Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 28s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

A Comparative Study of PNF along with ultrasound versus Therapeutic exercises along with Tens in Adhesive Capsulitis of Shoulder joint

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Cite this paper as: Dr. Shiny George Gill, Dr. Neha Chopra, Dr. Pushpdeep Singh, (2025) A Comparative Study of PNF along with ultrasound versus Therapeutic exercises along with Tens in Adhesive Capsulitis of Shoulder joint. *Journal of Neonatal Surgery*, 14 (28s), 283-294.

Received: 12-03-2025 Accepted: 24-04-2025 Published: 16-05-2025

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. Adhesive Capsulitis involves a limitation of range of motion secondary to glenohumeral capsular tightening and scarring.

Method: 90 Subjects will be selected, as per inclusion and exclusion criteria, between age group 40 to 60 years. The subjects were divided into three groups- Group A was control group and subjects was given Short wave diathermy. Group B was given Short wave diathermy, PNF and Ultrasound Therapy. Group C was given Short wave diathermy, Therapeutic exercises along with transcutaneous electrical nerve stimulation. Total 15 treatment sessions was given, for 5 times a week, for 3 consecutive weeks. Readings were taken by using VAS (Visual Analogue Scale) for pain and Goniometry to check Range of motion (Abduction and external rotation). At the end of 3th week analysis was done using paired and unpaired t-test and significant results were found.

Results And Conclusion: Capsular PNF along with ultrasound therapy is beneficial in reducing pain and improving ROM of shoulder joint in patients with Adhesive Capsulitis of shoulder. Capsular PNF along with Ultrasound achieved greater improvements than therapeutic exercises along with TENS. The results of present study indicate that there was highly significant ($p<0.05$) decrease in pain.

Keywords: *Adhesive capsulitis, Proprioceptive neuromuscular facilitation,Visual analogue scale, Ultrasound Therapy.*

1. INTRODUCTION

Shoulder is unique anatomical structure with an extraordinary range of motion (Sedeek S. et al 2013). Shoulder is made up of three bones: The scapula (shoulder blade), the humerus (upper arm bone), and the clavicle (collar bone). The joint capsule is a water tight sac that bathes and lubricates it. The joint capsules are made up of ligaments. It 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 (Jothi K. et al 2017). The causes of shoulder pain include supraspinatus tendinitis, bicipital tendinitis, adhesive capsulitis, rotator cuff tendinitis, impingement syndrome. The patient generally keeps the arm close to the body as even the smallest movements cause pain (Vikram K. et al 2015). Adhesive capsulitis is one of the most common problems of arm (Jacob. et al 2015). Adhesive capsulitis is also known as frozen shoulder (Brigham. et al 2010).The occurrence of frozen shoulder in one shoulder increases the risk of contralateral shoulder involvement by 5% to 34% and simultaneously bilateral shoulder involvement occurs as often as 14% of the time (Martin J. et al 2009).

Adhesive capsulitis is usually classified as primary or secondary. Patients with primary Adhesive capsulitis have very gradual onset and progressiveness of symptoms with no predisposing factor that can be detected. Secondary Adhesive capsulitis develops from known causes of stiffness and immobility such as previous shoulder trauma or surgery, patients usually notice

symptoms soon after a fall or trauma (Sedeek S. et al 2013). According to Reeves, the first phase of Adhesive capsulitis of shoulder last two and half to nine months, the second phase lasts four to twelve months, and the third phase lasts five to twenty six months (Henricus M. et al 2000).

Pathophysiology of Adhesive capsulitis is not clear. It starts without a specific precipitating event, as an inflammatory reaction in the shoulder capsule. The presence of cytokines is evidence of a possible autoimmune process, which however has not established relations or etiology (Dimitris G. et al 2017). Shoulder pain and stiffness are accompanied by severe disability often this results in absenteeism from work, inability to perform leisure activities, and utilization of health care resources (Sun WP. et al 2014).

Many treatments have been advocated for Adhesive Capsulitis. Rest, analgesia, active and passive mobilization, physical therapy, oral and injected corticosteroids, capsular distention, manipulation under anesthetics, arthroscopic capsular release (Mohsen K. et al 2000). Non- operative treatment includes medications to reduce the inflammation and relieve the pain, A program of physical therapy, often combined with home exercises and other therapies to actively stretch and help restore motion and function, heating or icing the shoulder, corticosteroid injections (Edina MN). The goals of exercise programs consisting of range of motion, strengthening and stretching exercises, proprioceptive neuromuscular facilitation, mobilizing techniques are to relieve pain resulting from capsular contracture and improve glenohumeral range of motion (Nilay CB. et al 2016). With respect to physical therapy, a variety of interventions are used ice applications, ultrasound, interferential therapy, transcutaneous electrical nerve stimulation, active and passive range of motion exercises, proprioceptive neuromuscular facilitation techniques and mobilizations techniques (Henricus MV. et al 2006).

In this study, we compare the effectiveness of capsular PNF along with ultrasound versus therapeutic exercises along with TENS. PNF is a type of therapeutic exercise composed of a pattern of muscular contractions and diagonal movements targeting specific muscle groups and movements to improve joint movement and muscle activation. PNF stretch is a technique commonly used in clinical environment both active and passive ROM with ultimate goal being to optimize motor performance. US is one of the modalities used to treat frozen shoulder which elevates tissue temperature to depths of more than 5cm causing increased collagen tissue extensibility pain threshold and enzymatic activity. It also changes nerve conduction velocity, contractile activity of the skeletal muscle. To our knowledge, there is a dearth of evidence that PNF and ultrasound is effective in treating frozen shoulder (Purva P. et al 2017).

Many studies have been conducted on efficacy of TENS versus SWD, MET, therapeutic exercises, mobilization and PNF techniques alone in reducing pain and improving functional ability in patients with Adhesive Capsulitis. But till date no research is available to compare the effectiveness of capsular PNF along with ultrasound therapy versus therapeutic exercise along with TENS to reduce pain and improve range of motion. In case, the protocol works it will be boon to ortho physiotherapist for improving range of motion and reduce pain which is important in managing various tasks in day to day life. Thus it will be helpful to engage them successfully in physical activity. Furthermore, it will increase their independence level, thus helping them leads a stress free life.

