

To Study the Effect of End Range Mobilization with Scapular Mobilization on Pain, Range of Motion, Joint Space and Functional Disabilities in Adhesive Capsulitis Individuals with Type 2 Diabetes Mellitus-Randomized Controlled Trail

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Abstract: ***Purpose:** The study aims to find out the effect of end range mobilization with scapular mobilization on pain, range of motion, joint space and functional disabilities in adhesive capsulitis individuals with type 2 diabetes mellitus. **Background:** Adhesive Capsulitis, a prevalent musculoskeletal issue especially in type 2 diabetes mellitus, is a major cause of shoulder joint and functional impairments, impacting the components of the shoulder movements and thus impairing the ADLs. End range mobilization coupled with scapular mobilization, proves effective in enhancing the shoulder movements and thus improving the functional activities. **Participants:** The study recruited 50 adhesive capsulitis subjects meeting inclusion criteria, aged 40 - 60, both men and women with HbA1c ranging 6.5 - 8.5 with medications. **Methodology:** The study employs a randomized controlled method. Subjects were randomly assigned into two groups: Group A received end range mobilizations with scapular mobilization with conventional therapy, Group B underwent only end range mobilization with conventional therapy. Both the groups participated in 30 - 40 minutes of daily sessions, 3 days in a week, over a 12 - week period. Pain was evaluated by Visual Analog Scale (VAS), range of motion by digital inclinometer, joint space by radiological measure and functional ability by SPADI questionnaire. **Analysis:** Pre - and post - values were measured using paired t - tests within the groups. The individual t - test is used to measure the between group data. **Results:** Following treatment, both groups exhibited significant differences. Additionally, a comparison between the experimental and control groups revealed End - range mobilization combined with scapular mobilization significantly improves shoulder mobility and reduces pain. The experimental group showed notable improvements in shoulder movements and a substantial reduction in pain and disability. This treatment approach is more effective in enhancing shoulder function and alleviating pain than the control group. **Conclusion:** This study showed that end range mobilization with scapular mobilization be used as an effective treatment in reducing pain, functional disabilities and improving shoulder range of motion and joint space in diabetic adhesive capsulitis individuals.*

Keywords: Adhesive capsulitis, diabetes mellitus, VAS, digital inclinometer, SPADI

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1. Introduction

Adhesive Capsulitis is a painful condition in which the shoulder becomes stiff and inflamed and thus movement is restricted. Simon – Emmanuel Duplay is the first to name it as "SCAPULO - HUMERAL PERIARTHROSITIS".¹ Codman in 1934 described it as "FROZEN SHOULDER", indicating the possibility of developing shoulder stiffness and pain without the influence of external factors.² Neviasser, was the first to use the term "ADHESIVE CAPSULITIS", describing it as a chronic inflammation of synovial membrane with fibrosis of joint capsule and intra articular adhesions in the shoulder.³ According to the American Shoulder and Elbow Surgeons is "the condition of uncertain etiology characterized by significant restriction of both active and passive shoulder motion that occurs in the absence of a known intrinsic shoulder disorders".⁴ Adhesive capsulitis individuals experience a restriction in capsular region along with

limitation in rotation of external plane of the scapula.⁵ Shoulder pain is the third most common Musculo - skeletal condition. The reported Annual incidence of shoulder pain in primary care is 14.7 per 1000 patients per year with a lifetime prevalence of up to 70%. Nearly 20% of the adult population experience shoulder symptoms at any one time.⁶ Adhesive capsulitis is 2 to 4 times more common in diabetic individuals than the general population.

2. Need of the Study

Adhesive Capsulitis is a common musculoskeletal problem that affects the activities of daily living. Various studies were done on physiotherapeutic approaches to treat Adhesive Capsulitis. The different approaches were therapeutic ultrasound, wax therapy, TENS, laser, shoulder mobilizations and many more.⁷ Studies on various grades of mobilizations suggest that improvement in joint mobility and pain reduction,

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but prognosis at end range of motion is limited.⁸ During last few decades, increased focus has been placed on evidence based in physiotherapeutic approaches. This development has made it essential to utilize instruments and methods that can detect clinically relevant changes. There was lack of studies in relation between diabetics and adhesive capsulitis with the degree of range of motion. Studies are needed to find out which treatment approach is better for adhesive capsulitis individual; this will help in refining the outcomes of treatment and in defining indications of what mobilization methods to be used. Present need of the study is to find the effect of end range mobilization with scapular mobilization on pain, range of motion, joint space and functional disabilities in adhesive capsulitis individuals with type 2 diabetes mellitus

Aim of the Study

The main aim of the study is to find out the effect of the end range mobilization with scapular mobilization on pain, range of motion, joint space and functional disabilities in adhesive capsulitis individuals with type 2 diabetes mellitus.

