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Dr. Mokshakumar Mukesh Baheti
MPT Student, Dr. APJ Abdul Kalam College of Physiotherapy, Loni, Maharashtra, India

Dr. Pankaj Jayswal
Associate Professor of Orthopedic Physiotherapy, Dr. APJ Abdul Kalam College of Physiotherapy, Loni, Maharashtra, India

Bhakti Baheti
MBBS Student, Malla Reddy Institute of Medical Sciences, Dr. APJ Abdul Kalam College of Physiotherapy, PIMS (DU), Loni, Maharashtra, India

Corresponding Author:
Dr. Mokshakumar Mukesh Baheti
MPT Student, Dr. APJ Abdul Kalam College of Physiotherapy, Loni, Maharashtra, India

The effect of scapular stabilization exercises on pain and function in patients with frozen shoulder

Dr. Mokshakumar Mukesh Baheti, Dr. Pankaj Jayswal and Bhakti Baheti

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Abstract
Background: Frozen shoulder is a painful condition which is characterized by gradually progressive stiffness and restriction of ROM. The purpose of SSE is to restore the position, direction, muscle movement control, and movement pattern of the scapula to stabilize the scapula and improve shoulder joint functions.
Methodology: 30 individuals with the age of 30-80 were included in study. Randomly assigned in two groups. Group A received SSE and CT, group B received only CT. Both groups received 40 min treatment for 2 weeks. Goniometer, NPRS, SPADI were used for Pre and post intervention assessment.
Results: Both groups demonstrated significant difference in range of motion and pain in 2 weeks of intervention when compared within group. Data was analysed with help of instant unpaired t test.
Conclusion: Conclusion was the SSE techniques are effective in improving range of motion and pain SPADI score in Frozen Shoulder Patients.

Keywords: Numerating pain rating scale, shoulder pain disability index, scapular stabilization exercise

Introduction
Adhesive Capsulitis (AC) is the most common disorder of the shoulder joint [1]. This condition is due to unknown etiology and is characterized by pain and a loss of range of motion (ROM), primarily in the abduction and external rotation of the shoulder. Shoulder pain and stiffness of capsule contributes to severe disability. Adhesive Capsulitis is generally divided into two categories: primary adhesive capsulitis and secondary AC. Primary is associated with conditions such as, diabetes mellitus and thyroid diseases and Parkinson's disease at higher risk. Secondary adhesive capsulitis can occur after shoulder injuries, rotator cuff tear, or post-surgical immobilization [1]. Primary adhesive capsulitis describes an insidious onset of painful stiffness of the glenohumeral joint. Secondary adhesive capsulitis, on another hand, is associated with a known predisposing condition of shoulder. Primary adhesive capsulitis affects from 2% to 3% of the general population and is the main cause of shoulder pain and dysfunction in individuals aged 40 to 70 years. The range of motion (ROM) impairments associated with primary adhesive capsulitis can impact a patient's ability to participate in self-care and occupational activities. Even though this condition is considered self-limiting, with most of patients having spontaneous resolution within 3 years some patients can suffer long-term pain and restricted shoulder range of motion well beyond 3 years. A disability of this duration places severe emotional, economic hardship on the afflicted person. Most patients are unwilling to suffer this pain, prolonged disability, and sleep deprivation without seeking treatment [2].

Stages
Adhesive capsulitis progresses in 3 different stages: freezing, frozen and thawing stages. Stage 1 refers to the freezing stage and this stage can endure for a period ranging from three to nine months. Pain is primarily experienced by the patient during night time, coupled with restricted forward flexion, abduction, internal and external rotation. Which is also characterized by stiffness with significantly decreased active and passive ROM due to reduced capsular volume.

