



## TO COMPARE THE EFFECTIVENESS OF HOLD-RELAX PNF STRETCHING AND PASSIVE STRETCHING IN IMPROVING ROM AND DECREASING SHOULDER PAIN AND DISABILITY SCORE IN PATIENTS WITH ADHESIVE CAPSULITIS

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### ABSTRACT

**Background** – Adhesive capsulitis is also named peri-arthritis or frozen shoulder. It is primarily the inflammation and adhesions in the capsule which causes restricted glenohumeral joint mobility and pain with idiopathic cause. This leads to various functional limitations/disabilities. Various physical therapy interventions, including different stretching techniques like hold-relax PNF stretching and passive stretching were used to treat adhesive capsulitis. In a quest to find out which of these techniques exhibit profound outcomes, the study aimed to compare the effectiveness of Hold-Relax PNF stretching and passive stretching in improving ROM and decreasing shoulder pain and disability score in patients with adhesive capsulitis.

**Methodology** – A comparative study was carried on 30 patients. Subjects diagnosed with Adhesive Capsulitis were selected as per inclusion criteria and randomly divided into Group A (hold-relax PNF stretching) and group B (passive stretching), 15 in each group. Both groups of patients received a Hydro-collateral pack before stretching. AROM and SPADI scores were taken at baseline and after 4th week. The data were analyzed using the paired and unpaired t-test.

**Results:** Hold-relax PNF stretching and passive stretching was effective among which hold-relax PNF stretching was more effective in increasing shoulder ROM of external rotation (Mean 67.8, p=0.0015), abduction (Mean 85.33, p=0.0053), and internal rotation (Mean 64.4, p=0.0002), and reducing pain and disability on SPADI (Mean 32.46, p=0.0001).

**Conclusion:** Hold-relax PNF stretching (Group A) is more effective in improving shoulder ROM and function as compared to passive stretching (group B).

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### INTRODUCTION

"ADHESIVE CAPSULITIS" is caused by inflammation of the joint capsule that eventually results in the formation of capsular contracture and restriction of shoulder joint motion.<sup>1,2</sup> Primary adhesive capsulitis affects 5 % of the general population. Most commonly seen in 40-65 years.<sup>3</sup> It is the most common cause of pain and disability in the shoulder in the general population. Various physical therapy interventions including different stretching techniques like hold-relax PNF stretching and passive stretching are used for treating adhesive capsulitis. The concept of PNF is to reinforce mobility, movement control, and joint coordination. This can be achieved by rotational diagonal patterns of movement through several stimuli and guidance provided by the therapist.<sup>4</sup>

One of the techniques utilized in PNF is the Hold-Relax technique. It is an effective, simple, and pain-free technique which has the potential to induce relaxation, improve flexibility, improve ROM and reduce pain. The literature stated that PNF can be used to supplement daily stretching to

make quick gains in ROM.<sup>5</sup> Limited studies have proven PNF techniques to be most effective for producing much improvement in ROM.<sup>6</sup> Literature stated that passive stretching in adhesive capsulitis demonstrated a greater improvement of range of motion.<sup>7</sup>

In a quest to seek out which of these techniques exhibit profound outcomes in our clinical setting, this study attempts to compare the efficacy of the Hold-relax PNF stretch technique and Passive stretching intervention among subjects with shoulder adhesive capsulitis.

The study aimed to compare the effectiveness of Hold-Relax PNF stretching and passive stretching in improving ROM and decreasing shoulder pain and disability score in patients with adhesive capsulitis.

### MATERIALS AND METHODOLOGY

A comparative study was conducted in the physiotherapy department of Maharashtra Institute of Physiotherapy, Latur. Following approval granted by the institutional ethical

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committee, thirty subjects from the out-patient department, diagnosed with adhesive capsulitis were selected based on inclusion and exclusion criteria detailed below and were randomly divided into group A and group B of 15 subjects each by an independent collaborator by using opaque closed envelopes. A prior written Informed consent was taken from each subject.

