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INFLUENCE OF TWO STRUCTURED REHABILITATION APPROACHES ON PAIN, SHOULDER KINEMATICS IN EARLY ADHESIVE CAPSULITIS

[1]Dr.J. Surya Sakthi, [2]Dr.V.Balchandar, [3]Dr.K.Velpari, [4]Dr.E. Kanimozhi, [5]Dr.D. Keerthivasan.

[1]Assistant professor, [2]Principal, [3]Associate professor, [4]Assistant professor [5]Assistant professor.

[1]Physiotherapy department, Jaya college of physiotherapy, Chennai,

Abstract:

Background: This study evaluates the outcomes of rehabilitation program for adhesive capsulitis of shoulder using capsular flexibility exercise and PNF stretching following heat therapy

objective: to assess the effectiveness of capsular flexibility training and contract relax stretching for adhesive capsulitis, this study aims to reduce pain and improve ROM of shoulder joint.

Methodology:

Study design. Pilot Randomized Experimental study

Sample size: 30 subjects with clinically diagnosed adhesive capsulitis.

Study setting: Jaya College of physiotherapy

Inclusion Criteria:

- Subjects clinically diagnosed with adhesive capsulitis.
- Age group 40-70years.
- Both males and females
- Restricted joint ROM of shoulder
- Diabetes, Absence of local sepsis and skin disease

Exclusion Criteria:

- Previous shoulder surgery
- Fracture Shoulder dislocation
- Rotator cuff tear
- Glenohumeral arthritis
- Humerus fracture

Out Come Measurement:

Goniometer-Active and passive ROM OF shoulder, Pain -NPRS score.

Methods And Procedure: A pilot randomized control study was conducted by 30 subjects who have shoulder adhesive capsulitis, 15 subjects in Group A received capsular flexibility exercise while 15 subjects in Group B received PNF Contract relax following heat therapy. The treatment duration scheduled for 30 minutes per day, 5 times a week for 4 weeks.

Results: The result of this study shows for 2 outcome measurements indicating both group A group B intervention methods are effective in shoulder adhesive capsulitis.

Conclusion: finally, we conclude both capsular flexibility exercise and PNF stretching following heat therapy are effective on reducing pain and improving ROM of shoulder.

Key words: adhesive capsulitis, capsular flexibility exercise, PNF stretching.

INTRODUCTION:

The shoulder is complex joint that is crucial to many "activities of daily living (ADL)". A serious clinical finding indicates decrease in shoulder mobility [1]. Adhesive capsulitis is an insidious painful condition with gradual restriction of all planes of movement in the shoulder joint. It is the main cause of shoulder pain and dysfunction in the middle aged and elderly population. It can be due to idiopathic or post traumatic causes, but the term adhesive capsulitis should be reserved for the idiopathic type of shoulder stiffness[2,3.]

Evasier et al first in introduced the term adhesive capsulitis in the 1940 and described primarily an inflammation reaction in the capsule and synovium that subsequently leads to formation of adhesion, specifically in the axillary fold and in the attachment at the anatomic neck of the humerus[4]. Another more definition for adhesive capsulitis is severe shoulder dysfunction characterized by an inability to flexion, extension, abduction, internally rotation, external rotation of shoulder[5] in adhesive capsulitis the capsular extensibility is decreased, the axillary recess becomes adherent and the flexibility of biceps tendon in the sheath is reduced. As a result of external rotation of humeral head to pass under the acromion during abduction is severely restricted.

Adhesive capsulitis otherwise called as frozen shoulder, is a common source of shoulder pain and stiffness among middle-aged adults and is linked with significant functional impairment, increasing evidence indicates that many individuals may experience persistent symptoms and incomplete recovery. Diagnosis is mainly clinical, based on patient medical history and physical examination findings showing limitation of passive glenohumeral movement, while imaging is mainly used to exclude other pathologies. Capsular flexibility training and PNF stretching combined with heat therapy help improve capsular mobility, soft tissue flexibility, and reduce pain and disability. Outcome measures include assessment of shoulder joint range of motion using a goniometer and pain evaluation using the NPRS (Numerical Pain Rating Scale). Therefore, this study aims to evaluate the effectiveness of capsular flexibility exercises and PNF stretching combined with heat therapy in individuals with adhesive capsulitis of the shoulder joint.