2. LITERATURE SURVEY

Jaya et al., (2019) conducted a study which includes proprioceptive neuromuscular facilitation techniques in adhesive capsulitis: A systematic review and meta- analysis. He concluded that PNF was superior in decreasing pain and reducing disability, increasing ROM, improving function. A meta- analysis also shows a significant effect size and that the PNF is superior to conventional physical therapy in decreasing pain, increasing external rotation and abduction ROM.

Salameh et al., (2014) conducted a study which includes Soft tissue mobilization and PNF improve range of motion and minimize pain level in shoulder impingement. He concluded that the combination of soft tissue mobilization and for subscapularis for 7 minutes and the 5 repetitions of the contract-relax PNF technique for the shoulder internal rotator muscles followed by 5 repetitions of a PNF facilitated abduction and internal rotation diagonal pattern was found to be effective in reducing pain and improving glenohumeral external rotation and overhead reach during a single intervention session.

Eda et al.,(2015) conducted a study which includes the effects of additional proprioceptive neuromuscular facilitation over conventional therapy in patients with adhesive capsulitis. He concluded that PNF pattern provide significant contribution to night pain and range of flexion and abduction movements in patients with Adhesive Capsulitis. Including PNF applications in Adhesive Capsulitis treatment program may provide better outcomes.

Joseph et al., (2003) conducted a study which include the immediate effects of soft tissue mobilization with proprioceptive neuromuscular facilitation on glenohumeral external rotation and overhead reach. He concluded that a single intervention session of STM and PNF was effective for producing immediate improvements in glenohumeral external rotation and overhead reaches in patients with shoulder disorders.

MATERIAL AND METHODS

Patients were taken from the OPD of Dasmesh college of Physiotherapy Faridkot and OPD of Orthopaedics Department of Guru Gobind Singh Medical College, Faridkot and written informed consent was received from all patients enrolled in the

study. 90 patients between the age of 40-60 years were included according to inclusion criteria i.e. (1). Patients diagnosed with unilateral frozen shoulder with limited Range of Motion of shoulder joint (gradeII-III) according to Hannafin JA et al (2000). (2). Patients of both genders were taken. (3). No physical therapy for shoulder was given to the patients 4-5 weeks prior to our study. (4). At least 4 out of 10 on a VAS scale. Three groups of 30 patients each were made by randomized selection of the patients. The patients were divided serially by assigning patients to group A, then to group B and remaining to group C. Group A: received only SWD, Group B: received SWD along with capsular PNF and ultrasound, Group C: received SWD along with therapeutic exercises and TENS. The treatment comprised of physiotherapy sessions 5 days per week for 3weeks.Total of 15 sessions were given to all three groups. All the three groups were assessed using the VAS scoring for pain and goniometer for ROM assessment at the time of starting of treatment and after 3 weeks of treatment.

Procedure:

Group A: 30 patients were given only SWD, received treatment for 5 times per week, for 3 weeks. A shortwave diathermy machine with an operating frequency of 27.12 MHz and wavelength between 30-3m was used to deliver the deep heat. The subjects were positioned comfortably in supine lying, on a wooden couch with their back and affected arm supported. A pair of pad electrodes was placed on the antero-posterior aspects of the affected glenohumeral joint. The intensity of the heat was adjusted according to subject's subjective feeling of comfortable warmth. Duration of treatment was for 20 minutes.

Group B: 30 patients were given SWD along with capsular PNF and Ultrasound. **Scapular PNF** in two diagonals, anterior elevation with posterior depression and posterior elevation with anterior depression with 20 repetitions each. Patient position was side lying, on unaffected side while the therapist stood in the line of desired motion. Firstly, the therapist gave preparatory instructions in the beginning of the pattern; therapist will pull the scapula to the elongated position and then give instructions for the desired movement. Rhythmic initiation and repeated contractions facilitation techniques were applied in all patterns. **Ultrasound therapy** is deep heating modality that uses high frequency acoustic vibration above the human audible spectrum (i.e. > 20,000 Hz). The most commonly used frequency was 1 MHz A transducer operating at therapeutic frequencies will produce a beam with greater angle of divergence if diameter of transducer is small than if it is large. Intensity used of therapeutic ultrasound was 0.1-3 W/cm^2 according to machine. Wavelength was approximately 0.15cm; duration was 8 min over site.

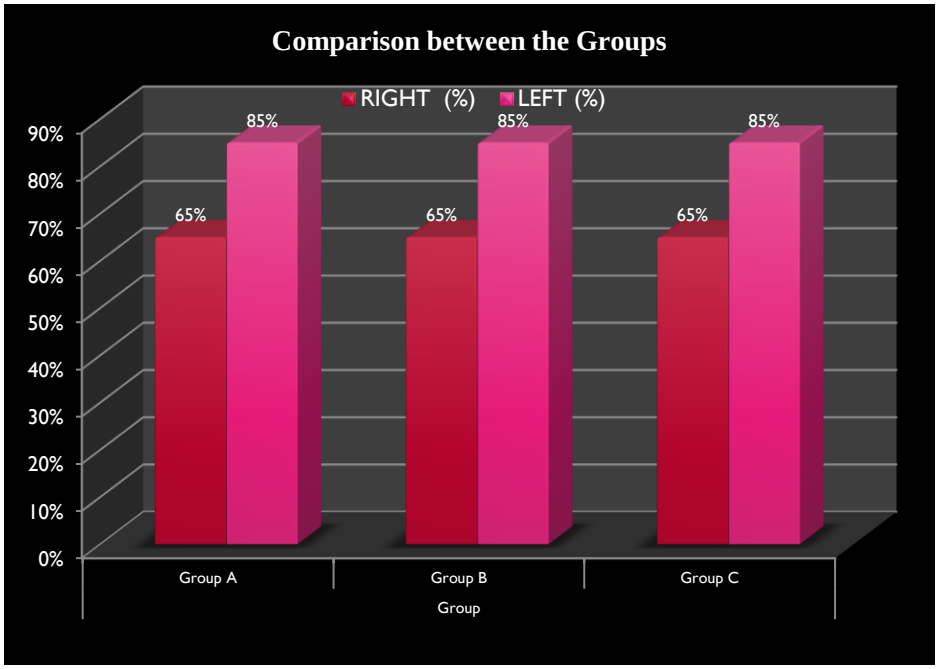
Group C: 30 patients were given SWD along with therapeutic exercise and TENS. **Therapeutic exercises includes**: Codman (Pendulum) exercises with (shoulder flexion, abduction and circumduction) and Wand exercises (shoulder flex, abduction and ext, internal rotation) were given. Each exercise was performed for 3 sets of 20 repetitions, 5 times per week for 3 weeks. Total duration of treatment was 20 min. Subjects were allowed to rest whenever they feel fatigue during exercise. **TENS:** The frequency used was 100Hz, pulse width used was 0.2ms, intensities that prove gentle contraction. The patient should feel a tingling pins and needle sensation. We used high frequency TENS in our study. The skin in the treatment area was first sterilized with an isopropyl alcohol skin wipe. Conductive electrodes covered with a conductive with a conductive gel in order to gain good skin contact re placed on the patient's skin. The electrodes are bandaged on to the patient or fixed with adhesive tape. Method of application of electrodes is contra planar. 2 electrodes are applied to affected shoulder. Duration of treatment is 15min.