The subjects were included if they met the following criteria: 1) Diagnosed case of unilateral involvement of Adhesive Capsulitis stage 2. 2) Minimum 50 % restricted Joint range of motion specifically abduction, external rotation and, internal rotation. 3) Male and female were included. 4). Age of 40-60 years.

Subjects were excluded if they were having 1) Unstable shoulder. 2) Post fracture stiffness. 3) Infections. 4) Malignancy. 5) Previous surgery or rotator cuff injury. 6) Diabetes mellitus. 7) Shoulder stiffness due to any other pathological conditions. 8.) Shoulder pain in neurological conditions.

The baseline data of AROM of movements of the shoulder was obtained by using a universal goniometer and the pain and disability data were obtained using SPADI to check for functional outcome. The AROM and SPADI were taken at baseline and after 4 weeks.

Group A subjects received Hold-relax PNF stretching technique for abduction, external rotation, and internal rotation in addition to hydro-collateral pack (10-15 min). For Hold-relax PNF stretching starting position of the subject was in sitting position and the therapist at the side of the subject.

The therapist had passively moved the shoulder joint in external rotation until the stretch begin to feel “uncomfortable” to the subject. Subject was asked to perform a maximal isometric contraction of target muscle for 6 seconds followed by 10 seconds of relaxation. During the 10 seconds of relaxation the therapist slowly externally rotates the subject’s shoulder joint to the new range. The subject then performed 6 sec of maximal contraction for 2 more times i.e (total 3 contractions) with 10 sec relaxation period in between. The same procedure was performed to improve shoulder abduction and internal rotation. In this, the subject was in a sitting position and the therapist was at the back of the subject for abduction, and the internal rotation therapist in a sitting position at the side of the subject. Duration: 1 time /1 day, 5 times/week for 4 weeks.

Group B subjects received passive stretching exercises, 3 times for 30 seconds and 10 second relaxation between 2 stretch in a supine lying position for abduction, external rotation, and internal rotation in addition to a hydro-collateral pack (10-15 min ). Duration : 1 time /day , 5 times / week for 4 weeks.

**Statistical analysis**

Descriptive statistical data was presented in the form of mean +/- standard deviation and mean difference percentages were calculated and presented. The data were analyzed using paired T test to assess the statistical difference within the group for the shoulder AROM and SPADI from the pre and post-values. Unpaired T test was performed to assess the statistically significant difference between the groups for the shoulder AROM and SPADI from the pre and post-values. P value <0.05 were considered significant. Confidence interval was 95%.

**RESULTS**

**Table 1** Between group comparison of active Shoulder abduction range at baseline

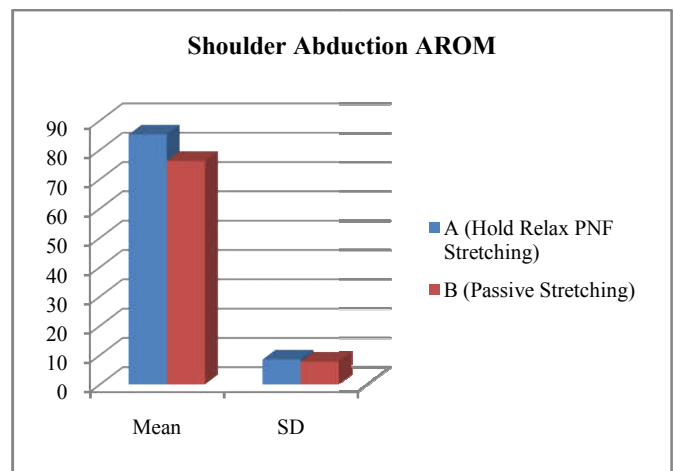
	Mean	SD	t stat	p value	
A	59	7.83			Statically not significant
B	61.33	9.15	0.74	0.4599	

Table 1: Baseline mean with SD of the Abduction ROM score was 59 ± 7.83 for Group A and 61.33 ± 9.15 for Group B respectively. The t test result was, (t = 0.74 & p = 0.4599), p > 0.05 i.e. statistically not significant at baseline.