Stage 2 is referred to as the frozen stage which can last from nine to fifteen months. The affected person might also additionally nonetheless enjoy ache in the long run degrees and might enjoy limited variety of motion. In stage 3, which is the thawing stage, in which ROM gradually improves due to capsular remodelling and is accompanied by minimal pain, which occurs between 15- 24 months. Ache can be faded with innovative development of movements [2, 3]. Adhesive capsulitis, which is also referred to as frozen shoulder, is a condition that results in the limitation of movements at the shoulder joint debilitating daily activities. The circumstance turned into first clinically diagnosed as "per arthritis scapula-humeral" via way of means of Duplay in 1872. However, Codman in 1934 defined it as frozen shoulder, indicating the opportunity of growing shoulder stiffness and ache without the have an impact on of outside factors. "Adhesive capsulitis", indicating a pathology in the glenohumeral capsule, was coined by Neviaser. Adhesive capsulitis is the main purpose of ache on the shoulder joint in center elderly and aged persons. These strategies assist the muscle tissues to relearn the ordinary timing of and the quantity of activation to preserve the balance between different groups of muscles [4].

Epidemiology

Adhesive Capsulitis occurs in up to 5% of the population. Females are 4 times more affected than men, while the non-dominant shoulder is more prone to be affected.

Pathophysiology

The exact pathophysiology of adhesive capsulitis is unknown. The maximum usually time-honoured speculation states that infection to begin with takes place in the joint tablet and synovial fluid. The inflammation is followed by reactive fibrosis and adhesions of the synovial lining of the joint. The initial inflammation of the capsule leads to pain, and the capsular fibrosis and adhesions lead to a decreased range of motion [6].

Histopathology

The research of histopathology for the glenohumeral pill have showed a tremendous growth in fibroblasts, my fibroblasts, and inflammatory cells, like B-lymphocytes, mast cells, and macrophages.

Scapular stabilization exercise

The purpose of scapular stabilization exercise is to restore the position, direction, muscle movement control, and movement pattern of the scapula to stabilize the scapula and improve shoulder joint function [8].

The scapular muscle group, which include the trapezius, serratus anterior (SA), pectoralis minor (PM), levator scapulae (LS), rhomboid muscle (RM), and teres major (TM), is especially liable for scapular movement and dynamic stabilization of the scapula. An optimal interaction between these muscles is needed to provide stability and mobility of the scapula both at rest and during shoulder movements [9]. The scapula plays an important role in maintaining complex shoulder kinematics [10]. The intensity of scapulothoracic exercises was gradually increased according to the pain and muscle strength of the patient.

Exercises were as follows

Scapular retraction with exercise band, Extension with exercise band, Scapular adduction and elevation, Wall, table, and floor push-ups, Scapular stabilization with exercise ball in upright standing position, Scapular adduction in prone position, Extension in prone position, Scapular protraction in supine position, Push-up in sitting position, Scapular abduction in upright standing position.

Aim of the study

To find the effect in Scapular Stabilization exercises On Pain and Function in Patients with Frozen Shoulder.

Methodology and Procedure

Convenient sampling was done for 30 individuals. The participants were taken in the age range of 30-80 years as per inclusion criteria. Participants were randomly assigned in two groups. The Group A participants Scapular Stabilization Exercise and conventional therapy and group B received only conventional therapy. Pre-intervention assessment was taken and both groups received 40 min treatment session over a span of two weeks. Pre-intervention and Post- intervention assessment was analyzed by paired and unpaired t test using Instate software.

Patients were screened on the basis of inclusion and exclusion criteria. The purpose of the study was explained and written informed consent and demographic data was obtained from all the participants. Participants were allocated in two different group by simple random sampling method. At 0 week and 2nd week in intervention period all patients were evaluated for range of motion and pain by NPRS. Both the groups' participants were asking to do home exercise program which include towel stretch, pendulum stretch, capsular stretch.

Description of groups –

Group A: Scapular Stabilization Exercise + Conventional therapy

Group B: Conventional therapy

Conventional therapy Includes

Hot water fomentation over shoulder region for 10 minutes. Mobilization technique-lateral glide for abduction, external and internal rotation for 10- 15 mins Pendulum exercises. Duration 10 mins, 10 repetition. Ultrasound for 7-10 mins, 1.2MHz Hot water fomentation before session and ice therapy after session.

Treatment for the group A is scapular stabilization exercises are

PM stretching

Subject is standing, the affected arm positioned at wall with elbow flexion into 90° subject performs stretching with leaning forward. b. Subject stands at desk and locations palms on the threshold of the desk for support, then plays stretching with squat slowly.

TM stretching

Subject is standing, slowly performs flexion of the shoulder.