OUTCOME MEASURES: Patients were assessed at baseline and end of 4th week by:

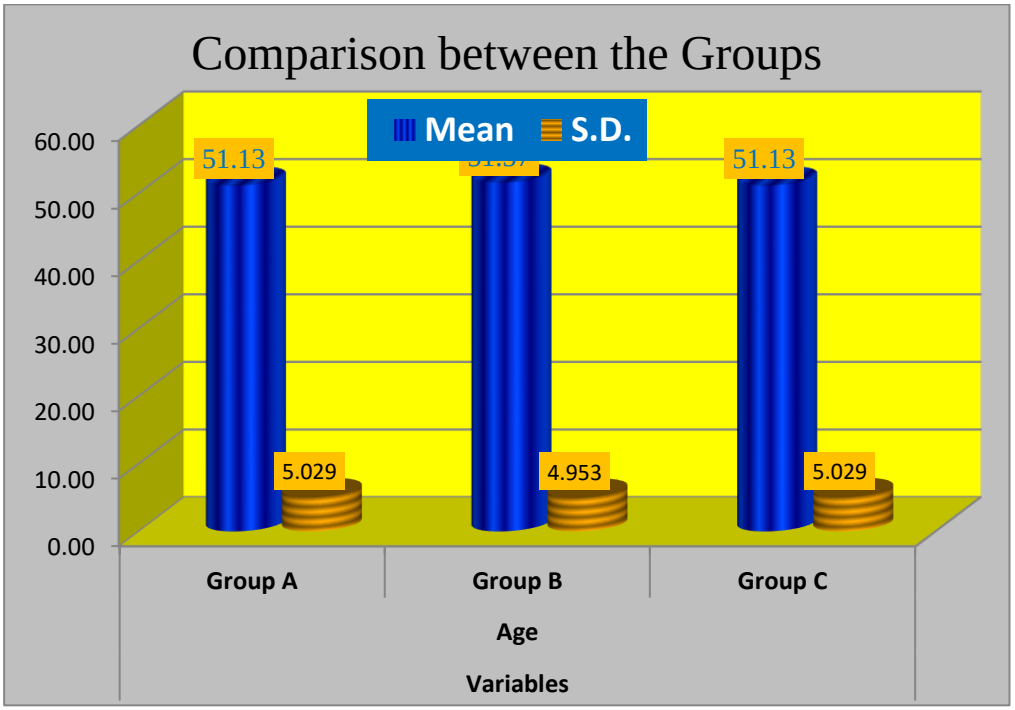
- Assessment of shoulder pain using VAS.
- Assessment of shoulder ROM using universal.

RESULTS:

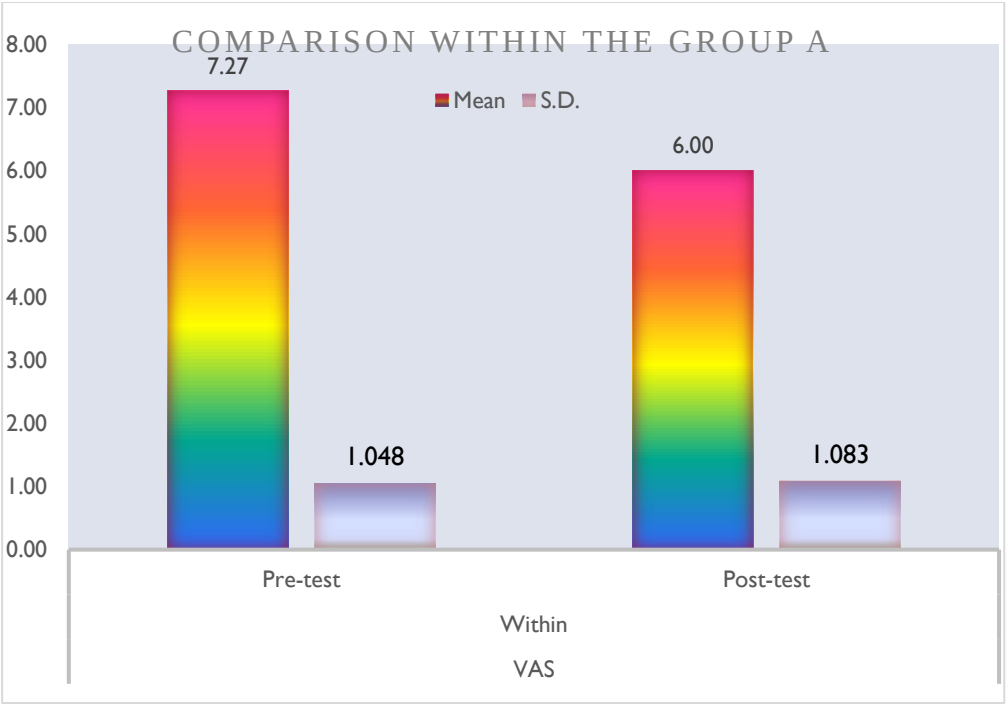
The demographic data distribution showing number of subjects, Age, gender for all groups, group A, B and C.