Idiopathic adhesive capsulitis is characterized by fibrosis of the capsule resulting with progressive, painful loss of active and passive shoulder joint motion. Reeves et al describe three stages of the disease: Stage: 1 it is mainly characterized by pain usually lasting 2-9 months. In stage: 2 [frozen stage]: pain gradually subsides but stiffness is marked 4-12 months. In stage 3: [thawing phase] pain resolves and improvement in range of motion [ROM] appears[6,7.]

Primary adhesive capsulitis is characterized by idiopathic fibrosis of the joint capsule. Secondary adhesive capsulitis occurs following some predisposing factors or over 40 years, rotator cuff lesion, diabetes, female gender, stroke, thyroid disease, lung disease, myocardial infarction, cervical spine disorder, and reflex sympathetic dystrophy syndrome are factors associated with adhesive capsulitis[9].

Adhesive capsulitis usually affects patients aged 40-70, with females affected more than males, and no predilection for race. There is a higher incidence of adhesive capsulitis of shoulder among patients with diabetes. Adhesions and capsular contractures causing restriction of motion, intra articular pain, and microscopic evidence of reparative inflammatory Changes in the glenohumeral joint capsule[10,11.]

HAGGARD and CARR that the basic factor causing this adhesive capsulitis is the presence of adhesion between the floor and roof of the subacromial bursa, and consequence loss of gliding function normally present here[12.]

Wax therapy can heat up the larger treatment area and volume of tissue at the therapeutic frequency of 27.12Mhzfor 10-15minutes. G C goats et al when wax therapy of sufficient intensity is directed at biological tissue it will cause heating. This effect was recognized many years ago and has been used therapeutically since 1928.wax therapy emits either a continuous or pulsed sometimes both. Continues output units are used primarily achieve deep heating of tissue[13.]

VOSS g knot et al PNF stretching utilizing a shortening contraction of the opposing muscle to the place the target muscle on stretch, the inclusion of shortening contraction of the opposing muscle appears to have the greatest impact on enhancing ROM.PNF or proprioceptive neuromuscular facilitation is one of the most effective form of flexibility training, the PNF position to encourage flexibility and coordination in the limbs. It helps to gains in ROM. PNF is advanced form of flexibility training that involved both stretching and contraction of the muscle group[14.]

Capsular flexibility exercise is the application of specific and progressive forces with the intent of promoting changes in the myofascial allowing for elongation of shortened structures. Capsular flexibility exercise more effective to increase the active and passive range of motion for the shoulder[15.]

Stretching import changes such as remodelling of elastin and collagen molecules, these changes may be associated with alteration on the muscle tendon units and fascia, caused by increase tissue elasticity. 12In other words the RANGE OF MOTION would be influenced by the increase on the length of the tissue[16,17.]

METHODS AND PROCEDURES:

A total of 30 subjects is taken from OP department of Jaya college of physiotherapy, Chennai and other hospitals. All subjects were clinically diagnosed as adhesive capsulitis and referred for physiotherapy. Patients were selected based upon inclusion and exclusion criteria. The purpose of the study was explained to all subjects and consent from each subject was taken. All subjects were assessed using a special Performa. All subjects were randomly assigned into either capsular flexibility exercise with wax therapy (Group A) or PNF stretching with wax therapy(Group B).The study included individuals with adhesive capsulitis who had Subjects clinically diagnosed with adhesive capsulitis, Age group 40-70years,Both males and females Restricted joint ROM of shoulder, Diabetes, Absence of local sepsis and skin disease, Age group 40-70years,Both males and females, Restricted joint ROM of shoulder, Diabetes, Absence of local sepsis and skin disease, and exclusion criteria included subjects whose vital signs are unstable, Previous shoulder surgery, Fracture Shoulder dislocation, Rotator cuff tear. Glenohumeral arthritis, Humerus fracture and non-co-operative patients.