UT stretching

Subject is sitting, with the affected hand pressed under the buttock; subject tips head to the healthy side, and then rotates to the affected side; subject performs stretching with slowly lowering head.

LS stretching

Subject is sitting, with the affected hand pressed below the buttock; concern suggestions head to the healthful side, after

which rotates to the healthful side; concern plays stretching with slowly lowering head.

RM strengthening

Stage 1: Lively exercising Sitting, take a deep breath and make bigger the shoulders again and pull the elbows again, bringing the scapula as near the backbone as possible, maintain for five seconds, then slowly go back to the beginning role even as exhaling.

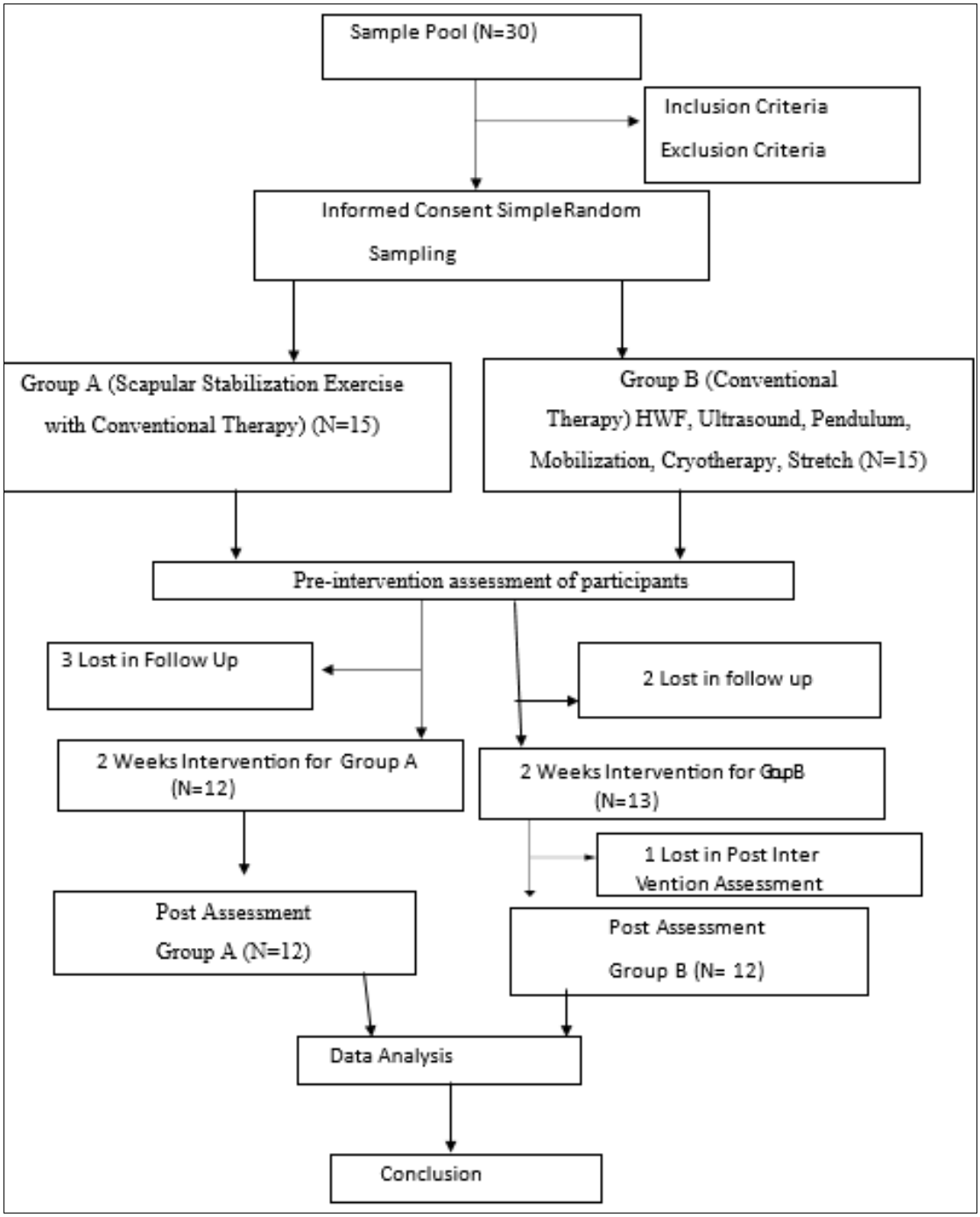
Stage 2: Resisted exercising Subject is sitting, each palms retaining the elastic band constant in the front of the body, different information are similar to the above lively exercising.

