinically significant improvement in pain reduction and improvement in functional status of the patients with chronic frozen shoulder.

KEYWORDS: positional release therapy, proprioceptive neuromuscular facilitation, frozen shoulder, mulligan mobilization.

INTRODUCTION

Shoulder joint is one of the most mobile joint and a functional joint of upper extremity which involves in many activities of daily living.[9] It is estimated that frozen shoulder affects 2% - 5% of the general population and most commonly it affects 4th to 6th decade of life causing significant pain and disability. The frozen shoulder is often progressing into three stages which are known as freezing, a painful stage, frozen, adhesive stage and thawing stage. The pain during frozen stage will reduce and causes restriction in Glenohumeral flexion, abduction, internal and external rotation movements.[6]

Capsular patterns are patterns of restricted motion which involves multiple motions at the joints. The patterns are due to diffuse, intra articular inflammation of the joint capsule. These patterns may vary from joint to joint. The capsular pattern of the Glenohumeral joint shows maximal loss of external rotation, moderate loss of abduction and minimal loss of internal rotation.

The concept of Proprioceptive neuromuscular facilitation was developed by Dr. Herman Kabat and Margaret Knott for rehabilitation purposes.[24] The proprioceptive neuromuscular facilitation stretch is an effective stretching technique comparing to static stretching in increasing range of motion due to Neuro physiological mechanisms mediated by the Golgi tendon organ and Muscle spindle.[3] The stretch also involves combination of functionally based diagonal patterns of movement with techniques of neuromuscular facilitation to evoke motor responses.

The speciality of this Proprioceptive neuromuscular facilitation stretch is the use of diagonal patterns and application of sensory cues – specifically proprioceptive, visual, Cutaneous and auditory stimuli – to elicit motor response. The Proprioceptive neuromuscular facilitation stretch involves shortening contraction of the opposing muscle to place the target muscle on stretch; this is followed by an isometric contraction of the target muscle. Thus, literature supports the use of Proprioceptive neuromuscular facilitation can be used to

relax the tensed muscles and restricted joints which results in quick gains in the range of motion.

Range of motion of a particular joint is dependent on the state of balanced muscle work that crosses the involved joints and restriction of motion may be directly attributed to abnormalities in the tone and activity of the system. The response of muscle due to injury is protective muscle spasm and this reflex is mediated by local Proprioceptors and monosynaptic reflexes at the spinal level. Trigger points or tender points are taut palpable points or bands present in the muscle which are pathophysiologic indicator of musculoskeletal dysfunction. Positional release therapy is an indirect technique that applies force away from a resistance barrier, that is, in the direction of ease. The tender points in Positional release therapy are used primarily as diagnostic indicators of the location of the dysfunction.

Positional release therapy is accomplished by placing the involved tissues in an ideal position of comfort. The purpose of the position of comfort is to reduce the irritability of the tender point and to normalize the tissues associated with the dysfunction. The ideal position is determined subjectively by the patient's perception of tenderness and objectively by the reduction in palpable tone of the tender point.[25]

Brain mulligan's mobilization technique is one of the advanced methods of manual therapy technique used in conditions with restricted joint range of motion. It involves combination of sustained manual application of 'gliding' force to the affected joint thereby improving range of motion.

The shoulder pain and disability index were developed to measure the shoulder pain and the functional ability of the patients with shoulder conditions. The SPADI contains 13 items that assess to domains; a 5-item subscale that measures pain of the affected part and an 8-item subscale that measures disability. The SPADI has a very high internal consistency and it is a valid and reliable outcome measure used to assess the pain and disability among the patients with shoulder dysfunction.[22]

There were less literature reviews that focus on the use of Positional release therapy on improving functional ability and range of motion in various musculoskeletal dysfunctions. But there was very less literature evidence on the effect of positional release therapy showing improvements in pain reduction, range of motion and functional improvements. So, the present study focusses on comparing the effectiveness of Proprioceptive neuromuscular facilitation stretch and Positional release therapy along with mulligan's mobilization among the chronic frozen shoulder patients.

METHODS

There were 50 patients who have been selected in the study based on the inclusion criteria. All the patients were explained about the treatment procedures and obtained informed consent from them. The patients were allocated into group A and B. The pre-test score on pain using numerical pain rating scale, range of motion using universal Goniometer and functional status by shoulder pain and arm disability index. Group A patients received proprioceptive neuromuscular facilitation with mulligan mobilization. Group B received positional release therapy with mulligan mobilization.