**Table No. 2** Between group comparison of active Shoulder abduction range at 4 weeks

	Mean	SD	t stat	p value	
A	85.33	8.58			Very statistically Significant
B	76.26	7.84	3.02	.0053	

Table 2 showed comparison of Shoulder Abduction Active ROM at 4 weeks between groups A & B. At 4 weeks mean with SD of the Abduction ROM score was 85.33 ± 8.58, 76.26 ± 7.84 for Group A & Group B respectively. The t test result was, (t = 3.02 & p = 0.0053), p < 0.05 i.e statistically significant. It showed that Group A had comparatively more improvement in the abduction ROM at 4 weeks as seen in graph 1.



**Graph 1** Between group comparison of active Shoulder abduction range of motion at 4 weeks.

**Table No 3** Between group comparison of active shoulder external rotation range of motion at baseline

	Mean	SD	t stat	p value	
A	38	7.74			statically not Significant
B	39	6.03	0.3947	0.6960	

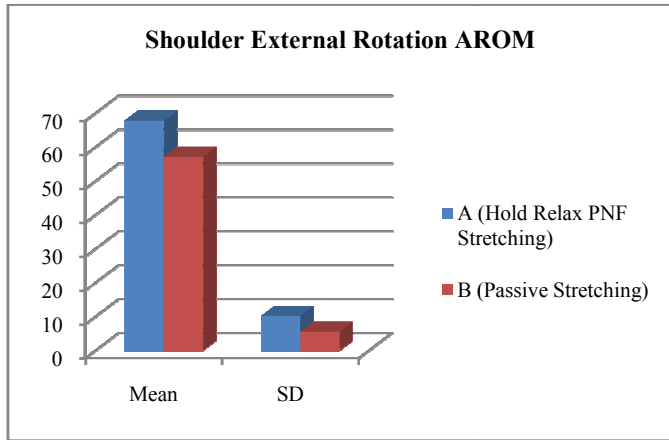
Table 3: Baseline mean with SD of the Abduction ROM score was 38 ± 7.74 for Group A and 39 ± 6.03 for Group B respectively. The t test result was, (t = 0.394& p = 0.6960), p > 0.05 i.e statistically not significant.

**Table No 4** Between group comparisons of active shoulder external rotation range of motion at 4 weeks

	Mean	SD	t stat	p value	
A	67.8	10.22			Very statistically Significant
B	57.2	5.58	3.52	.0015	

Table 4 showed comparison of Shoulder external rotation Active ROM at 4 weeks between groups A & B at 4 weeks. Mean with SD of the external rotation ROM score was 67.8 ±

10.22 for Group A and  $57.2 \pm 5.58$  for Group B respectively. The t test result was, ( $t = 3.52$  &  $p = 0.0015$ ),  $p < 0.05$  i.e statistically significant. It showed that Group A had greater improvement in external rotation ROM of shoulder than group B at the end of 4<sup>th</sup> week as seen in graph 2.



**Graph 2** Represents significant increase of shoulder active external rotation ROM in group A than group B at end of 4<sup>th</sup> week.