SA strengthening

Stage 1: Active exercise Subject is standing, with shoulder flexion into 90°; subject slowly performs scapular protraction (A) and retraction (B).

Stage 2: Resisted exercise Subject is standing, holding the elastic band, with shoulder in 90° of forward flexion; subject slowly performs scapular protraction (A) and retraction (B).

Flow chart



Demographics

A total of 30 participants were selected according to selection criteria, 6 of them were lost during follow up.

There were 16 Female and 8 male Scapular Stabilization Exercise and Conventional therapy. The duration of the treatment was for 2 weeks for days.

Table 1: Gender Distribution

Gender	Group
Male	6
Female	18

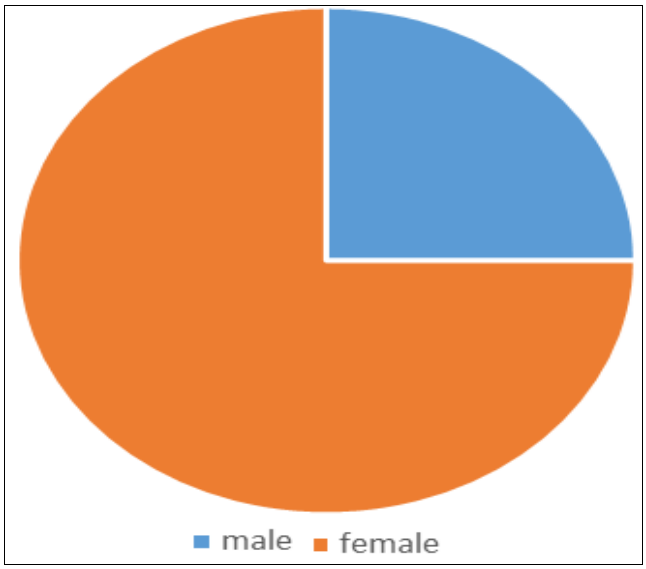


Fig 1: Gender Distribution

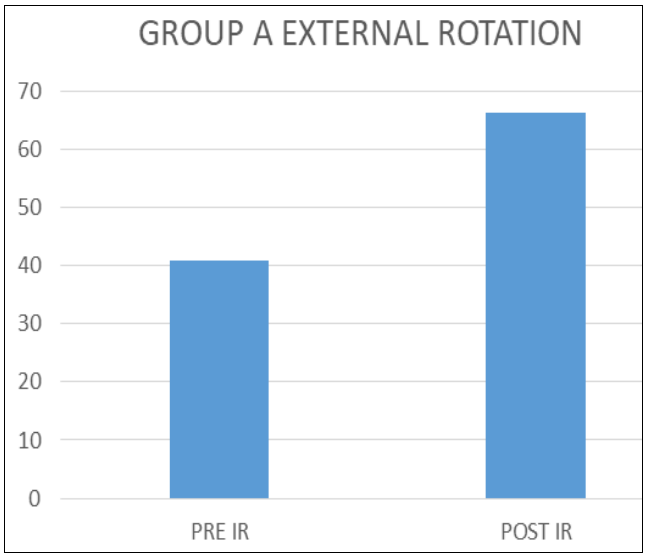


Fig 2: Group A pre and post comparison of rom-external rotation

Table 2: Group A pre and post comparison of rom-external rotation

Group A External Rotation	Mean	SD	T- Value	P Value	Result
Pre	40	10.4447	47.13	P=0.0001	Significant
Post	73.333	14.6680			