PROCEDURE:

30 Subjects were selected with clinically diagnosed adhesive capsulitis were evaluated using a assessment form, Numerical Pain Rating Scale, subjects ROM Evaluation. Patients were informed about the procedure, merits and demerits of the treatment. Consent is obtained from each patient for voluntary participation. Participants were randomly assigned into two groups i.e Group A and Group B. Patient were assessed before the commencement of treatment. subjects were again assessed after 12 sessions of treatment for 8 weeks. Total number of subjects participated in the study were 30. Subjects divided into 2 groups. Group A: capsular flexibility exercise with wax therapy. Group B: contract relax stretching with wax therapy.

They were asked to repeat the stretches 3times. Each stretch was sustained for 03 sec with 10 seconds rest between each stretch. The subjects were asked to stretching exercise at home every day[10.20]

Immediately after the treatment subjects were asked to perform four stretching exercises in the following fixed sequence. Stretching in internal rotation, in flexion followed by stretching in hand behind the back in standing and cross body adduction in standing or supine lying. The Subjects will first be applied with wax therapy treatment will be followed by capsular flexibility training.

Flexibility training for internal rotation, external rotation.

Position of patient: In standing the hand behind the back with towel grasp to

alternative upward and downward movement of hand. In these stretch the affected arm placed upward. This position maintained for 30 seconds and maximum duration up to the point of pain experienced by the patient.

Posterior capsule flexibility exercise will be performed with the subject in standing with cross body adduction.

For abduction, Antero- inferior capsule will be stretched, the affected arm taken to extreme attainable elevation of the shoulder[22,23]

Stretching in external rotation will be performed with subjects in standing against a wall, and arm in 90 of abduction, to move opposite side of shoulder within pain free range.

GROUP B: PNF stretching with wax therapy

1. Starting position: patient is in sitting position and therapist in standing at the side of the patient.

(PNF stretching) therapist will passively move the shoulder joint in external rotation and internal rotation until the stretch begin to feel uncomfortable to the subject. Then subject will be asked to perform maximal isometric contraction for 6 seconds followed by 10 seconds of relaxation.

During the 10 seconds of relaxation a tester slowly externally rotates the subject s shoulder joint, if the subjects still consider this test to be uncomfortable, it is kept as previous position.

The subjects then performed 2 more 6 seconds maximal contraction [total 3 contractions) with 10 second relaxation period in between. Same position maintained for external rotation

2. Starting position: patient is in sitting position and therapist in stand at the side of the patient.

(PNF stretching) therapist will passively move the shoulder joint in abduction until the stretch begin to feel uncomfortable to the subject. Then subject will be asked to perform maximal isometric contraction for 6 seconds followed by 10 seconds of relaxation.

During the 10 seconds of relaxation a tester slowly abducts the subject s shoulder joint, if the subject still considers this test to be uncomfortable; it is kept as previous position.

The subjects then performed 2 more 6 seconds maximal contraction (total 3 contractions) with 10 second relaxation period in between.

3. Starting position: patient is in sitting position and therapist in standing at the side of the patient.

(PNF stretching) therapist will passively move the shoulder joint in flexion and extension of the shoulder, until the stretch begin patient to feel uncomfortable to the subject. Then subject will be asked to perform maximal isometric contraction for 6 seconds followed by 10 seconds of relaxation.

During the 10 seconds of relaxation a tester slowly abducts the subject s shoulder joint, if the subject still considers this test to be uncomfortable; it is kept as previous position.

The subjects then performed 2 more 6 seconds maximal contraction (total 3 contractions) with 10 second relaxation period in between.