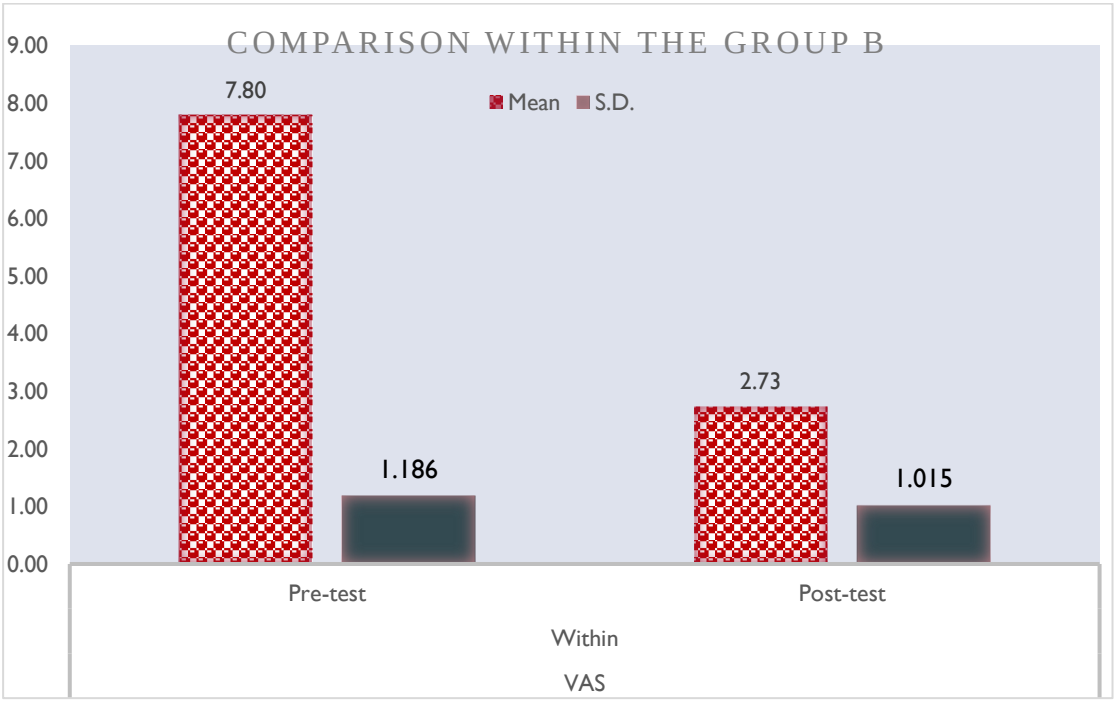
Graph No: 5.1 Distribution of number of subjects according to side for group A, B and C.



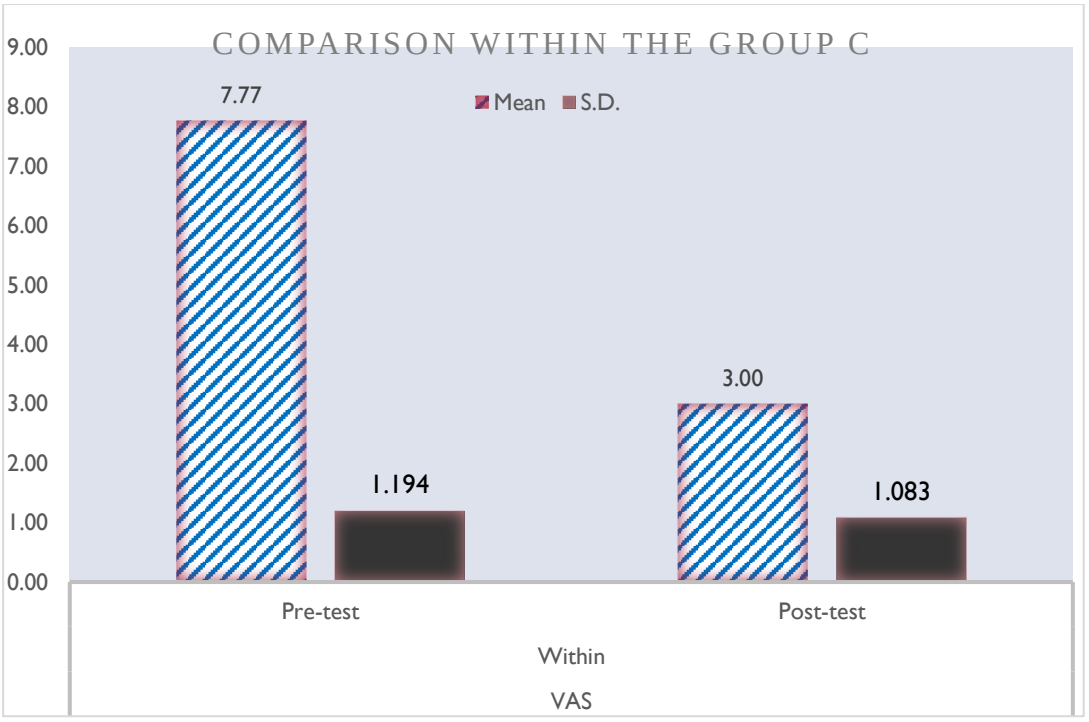
Graph No: 5.2 Distribution of number of subjects according to Age and number of samples.