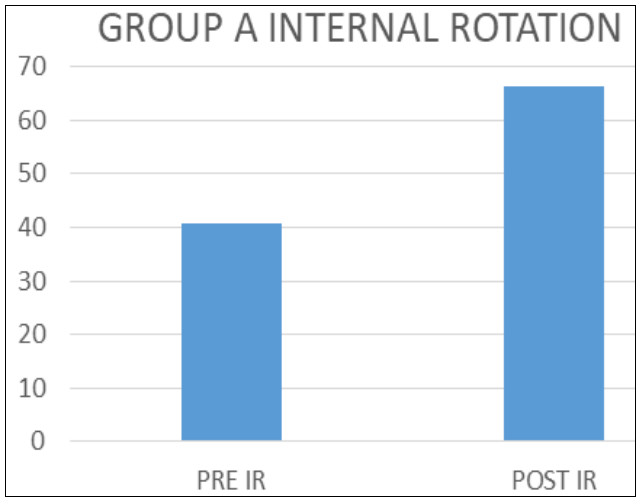


Fig 3: Group A pre and post comparison of rom-internal rotation

Table 3: Group A pre and post comparison of rom-internal rotation

Group A Internal Rotation	Mean	SD	T-Value	P Value	Result
Pre	40.83333	9.7312	35.95	P=0.0001	Significant
Post	66.25	15.0944			

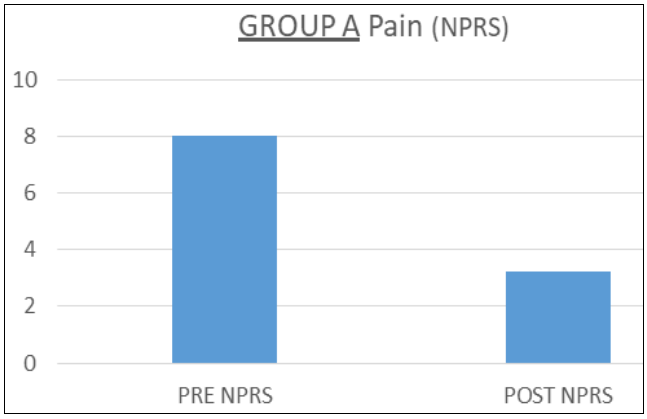


Fig 4: Group A pre and post pain assessment

Table 4: Group A pre and post pain assessment

Group A Pain	Mean	SD	T-Value	P value	Result
Pre	8	0.9541	16.13	P=0.0001	Significant
Post	3.25	0.9653			

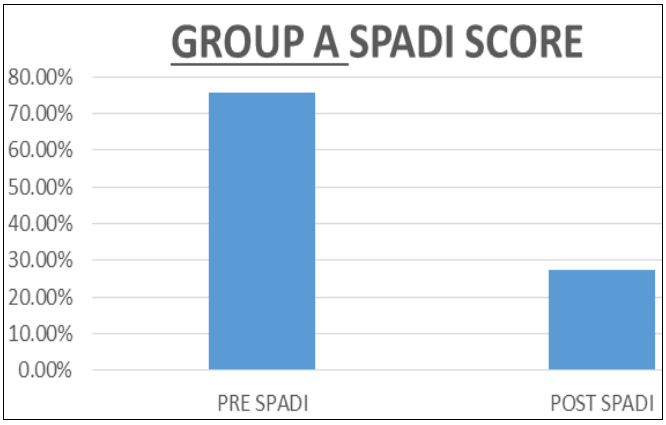


Fig 5: Group A pre and post SPADI score assessment

Table 5: Group A pre and post SPADI score assessment)

Group A SPADI score	Mean	SD	T-Value	P-Value	Result
Pre	75.53%	0.0759	69.75	P=0.0001	Significant
Post	27.37%	0.0525			

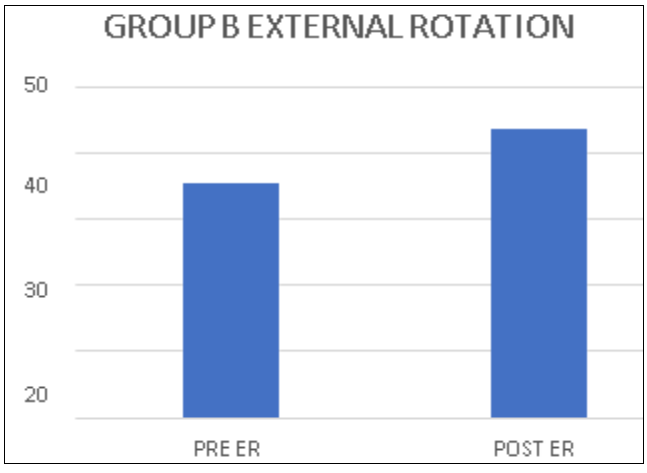


Fig 6: Group B pre and post comparison of ROM-external rotation

Table 6: Group B pre and post comparison of rom-external rotation

Group B External Rotation	Mean	SD	T-Value	P-Value	Result
Pre	38.333	9.3744	32.53	P=0.0001	Significant
Post	51.666	14.7853			