Group A

The group A received proprioceptive neuromuscular facilitation technique with mulligan mobilization.

D2 Flexion

Starting position: The position of involved upper extremity must be in shoulder extension, adduction and internal rotation; elbow extension; forearm pronation; and wrist and finger flexion. The forearm should lie across the umbilicus.

Therapist hand placement: The therapist grasps the dorsum of the patient's hand with his left-hand using lumbrical grip. Grasp the dorsal surface of the patient's forearm close to the elbow with your right hand. The therapist applies a quick stretch and instructs the patient "open your hand and turn it to your face".

Ending position: Complete the pattern in shoulder flexion, abduction and external rotation. Elbow extension; forearm supination; wrist and finger extension;

Fig. 01: D2 PNF STRETCH.

Fig. 02: D2 PNF STRETCH.

D2 Extension

Starting position: The position of the upper extremity must be in shoulder flexion, abduction and external rotation. Elbow extension; forearm supination; wrist and finger extension;

Therapist hand placement: The therapist places the index and middle fingers of his right hand in the palm of the patient's hand and the therapist's left hand on the volar surface of the forearm. As the therapist applies quick stretch instruct the patient "squeeze my fingers and pull down across your chest"

Ending position: Complete the pattern in shoulder extension, adduction and internal rotation; forearm pronation, wrist and finger flexion; Forearm across the umbilicus;

Proprioceptive neuromuscular facilitation stretch is performed 3 times a week for 6 weeks. The duration of each stretch can be maintained for 5-10 secs. Each pattern can be given 8 repetitions in a set in which 2 sets of stretch pattern for a single session in a day.

GROUP B

The group B received Positional release therapy with mulligan mobilization technique.

Supraspinatus lateral fibres Location of the tender point – The tender point is located deep to the belly of the lateral deltoid muscle just inferior to the acromion process. The therapist must flex or abduct to approximately 90 degree in order to slacken the deltoid sufficiently to allow for palpation of the tender point. Pressure is applied inferiorly.

Position of the treatment – The patient is supine. The therapist produces a combination of flexion and abduction of the arm to approximately 120 degree and adds slight external rotation to fine tune.

The ideal position of comfort achieved was held for a period of 90- seconds and followed by a passive return of the body part to an anatomically neutral position. The therapy is continued for 5 minutes duration with rest interval. The therapy is given for 3 times a week for 6 weeks and applied for 2 times a day.

Supraspinatus Medial fibres Location of the tender point – The tender point is located at the belly of the supraspinatus muscle in the supraspinous fossa or at the musculoskeletal junction just medial to the posterior aspect of the Acromio clavicular joint. Pressure is applied anteriorly and inferiorly.

Position of treatment – The patient lies supine. The therapist is on the side of the tender point. The therapist grasps the forearm near the elbow and places the shoulder into 45 degree of flexion, abduction and external rotation.

The ideal position of comfort achieved was held for a period of 90- seconds and followed by a passive return of the body part to an anatomically neutral position. The therapy is continued for 5 minutes duration with rest interval. The therapy is given for 3 times a week for 6 weeks and applied for 2 times a day.

Infraspinatus superior fibres Location of the tender point – The tender point is located along the inferior border of the spine of scapula. Pressure is applied anteriorly.

Position of the treatment – The patient is in supine and the therapist is on the side of the tender point. The therapist grasps the forearm and flexes the shoulder to

approximately 90 degree to 100 degree with moderate horizontal abduction and slight external rotation.

The ideal position of comfort achieved was held for a period of 90- seconds and followed by a passive return of the body part to an anatomically neutral position. The therapy is continued for 5 minutes duration with rest interval. The therapy is given for 3 times a week for 6 weeks and applied for 2 times a day.

Infraspinatus middle fibres Location of the tender point – The tender point is located in the upper portion of the infraspinous fossa. Pressure is applied anteriorly.
Position of treatment – The patient is in supine and the therapist stands on the side of the tender point. The therapist grasps the forearm and flexes the shoulder approximately 110 degree to 120 degree with moderate horizontal abduction and slight external rotation.