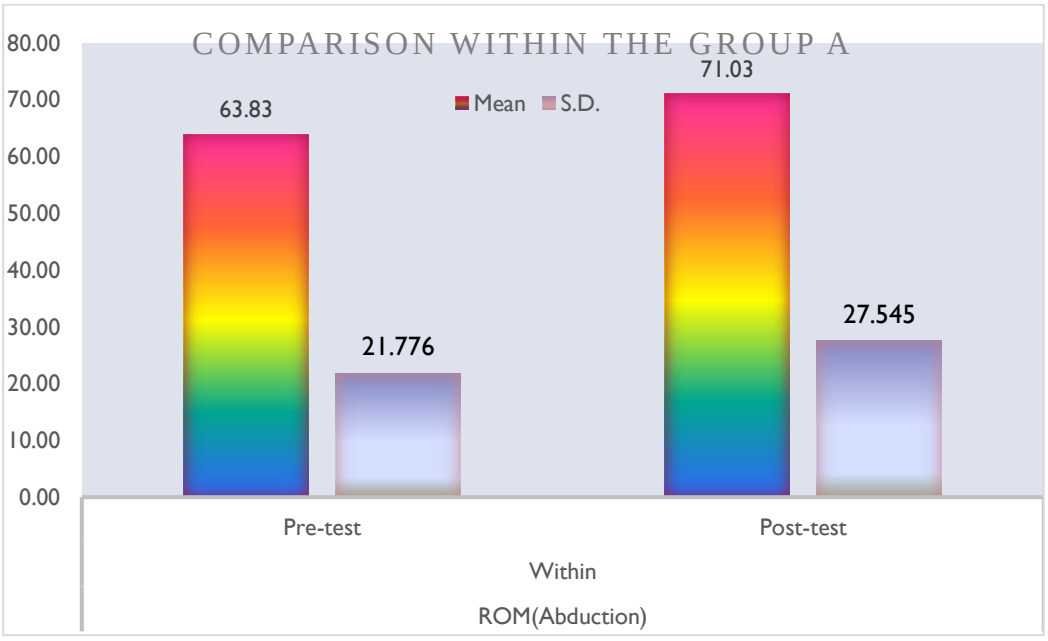
Graph No : 5.3 Comparison of pre and post values Of VAS within group A.



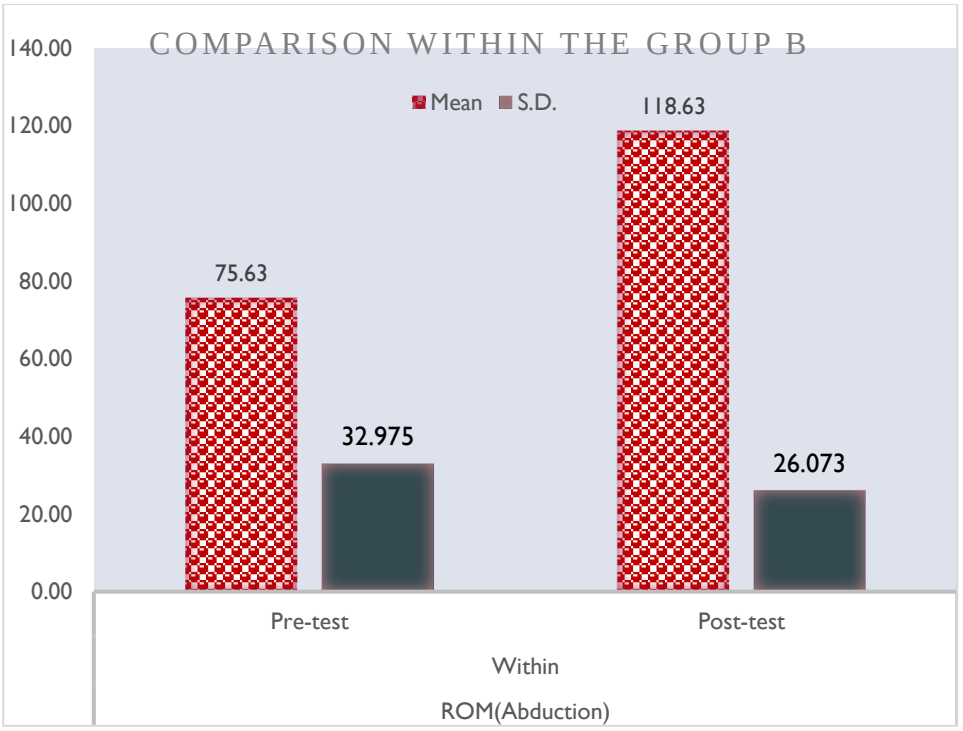
Graph No: 5.4 Comparison of pre and post values of VAS scale within group B.



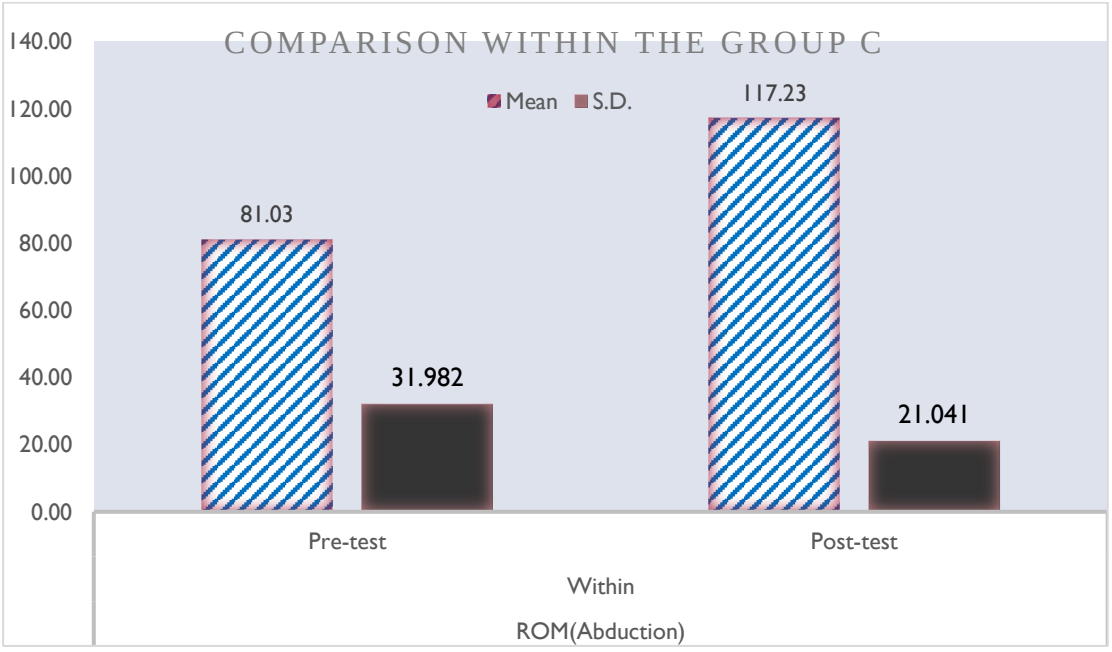
Graph no: 5.5 Comparison of Pre and Post values of VAS scale within group C.