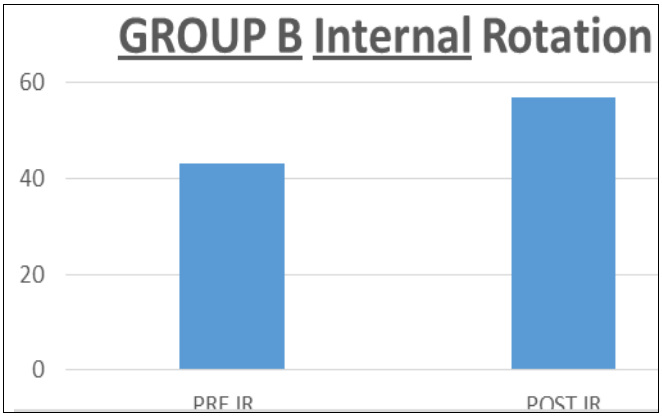


Fig 7: Group B pre and post comparison of rom internal rotation

Table 7: Group B pre and post comparison of rom internal rotation

Group B Internal Rotation	Mean	SD	T-Value	P Value	Result
PRE	42.9166	5.822	5.38	P=0.0001	Significant
POST	56.666	19.0804			

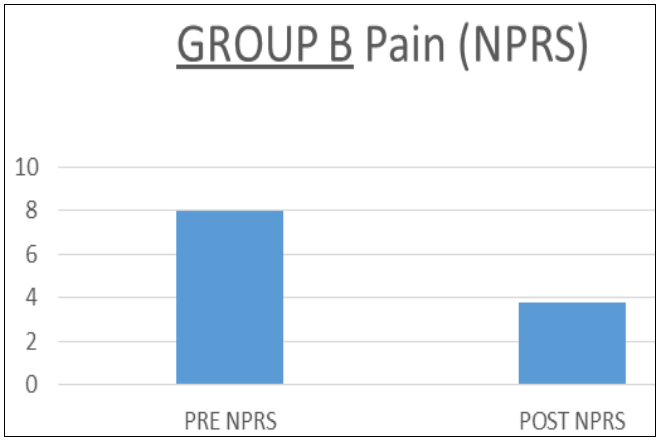


Fig 8: Group B pre and post pain assessment

Table 8: Group B pre and post pain assessment

Group B Pain	Mean	SD	T-Value	P Value	Result
Pre	8	0.7177	15.14	P=0.0001	Significant
Post	3.75	0.7538			

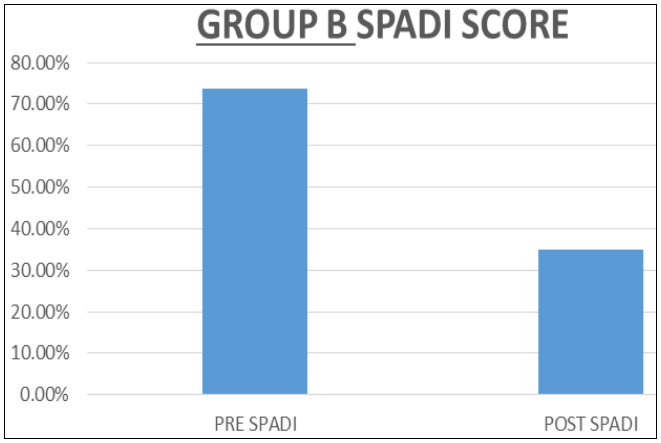


Fig 9: Group B pre and post SPADI score assessment

Table 9: Group B pre and post SPADI score assessment

Group B SPADI Score	Mean	SD	t-Value	P- value	Result
Pre	73.71%	0.0393	35.54	P=0.0001	Significant
Post	35.00%	0.0638			