**Table no 5** Between group comparison of Shoulder active internal rotation range of motion at baseline

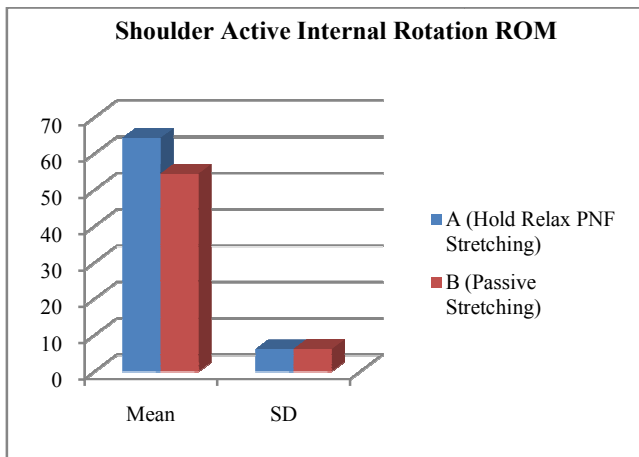
	Mean	SD	t stat	p value	
A	42.6	6.43			Statically not Significant
B	43.86	5.66	0.5697	0.5734	

Table 5: Baseline mean with SD of the active internal rotation ROM score was  $42.6 \pm 6.43$  for Group A and  $43.86 \pm 5.66$  for Group B respectively. The t test result was, ( $t = 0.56$  &  $p = 0.5734$ ),  $p > 0.05$  i.e statistically not significant.

**Table no 6** Between group comparison of Shoulder active internal rotation range of motion at 4 weeks

	Mean	SD	t stat	p value	
A	64.4	6.15			Extremely Statically Significant
B	54.53	6.24	4.36	0.0002	

**Table 6** showed comparison of Shoulder internal rotation Active ROM at 4 weeks between groups A & B. At 4 weeks mean with SD of the internal rotation ROM score was  $64.4 \pm 6.15$  for Group A and  $54.53 \pm 6.24$  for Group B respectively. The t test result was, ( $t = 4.36$  &  $p = 0.0002$ ),  $p < 0.05$  i.e extremely statistically significant. It showed that Group A had greater improvement in internal rotation ROM of shoulder than group B at the end of 4<sup>th</sup> week as seen in graph 3.



**Graph 3**

Graph 3 represents significant increase of shoulder Active internal rotation range in group A than group B at the end of 4<sup>th</sup> week.

**Table No 7** Between group comparison of SPADI scores (%) at the baseline.

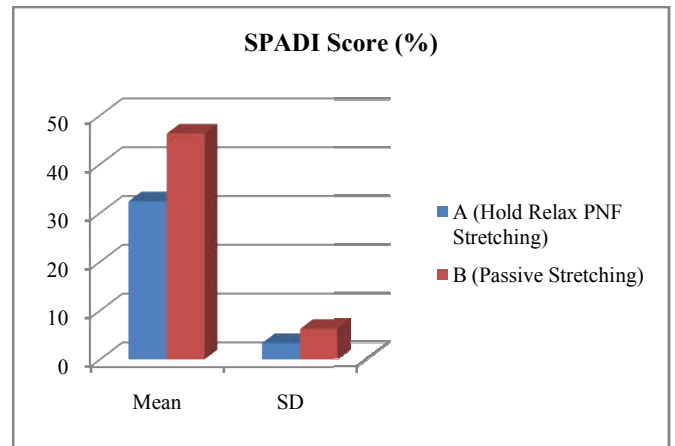
	Mean	SD	t stat	p value	
A	75.96	6			Statically not significant
B	75.89	4.76	0.0354	0.9720	

Table 7: Baseline mean with SD of the SPADI score (%) was  $75.96 \pm 6$  for Group A and  $75.89 \pm 4.76$  for Group B respectively. The t test result was, ( $t = 0.0354$  &  $p = 0.9720$ ),  $p > 0.05$  i.e statistically not significant.

**Table No 8** Between group comparison of SPADI scores (%) at 4 weeks

	Mean	SD	t stat	p value	
A	32.46	3.4			Extremely Statically Significant
B	46.25	6.32	7.49	0.0001	

Table 8 showed comparison of SPADI Score at 4 weeks between groups A & B. At 4 weeks mean with SD of the internal rotation ROM score was  $32.46 \pm 3.4$  for Group A and  $46.25 \pm 6.32$  for Group B respectively. The t test result was, ( $t = 7.49$  &  $p = 0.0001$ ),  $p < 0.05$  i.e extremely statistically significant. It showed that Group A had greater improvement in shoulder function than group B at the end of 4<sup>th</sup> week as seen in graph 4.