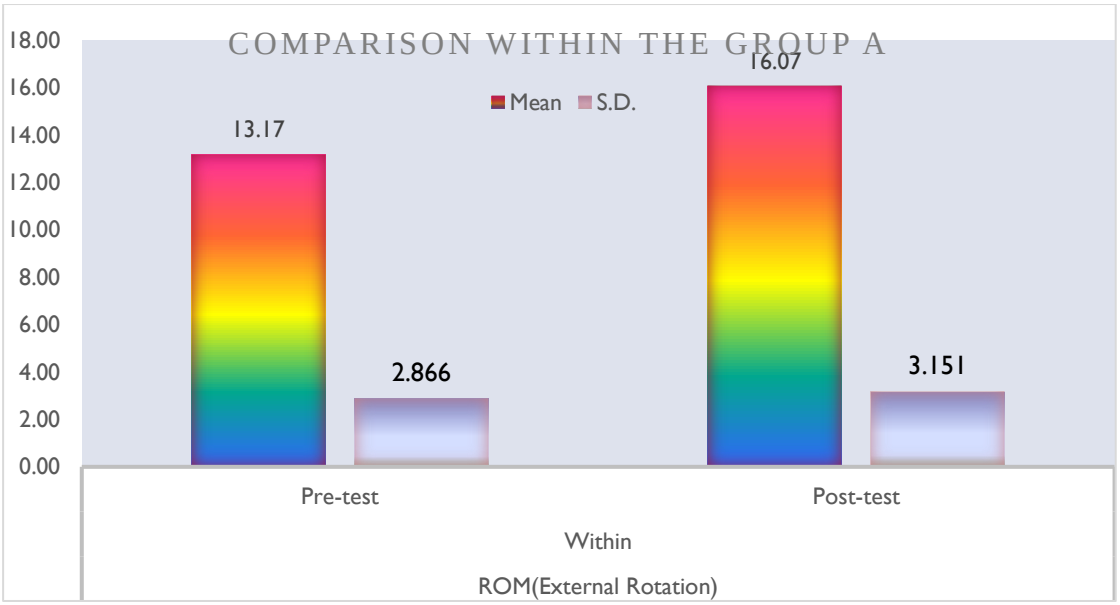
Graph No: 5.6 Comparison of Pre and Post values of ROM within group A.



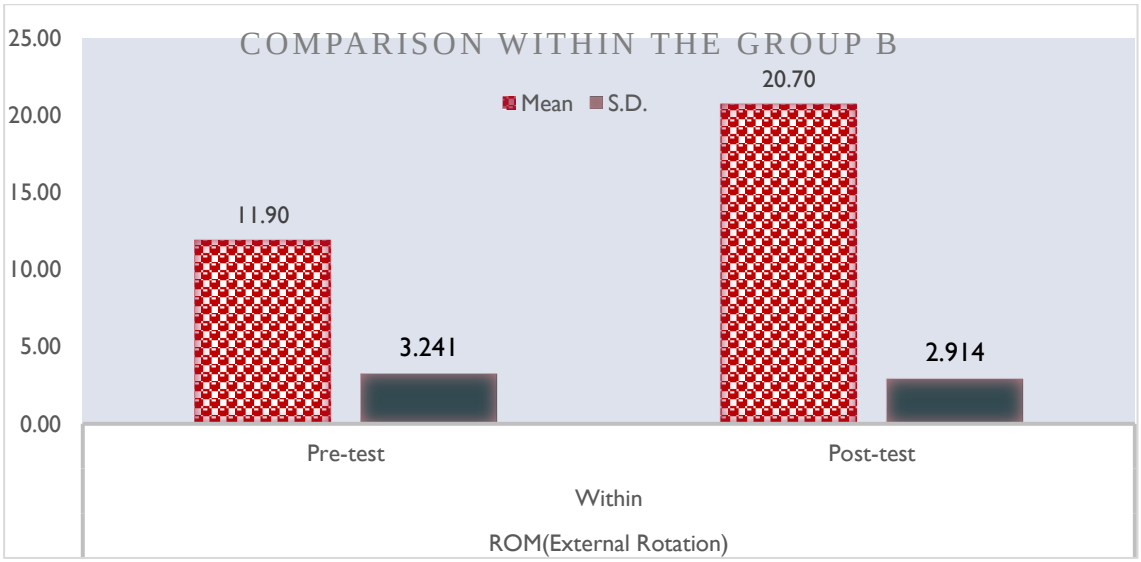
Graph No: 5.7 Comparison of Pre and Post values of ROM within group B.