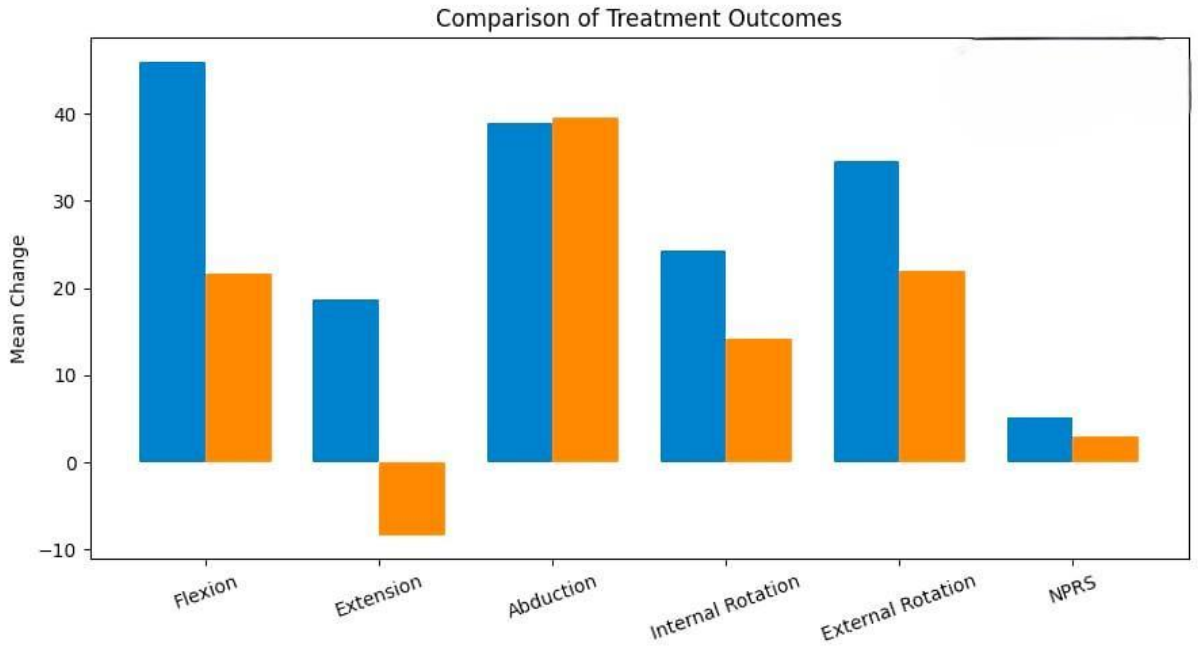
RESULTS:

1. There is significant difference between two treatments in terms of average increment in Flexion ($t(28) = 2.721$ $p < 0.05$) Going by the mean values, we conclude that the average increment in Flexion score due to Treatment 1 "Capsular flexibility exercise with Wax therapy " (M = 46 , SD = 25.3) is greater than that of Treatment 2 "PNF Stretching with Wax therapy " (M = 21.67 SD = 23.65)

2. There is significant difference between two treatments in terms of average increment in Internal Rotation ($t(28) = 2.179$, Going by the mean values, we conclude that the average increment in Internal Rotation score due to Treatment 1 "Capsular flexibility exercise with Wax therapy " (M = 24.33 , SD = 13.998) is greater than that of Treatment 2 "PNF Stretching and Wax therapy " (M = 14.13 , SD = 11.52) $p < 0.05$)

3. There is significant difference between two treatments in terms of average increment in External Rotation ($t(28) = 2.172$, $p < 0.05$) Going by the mean values, we conclude that the average increment in External Rotation score due to Treatment 1 "Capsular flexibility exercise with Wax therapy " (M = 34.67 , SD = 12.6) is greater than that of Treatment 2 "PNF Stretching and Wax therapy " (M = 21.93 , SD = 18.89)

4. There is significant difference between two treatments in terms of average reduction in NPRS scores (t(28) = 3.688. $p < 0.05$) Going by the mean values, we conclude that the average reduction in NPRS scores due to Treatment 1 "Capsular flexibility exercise with Wax therapy " (M = 5.2, SD = 0.77) is greater than that of Treatment 2 "PNF Stretching and Wax therapy " (M = 2.93, SD = 2.25).



Result that shows INSIGNIFICANT difference between two treatments:

The difference between two treatments was found to be insignificant with respect to average change in the remaining 2 standard measures, which are shown below:

1. No significant difference between two treatments in terms of average increment in Extension scores (t(28) = 2.012, p=0.054>0.05).

2. No significant difference between two treatments in terms of average increment in Abduction scores (t(28) = -0.055, p=0.957>0.05)

DISCUSSION:

Thirty participants took part in this study following an evaluation of inclusion and exclusion criteria. Participants were randomly assigned to two groups. Group A underwent capsular flexibility exercises combined with wax therapy, while Group B engaged in PNF stretching along with wax therapy. This research aims to compare the effectiveness of capsular flexibility training against PNF stretching combined with wax therapy in cases of adhesive capsulitis.