The ideal position of comfort achieved was held for a period of 90- seconds and followed by a passive return of the body part to an anatomically neutral position. The therapy is continued for 5 minutes duration with rest interval. The therapy is given for 3 times a week for 6 weeks and applied for 2 times a day.

Infraspinatus inferior fibres Location of the tender point – The tender point is located in the centre or lower portion of the infraspinous fossa. Pressure is applied anteriorly.

Position of the treatment – The patient is in supine and the therapist stands on the side of the tender point. The therapist grasps the forearm, flexes the shoulder to approximately 130 degree to 140 degree and fine tunes with slight abduction/adduction and internal/external rotation.

The ideal position of comfort achieved was held for a period of 90- seconds and followed by a passive return of the body part to an anatomically neutral position. The therapy is continued for 5 minutes duration with rest interval. The therapy is given for 3 times a week for 6 weeks and applied for 2 times a day.

Fig. 3: Positional release therapies for supraspinatus and Infraspinatus.

Common Mulligan's mobilization for both Group A and B
The Mulligan's technique was performed on the involved shoulder for both the groups. The treatment was administered on the guidance of the physiotherapist who was trained in mulligan technique. The technique is applied in a pain free range of motion.

Shoulder internal rotation and external rotation
Patient position – supine lying
Therapist position – The therapist stood lateral to the affected joint. The patients shoulder and elbow were placed in 90 degree of flexion; belt was placed close to the shoulder joint line and secured around the therapist's waist. The therapist pulled the belt laterally to distract the joint and stabilized the Humerus by holding the distal end of the Humerus with both hands. Patient was then asked to perform the offending movement i.e. internal and external rotation actively and applies a passive overpressure on the other hand at the end of new available range.

Shoulder Abduction
Patient position – sitting
Therapist position – The belt was placed around the head of the Humerus and postero-lateral as well as inferior glide was maintained. With one hand the therapist held the belt in place sustaining the glide. A counter pressure was also applied to the scapula with the therapist's other hand. The patient was asked to perform slow active shoulder movements to the end of abduction. The glide must be sustained during the movement.

Dosage of the mobilization – The mobilization can be applied in both groups for about 10 repetitions 3 sets with 1-minute rest interval between each set. The therapy can be followed along with the PNF and PRT for 3 times a week for 6 weeks.

Fig. 4: Mulligan mobilizations.

DATA ANALYSIS

The ordinal data were calculated with the SPSS software version 17. The results from the outcome measures for both groups were analysed by the Non – Parametric tests i.e Mann Whitney U test and Wilcoxon signed rank test. The mean and standard deviation have been tabulated.

Table 1: The values are Mean ± S.D ($p < 0.001$).

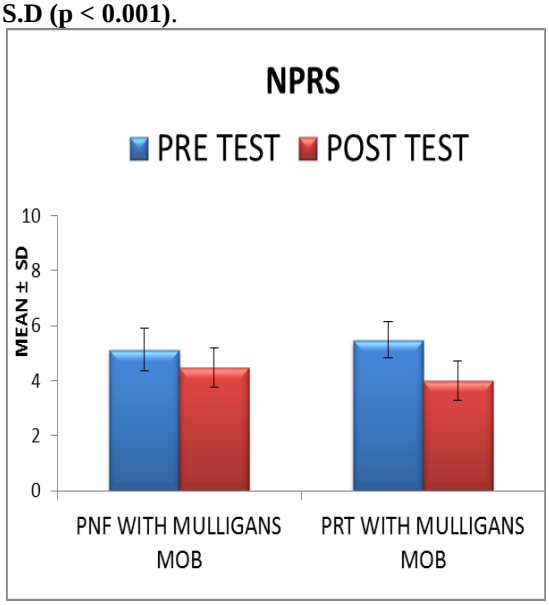


Table 2: The values are Mean ± S.D ($p < 0.001$).