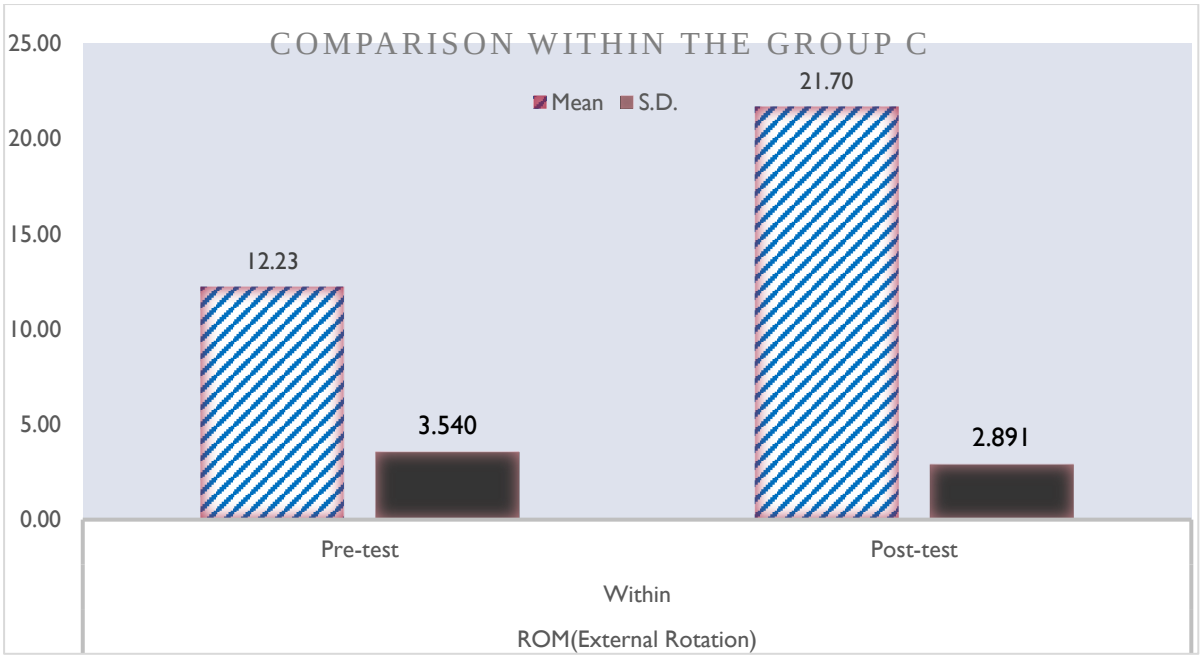
Graph No: 5.8 Comparison of Pre and Post values of ROM within the group C.



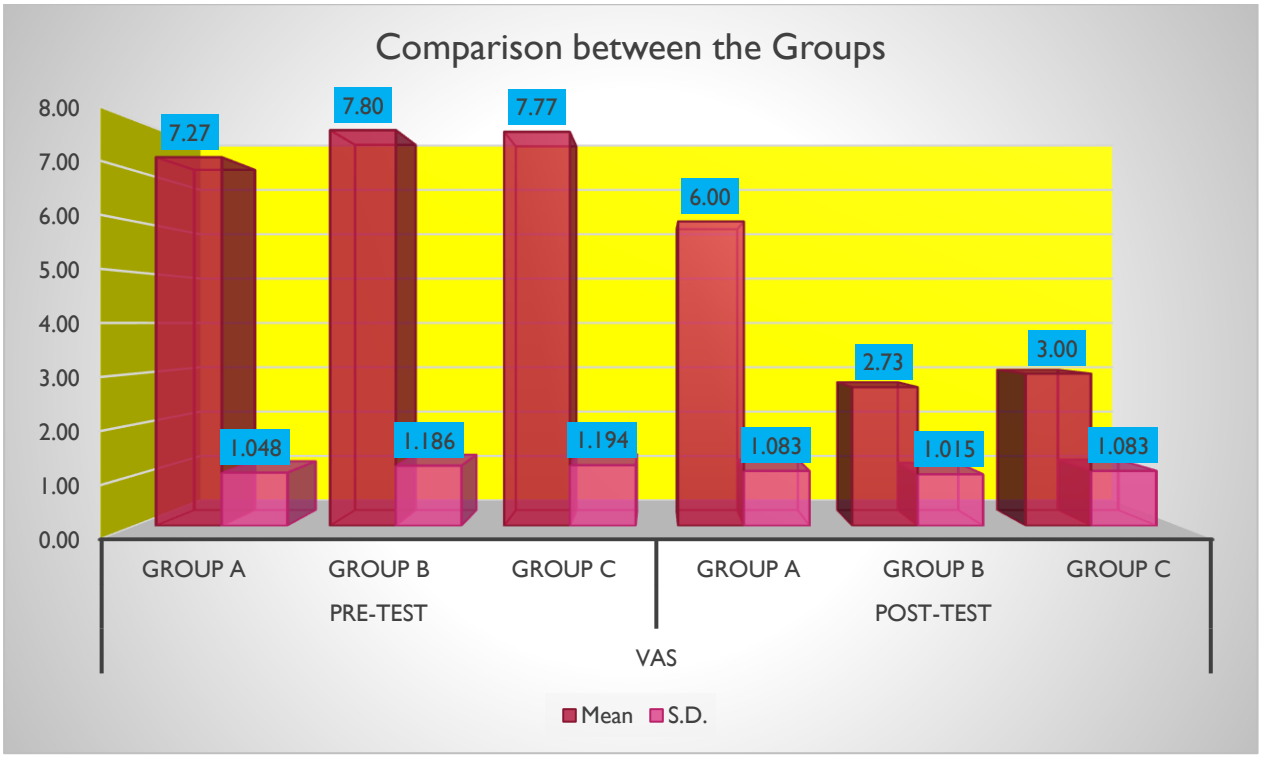
Graph No: 5.9 Comparison of pre and post protocol mean value of ROM (External Rotation) score with in group A.