This research demonstrates efficacy within the group, revealing a notable enhancement in post-test assessments for both Group A's capsular flexibility exercises and Group B's PNF stretching combined with wax therapy for adhesive capsulitis of the shoulder, reducing pain and enhancing joint range of motion. In this research, wax therapy serves as the shared method in group A and B. Geoffrey C et al. conducted experiments on the impact of wax therapy and found that several therapeutic benefits arise from heat therapy application, aiding in pain relief, enhancing vasodilation, improving connective tissue compliance, increasing joint range, and reducing joint stiffness[18].

In this research, Group A underwent capsular flexibility training; statistical analysis indicated a significant average decrease in NPRS scores ($p=0.000<0.05$) with a Mean of 5.20 and SD of 0.775. Lehmann et al. determined that wax therapy experimentally raises pain thresholds; this effect seems to be caused by a direct influence of heat on free nerve endings or on the nerve trunk supplying the area in question. Heat also activates cutaneous thermo-receptors enough to inhibit the transmission of pain as it enters the spinal cord through the 'pain gate mechanism.'[19] Prior research findings back this study that alleviates pain in adhesive capsulitis of the shoulder.

Likewise, group B, which underwent PNF stretching along with wax therapy, demonstrated effectiveness in pain relief. According to the statistical evaluation with Paired sample t test outcomes, NPRS score (14) =5.047, $p=0.000<0.05$. M=2.93. SD=2.25. In this research involving a wax therapy that aids in enhancing the range

of motion in adhesive capsulitis of the shoulder, Vanarama and Massock et al. reported that the viscoelastic properties of connective tissue change with temperature and the concentration of the common structural component after heat application. This treatment showed a higher tendency to elongate the tissue with minimal force exertion, leading to maximum joint range recovery with minimal tissue damage[27.30]. Previous studies support these findings.

In this study, Group B demonstrates the effectiveness of PNF stretching in alleviating pain and enhancing range of motion. According to Mazzule et al. (1978), PNF stretching activates two stimuli simultaneously: pain and pressure receptors. Based on the "gate control theory." (Mazzullo, 1978). Peripheral pain receptors are linked to either unmyelinated or small myelinated afferent fibbers, whereas pressure receptors are associated with larger myelinated afferent nerve Fibers. Every kind of afferent fibbers links to the identical interneurons in the spinal cord, and since the pressure afferent Fibers are both larger and myelinated, the signals for pressure reach the spinal cord prior to the pain signals when they are activated at the same time (Mazzullo, 1978). The dorsal horn inhibits pain signals when large Fibers transmit them (Melzack, 1993)[21]

Group A & B, using Independent sample t test results, NPRS Ip = 0.009 < 0.05 Group A CM = 5.2 SD = 0.05) greater than that of Group B (M = 2.93 , SD = 0.77)I A previous study done by Gammon et al they suggested that heat applied at sufficient intensity to cause pain act as a 'counter-imitate that closes the 'pain gate and reduces more severe pain. Therapeutic heating causes vasodilation in the heated tissue, thus increasing the rate of Blood flow to increase the delivery of oxygen and nutrient and the removal of waste Products. Therapeutic heating causes vasodilation by stimulating thermoreceptors that directly cause vascular smooth muscle relaxation and indirectly activate local spinal Cord reflexes[22] in addition, therapeutic heating promotes vasodilatation by increasing the Release of chemical mediators of inflammation and the release of nitrous oxide. (Kellogg, 1999, Minson, 2001)[23]. previous research study finding supports this study.