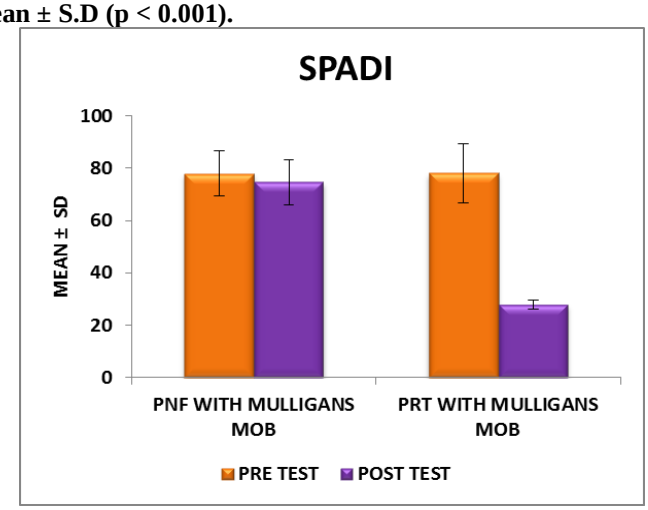


Table 3: The values are Mean ± S.D ($p < 0.001$).

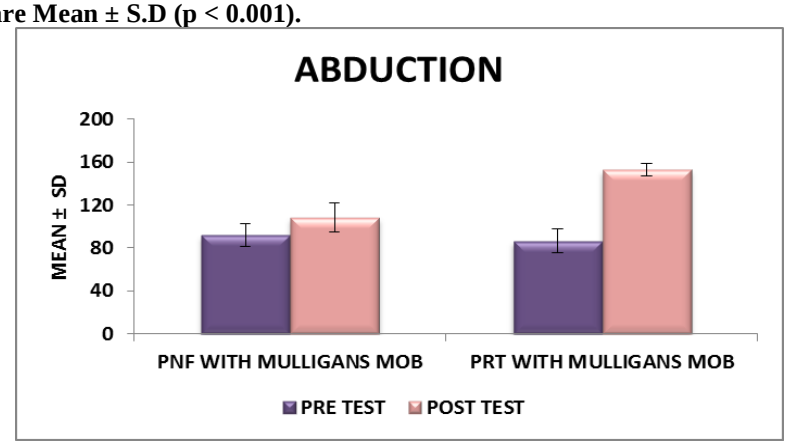


Table 4: The values are Mean ± S.D ($p < 0.001$).

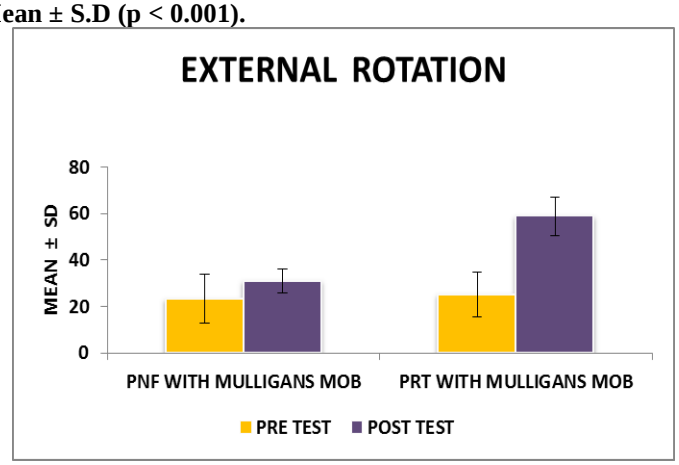
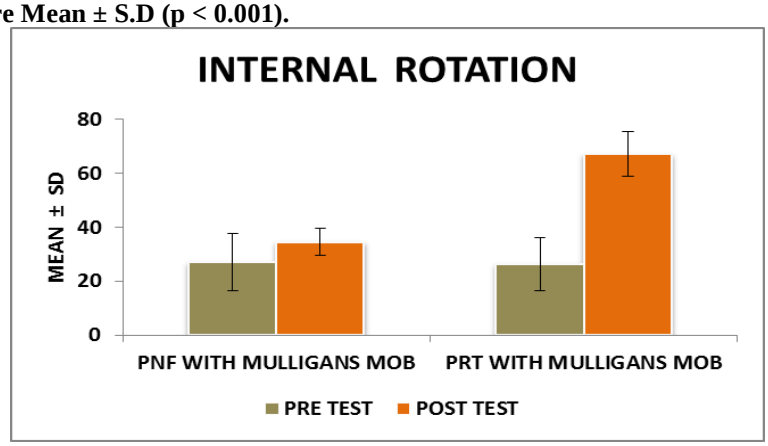


Table 5: The values are Mean ± S.D ($p < 0.001$).



RESULTS

The present study focusses on the comparison of Proprioceptive neuromuscular facilitation stretch and Positional release therapy with mulligan's mobilization. The study included 50 participants which were divided into 2 groups. The patients mean age group were between 40 to 60 years who come across with Chronic frozen shoulder.