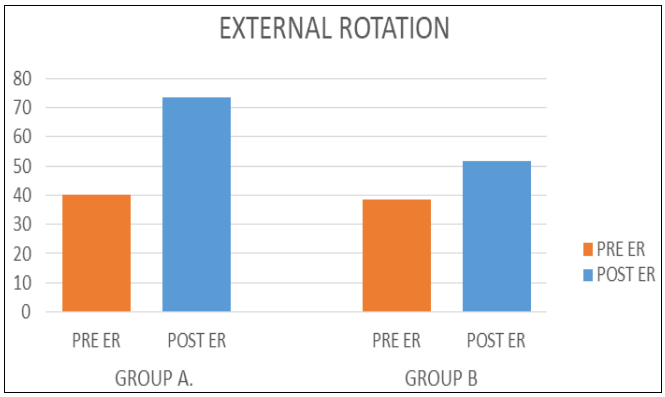


Fig 10: Comparison of rom-external rotation

Table 10: Comparison of Rom-external rotation

External Rotation	Mean		SD (Post)	T-Value	P Value	Result
	A	B				
Pre	40	38.33	14.6680	3.617	P=0.001	Extremely significant
Post	73.333	51.666				

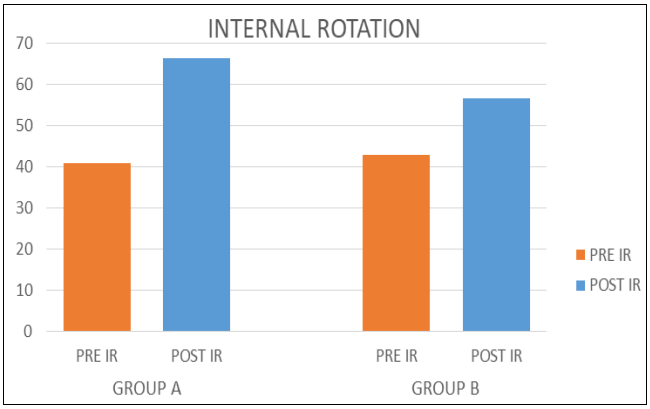


Fig 11: Comparison of ROM-internal rotation

Table 11: Comparison of Rom-internal rotation

Internal Rotation	Mean		SD (Post)	T-Value	P Value	Result
	A	B				
Pre	40.83	42.91	15.0944	1.461	P=0.1529	Not Significant
Post	66.25	56.66				

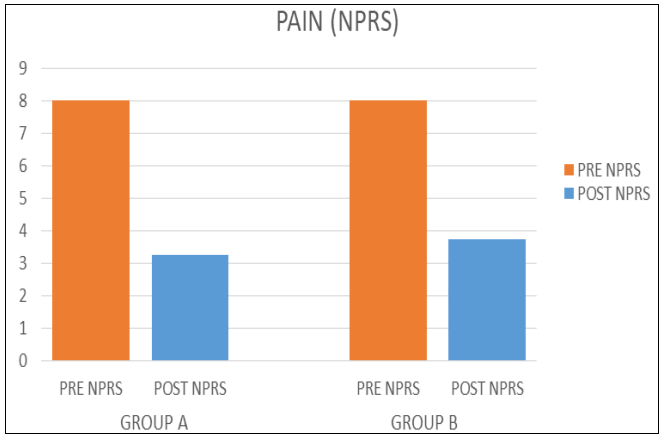


Fig 12: Pre and Post pain assessment

Table 12: Pre and Post pain assessment

Pain NPRS	Mean		SD (Post)	T Value	P Value	Result
	A	B				
Pre	8	8	0.44806	1.794	P=0.1267	Not Significant
Post	3.25	3.75				