A prior study by Begmark et al. raised the temperature of localized tissues, leading to vascular dilation that elevated pain threshold. This vascular enhancement also boosted nutrient and oxygen delivery to the tissues while aiding in the elimination of metabolic waste products. This interrupts the inflammatory process and reduces pain[24]. In group A, the comparison of pre and post-test scores revealed a notable increase in flexion score M = 21.67 SD = 25.3. As noted by Harshit Mehta et al., their research on adhesive capsulitis found that capsular flexibility training activates joint mechano-receptors, reduces nociceptive input at the pain gate, and preserves the extensibility of the joint capsule. This leads to a reduction in pain and enhances relaxation to achieve a greater range of motion in the shoulder1.34, p = 0 > 0.05, M = 21.67 SD = 25.3. Harshit Mehta et al. conducted a study on adhesive capsulitis, determining that the capsular flexibility exercise technique activates the joint mechanoreceptors, r+educes nociceptive input at the pain gate, and helps maintain the flexibility of the joint capsule. Consequently, reduced pain enhances relaxation to achieve a significantly larger range of motion in the shoulder[31.34]

In group A and B, intergroup comparison within the group there is significant reduction in internal rotation t[28]=2.179,p<0.05.] in group A [M = 24.33, SD = 13.998] | greater than that group B PNF stretching with SWD [M = 41.31, SD = 11.52] Previous study done by According to Mehta et al he concluded that capsular flexibility exercise physiological changes such as remodelling of elastin and collagen molecules, these changes may be associated with alteration on the muscle tendon units and fascia, caused by increase on tissue elasticity. In other words, the range of motion would be influenced by the increase on the length of the tissue.

Previous study correlated with this study that capsular flexibility exercise with wax therapy increases the range of motion in adhesive capsulitis of shoulder

Finally pre and post-test range of motion in group A from table 3 the external rotation in t\{28\} = 2.172 p < 0.05 M = 34.67 SD = 12.6 And Our result in correlated to, Swan and Geofrey et al in his study concluded that capsular flexibility training is essential in maintaining the capsular extensibility and the friction free sliding of the collagen fibres within the capsule, during the capsular flexibility exercise within the pain free range. Thus, results in lubricant increases in between the collagen Fibers that allow the free motion to occur between the articular surfaces of the joint it leads to improvement in shoulder joint range of motion[20,33.] Similarly in group B t [14] = 4.497 p = 0.01 < 0.05, M = 4.13, SD = 11.52 Funk et al 2003 concluded that PNF technique increases the range of motion by increasing the length of the muscle and increasing neuromuscular efficiency[27-32.]

We find both 2 treatment techniques there is significantly improved in group A and group B external rotation, t(28l =2.172.p<0.05,lN group A [M = 34.67, SD = 12.6] Group B[M = 34.67, SD = 12.6] the finding of this study co related with mace et al conducted that capsular flexibility exercise increases the joint space thereby it improve the range of motion in adhesive capsulitis of shoulder[29.]

The result shows that Group A and Group B is both having equal effects as shown in graph 4 5 and 4.6, extension ROM t [28] = 2.012 p = 0.054 > 0.05 and abduction ROM t [28] = - 0.055 p = 0.957 > 0.05] This is may be due to less repetition of exercise and also may be due to short duration of study.

Future studies can be done with long duration on wax therapy with capsular flexibility exercise and PNF stretching and by altering the repetition of exercise to analyse the effects on range of motion in adhesive capsulitis of shoulder.

CONCLUSION:

Going by the results of the analysis, this study concludes that Group A "Capsular flexibility training with wax therapy" group B the Treatment "PNF Stretching with wax therapy “is effective in reducing pain and improving ROM for the patients, which was evidenced in terms of all the standard measures, except Extension.

In addition, the difference between two treatments was found to be statistically significant only in terms of 4 standard measures namely Flexion, Internal rotation, External Rotation, and NPRS scores. Overall, we conclude that "Capsular flexibility exercise and PNF Stretching following wax therapy" for patients with Adhesive Capsulitis of Shoulder is effective.

LIMITATION:

- Sample size may be small.
- No control group.
- Specific exercise protocol is not given.
- Age interval in individual subject is more.
- Duration of study period is short.

RECOMMENDATION:

- Further research should include more subjects.
- Wax bath can be combined with the other modalities such as short wave, Ultrasound and Infra-red rays.
- Subjects without any other neurological problem.
- A subject for Adhesive capsulitis is more commonly in old age people with diabetes this study can also be done in specific groups in population.

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