**Graph 4** Graph indicates that significant decrease of SPADI score of group A than group B.

## DISCUSSION

The results of this study showed that both the Hold-relax PNF stretching technique and passive stretching are effective in improving the shoulder ROM and shoulder function in subjects with adhesive capsulitis. On further analysis, it showed that subjects treated with the Hold-relax PNF stretching technique demonstrated more significant improvement in terms of restoration of active shoulder range of motion of external rotation (Mean  $67.8, p=0.0015$ ), abduction (Mean  $85.33, p=0.0053$ ) and internal rotation (Mean  $64.4, p=0.0002$ ) and shoulder function on SPADI (%) (Mean  $32.46, p=0.0001$ ) in patients with adhesive capsulitis.

The mechanism of reducing pain in PNF techniques can be explained by the gate control theory. During the PNF activities the afferent inputs from the muscle spindles, tendons, joints, and capsule could inhibit the pain transmission at the dorsal

grey horn laminae of the medulla spinalis as proposed by the pain gate theory.<sup>8</sup>

The mechanism by which the Hold-relax PNF stretching technique caused improvement in shoulder ROM and function could also be because of elongation of tissues. Panjabi explains that each movement segment depends on three subsystems; the passive, the active, and the neural subsystem, which stresses the diagonal pattern of movement within the PNF technique.<sup>9</sup>

Hold-relax stretching improve the pliability through relaxation of the contractile component of the muscles, while static stretching causes an increase in the elasticity of the noncontractile viscoelastic component.<sup>10</sup> The finding of our study coincide with other previous studies that have reported similar results. Feland *et al.* reported that hold-relax and static stretching had similar benefits in improving flexibility.<sup>11</sup> Another possible mechanism for the increase in the range of motion is augmentation of stretch tolerance.<sup>12</sup> While performing PNF techniques the process of autogenic inhibition or post-isometric relaxation stimulates the golgi tendon organs, when a targeted muscle is maximally contracted which successively sends the inhibitory impulse through Ib afferent nerve fibers to the inhibitory interneurons within the spinal cord. These inhibitory interneurons further inhibits the alpha motor neuron of the targeted muscle to relax. This theory explains the likelihood of relaxation in the inhibiting muscle during the contract-relax and hold-relax techniques of PNF.<sup>13</sup>

In this study, all subjects received a hydro-collateral pack, which promotes tissue healing, decreases pain, while promoting general relaxation, and reduces joint stiffness, which increases the effect of stretching techniques.<sup>14</sup> The Passive Stretching Exercises given which were low in intensity, long duration, and low velocity helps in improving the Range of Motion, Functional Status and reducing the Pain by breaking the bonds within the collagen fibers of the connective tissue and hence improving the tissue flexibility and increasing the Range of Motion.<sup>15</sup>

## CONCLUSION

PNF (hold-relax) stretching and passive stretching produced improvement in Active shoulder ROM (Abduction, External Rotation, Internal Rotation) and reducing shoulder pain and disability values in patients with adhesive capsulitis. However, PNF stretching (hold-relax) showed more significant improvement in ROM and shoulder function when compared to passive stretching in patients with adhesive capsulitis.

## Limitations

1. The study does not have a control group.
2. It's a short duration study of 4 weeks.

## Suggestions

1. Follow up can be extended to long term benefits of PNF stretching and passive stretching.
2. Study can be extended by comparing with other treatment modalities using control group.
3. Passive ROM can be recorded.
4. Can consider the other quantitative outcome measures like scapular kinematics, shoulder muscle strength, movement analysis and quality of life in future studies.

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