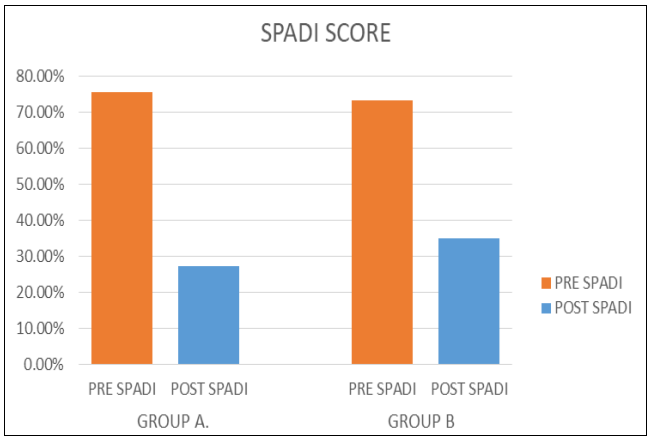


Fig 13: Comparison of SPADI score

Table 13: Comparison of SPADI score

SPADI Score	Mean		SD (Post)	T- Value	P Value	Result
	A	B				
Pre	73.53	73.71	0.0525	3.199	P=0.001	Extremely Significant
Post	27.37	35.00				

Result

Paired t test was done for within the group which showed that there was significant difference in range of motion and pain in 2 weeks of intervention in both the groups. Unpaired t test was done between the groups for internal and external rotation, NPRS for pain and SPADI for disability.

Table 1 and Fig 1 represents gender distribution with 75% female (8) and 25% male (16).

Table 2, 6 and Fig 2, 6 represents pre and post external rotation scores of both the groups. The t value within the group is, group A and group B is (t=47.13) and (t=32.53) respectively. In table 10 and Fig 10 Statistically extremely significant changes were also seen between the groups (p=0.001) with the t value (t=3.617) between the group.

Table 3,7 and FIG 3,7 represents the pre and post internal rotation values of both groups shows the t value of group A (t=35.95) and group B (t=5.38). Table 11 and Fig 11 shows between the groups values of group A and group B which shows considered no significant difference with p=0.1529 and t=1.461

Table 4, 8 and Fig 4, 8 represents pre and post NPRS scores of both the groups. The t value within the group is, group A and group B is (t=16.13) and (t=15.14) respectively. In table 12 and Fig 12 Statistically not significant changes were seen between the groups (p=0.1267) with the t-value (t=1.794) between the group.

Table 5,9 and Fig 5,9 represents the pre and post SPADI Score values of both groups shows the t-value of group A (t= 69.75) and group B (t=35.54). Table 13 and Fig 13 shows between the groups values of group A and group B which shows extremely significant difference with p=0.001 and t=3.199.

On comparing the external rotation and spadi in group A and B according to unpaired t test there was significant difference in pre and post value.

Discussion

The present study aimed to find out the effectiveness of Scapular stabilization exercise in pain, ROM and function in frozen shoulder patients. Group A participants treated with Scapular stabilization exercise and conventional therapy shows significant Reduction in Pain (NPRS) and increase of Range of motion (external rotation,) SPADI in compare to group B.

In frozen shoulder due to restriction of glenohumeral joint motion, reversed glenohumeral rhythm arises. So, there is a compensatory over activity of upper trapezius with weakness of rhomboids and depressors of scapula. Scapular Stabilization Exercise Techniques work on strength of the scapular muscles which helps in improving the stability of scapula during shoulder motion. Proximal stability provides smooth and efficient distal mobility.

Increasing in the scapular stability provides better control of glenohumeral complex. Better control leads to increasing in confidence that may be responsible for the improvement of functional scale in group A.

As both groups show significant improvement in pain outcome so better results could be due to effect of mobilization in both groups. Grade 1 and Grade 2 mobilization modulate pain by stimulating mechano-receptors, active pain gate theory, responsible for pain reduction.

The reason behind the net difference of pain relief between group is unknown.

Limitations & Recommendations

Small sample size Further study should be done for large sample group and can be compared for other parameters such as capsular pattern and strength Furthermore, as pain was unaltered, long-term effect of this protocol can be studied on pain.

Conclusion

Present study concludes that two-week Scapular Stabilization Exercise and Conventional Physiotherapy treatment is effective in increasing range of motion and pain and SPADI. On comparison Scapular exercise Stabilization Exercise exercises showed better improvement in external rotation, Pain and internal rotation and SPADI score. Whereas both techniques showed improvement in pain individually, but on comparison no significant difference was noted.

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