NPRS

The mean and standard deviation for NPRS in Group A was 0.640 and 0.952 with 'p' value 0.003 which is not showing significant improvement comparing to Group B which has 1.480 and 0.918 with 'p' value 0.000 which shows highly significant improvement ($p < 0.001$) in pain reduction.

SPADI

The mean and standard deviation for SPADI in Group A was 3.320 and 6.568 with 'p' value 0.18 which is statistically insignificant comparing to Group B which has 50.240 and 11.230 with 'p' value 0.000 which is highly significant ($p < 0.001$) in improving the functional ability of the patient.

ABDUCTION

The mean and standard deviation for Abduction range in group A will be -16.600 and 8.627 with 'p' value 0.000 and in group B -66.400 and 13.808 with 'p' value 0.000 showing significant improvement ($P < 0.001$) in both the groups. Both PRT and PNF stretch shows statistically significant improvement in both the groups with respect to the abduction range of motion.

EXTERNAL ROTATION

The mean and standard deviation for external rotation in group A -7.800 and 5.788 with 'p' value 0.000 and group B shows -33.600 and 8.602 with 'p' value 0.000 which shows significant improvement ($P < 0.001$). Both PRT and PNF stretch shows statistically significant improvement in both the groups with respect to the external rotation range of motion.

INTERNAL ROTATION

The mean and standard deviation for internal rotation in group A will be -7.600 and 6.144 with 'p' value 0.000 and in group B it will be -40.800 and 9.092 with 'p' value 0.000 showing significant improvement in the internal rotation range of motion ($p < 0.001$).

DISCUSSION

The results of the present study showed that the Group A and Group B showed better improvement in improving range of motion of the Glenohumeral joint. But Group B showed clinically and statistically significant improvement in reducing pain and improving the functional status of the patients with chronic frozen shoulder.

The previous study in which Brinda Shah et al 2018 and Mohamed EL sayed Abdelkarem Ali et al 2017 used positional release therapy concluded that the technique improves range of motion and helps in the reduction of pain in low back dysfunction and improving muscle strength among gastro – soleus muscle. Positional release therapy is an indirect technique that comprises of total body evaluation and treatment using tender points and a position of comfort to resolve the associated dysfunction.

Positional release therapy involves two major phases of release phenomenon. The neuromuscular phase which lasts approximately 90 seconds to 3 minutes and Myofascial phase which may last upto 5 to 20 minutes; the positional release therapy appears to affect the inappropriate proprioceptive activity during the neuromuscular phase. This helps in normalizing the muscle tone and reforms the normal length – tension relationship in the muscle. When the Positional release therapy is applied to the muscle that is increase in tone, it helps in relaxing the muscle tone, thus relieving the tension around the joint which makes it mobile from reduction in range of motion.[25]

The increase in range of motion of the Glenohumeral joint by Proprioceptive neuromuscular facilitation can be due to activation of the inhibitory neurons in the spinal cord followed by stimulation of the Golgi tendon organ. Also, there were previous studies that support Mulligan's mobilization can be an effective technique in improving mobility and increase in range of motion of the joint. Thus, mobilization techniques are been widely used to treat conditions with frozen shoulder. There was very less literature support on the use of Positional release therapy in treating frozen shoulder patients.

Though there were few limitations in this study like no homogeneity maintained and the sample size was small, this was the first study to analyse the effectiveness of Positional release therapy in improving range of motion, pain reduction and increasing the functional ability of the patients with chronic frozen shoulder. Although the Proprioceptive neuromuscular facilitation shown improvements in the abduction, external and internal rotation range of motion of the Glenohumeral joint, Positional release therapy showed highly significant improvement in the reduction of pain and increasing the functional ability of the patients with Chronic frozen shoulder. Further research can focus on larger samples and positional release can be applied with equipment. Thus, clinically the above results can be implemented by using positional release therapy along with mulligan's mobilization in order to relieve muscle tone as well as in pain reduction and better performance of Activities of daily living.

CONCLUSION

The current study has provided adequate evidence with neurophysiology background on the mechanism of positional release therapy and concludes that Positional release therapy is effective and statistically shows significant improvement in pain reduction, range of motion and functional status of the patients with chronic frozen shoulder.

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