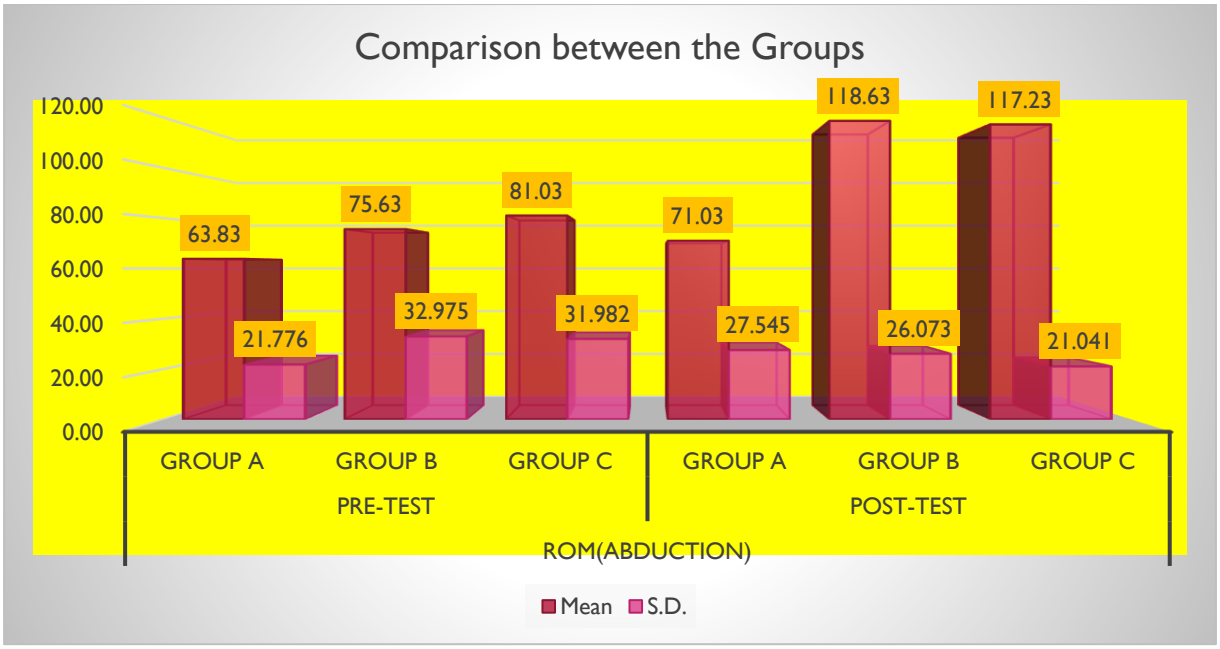
Graph No: 5.10 Comparison of pre and post protocol mean value of ROM (Abduction) score within the group B.



Graph No: 5.11 Comparison of pre and post protocol mean value of ROM (External rotation) score within the group C.



Graph No: 5.12 Comparison of pre and post protocol mean value of VAS score between the group A,B and C.



Graph No: 5.13 Comparison of pre and post protocol mean value of ROM (abduction) score between the group A,B and C.

3. DISCUSSION

The present study was undertaken to determine the effectiveness of capsular PNF along with ultrasound versus therapeutic exercises along with TENS in patients with Adhesive capsulitis of shoulder joint. Data collected showed highly significant improvement in VAS and ROM (Abduction and External rotation) of shoulder joint in patients with Adhesive Capsulitis of shoulder. Thus it can be concluded that capsular PNF along with ultrasound therapy is beneficial in reducing pain and improving ROM of shoulder joint in patients with Adhesive Capsulitis of shoulder. Capsular PNF along with Ultrasound achieved greater improvements than therapeutic exercises along with TENS. The results of present study indicate that there was highly significant ($p<0.05$) decrease in pain. Evidence from various literatures demonstrated the importance of capsular PNF, US, Therapeutic exercises and TENS was aimed to reduce pain and improve range of motion. The data was analyzed through 'F' test for comparison between capsular PNF along with US and therapeutic exercises along with TENS. Shahbaz et al. explored the effectiveness of any individual therapeutic modality in reducing pain in frozen shoulder is questionable and the combination of therapies has contradictory results. Study disclosed that Ultrasound therapy with end range mobilization produced a better result than cryotherapy with stretching in reducing pain and therefore can be recommended in the treatment of frozen shoulder. PH Laubscher et al. stated in 2009 that the best treatment option depends on the stage of the disease and clinical symptoms. Study concluded that in stage 1 physical therapy and intra-articular steroids are most effective, in stage 2 intra-articular steroid and arthroscopic release are effective, in stage 3 arthroscopic release is effective and in stage 4 monitoring progress and active physiotherapy is effective. Gokhan et al. stated in 2012 the evaluation of mulligan's technique for a adhesive capsulitis of the shoulder. Study concluded that mulligan's technique and passive stretching exercises are both effective in reducing pain, and restoring range of motion and function. Mulligan's technique led to better improvements in terms of pain, range of motion, shoulder scores, and patient and physiotherapist satisfaction.

4. CONCLUSION

Based on our study though both groups showed significant reduction in pain and improvement in range of motion of shoulder, but group B showed more improvement in the reduction of pain and range of motion of shoulder as compared to the group C. Hence, alternate hypothesis is accepted and null hypothesis is rejected. Thus, we conclude that Capsular PNF with ultrasound therapy is more beneficial than Therapeutic exercises with TENS. This study has shown that Capsular PNF along with ultrasound therapy is possible to reduce pain and improve range of motion in patients with adhesive capsulitis of shoulder. The results indicate that Capsular PNF along with ultrasound therapy has better influence on the reduction of pain, improving range of motion and functional activities in individuals with adhesive capsulitis of shoulder. The study also showed that Capsular PNF along with ultrasound therapy is safe, effective and well tolerated by patients with adhesive capsulitis of shoulder. Thus, this study proposes that, Capsular PNF along with ultrasound therapy is effective and can be applied individually in adhesive capsulitis of shoulder for immediate effects of pain and improving range of motion and thus function.

Limitations

1. The study sample size was relatively small.

2. In this study, subjects with physical function, emotional function and social levels were not considered.

3. Confounding Variables like functional limitation and environmental factors were not considered.

4. This study was limited to assess only the pain intensity by using visual analogue scale and range of motion by using goniometer.

Future Scope of the study

1. The treatment was given for 3 weeks but follow up was not done, therefore long-term effects of the treatment can be noticed.

2. The further scope for research is to investigate if Capsular PNF or therapeutic exercise can be applied independently for a longer duration with more lasting effects without any adjunct conventional modes of treatment.

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