Objectives of the Study

- To evaluate the effect of end range mobilization with scapular mobilization on pain using VAS in experimental group (A) and control group (B) in adhesive capsulitis individuals with type 2 diabetes mellitus.
- To evaluate the effect of end range mobilization with scapular mobilization on active and passive range of motion of affected shoulder joint using digital inclinometer in experimental group (A) and control group (B) in adhesive capsulitis individuals with type 2 diabetes mellitus.
- To evaluate the effect of end range mobilization with scapular mobilization on functional activities using SPADI questionnaire in experimental group (A) and control group (B) in adhesive capsulitis individuals with type 2 diabetes mellitus.
- To evaluate the effect of end range mobilization with scapular mobilization on shoulder joint space using shoulder radiograph in experimental group (A) and control group (B) in adhesive capsulitis individuals with type 2 diabetes mellitus

3. Materials and Methodology

Materials Used -

Digital Inclinometer – used to assess shoulder joint range of motion

Digital X - Ray machine – used to record shoulder joint space

Prognosys Pro RAD 3NC Ceiling Suspended DR System

Therapeutic ultrasound – used to reduce pain

Technomed Electronics ELECTROSON 60 Physiotherapy ultrasound machine

A wand/stick- used for doing shoulder exercises

Study Setting- Department of Physiotherapy, college of physiotherapy, SVIMS, Tirupathi

Sample Design- Simple Random sampling method

Study Procedures- Individuals are randomly allocated to either experimental group (A) or control group (B) through simple concealed random allocation by lottery method.

Study Design- Randomized control trial

Study Period- Treatment protocol was administered for 12 weeks. The sampling and data record was done from Dec 2023 to June 2024.

Sample Size: 50 individuals divided into 2 groups where they are randomly allocated either in group A or group b through concealed allocation using lottery method.

Ethical Aspects: The study was cleared by the Institutional Ethics Committee and written informed consent was obtained from each individual.

Inclusion Criteria

Both males and females

Age between 40 – 60 yrs.

Individuals with adhesive capsulitis with diabetes under control

HbA1c 6.5 - 8.5 with medication

Exclusion Criteria

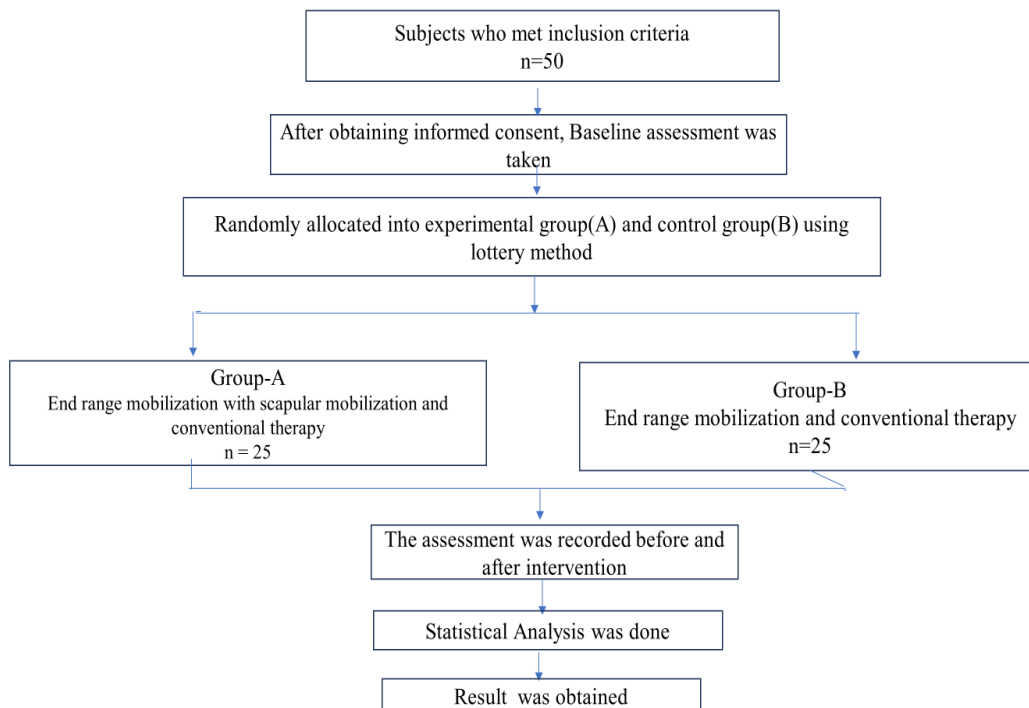
Individuals with age less than 40 yrs. and more than 60yrs

Individuals with associated injuries.

Individuals with neurological defects.

Individuals who underwent intra - articular injection within 6 months of period

Individuals with rheumatoid arthritis and individuals with uncontrolled diabetes.



Consort flow diagram of study

Outcome Measures

- **VAS – Visual analogue scale** 0 –10 numerical rating based on pain, measured on fixed 0 to 10 cm scale (physical Parameter)
- **Digital inclinometer** – Range of motion of shoulder (Physiological parameter), measured in degrees.
- **SPADI – Shoulder pain and disability index** 0 – 100 numerical rating based on the pain and disability questionnaire, measured by the average taken by the pain and disability questionnaire (Functional parameter)

- **X Ray AP View** and in bilateral arm abduction at 0 degree and maximum possible abduction – glenohumeral joint space and scapulo - thoracic angle, measured in angle and joint space distance in millimeter.

Treatment Protocol

Based on the inclusion and exclusion criteria, the individuals are recruited. Assessment was done before and after 12 weeks of the therapeutic treatment. The individuals with adhesive capsulitis in both the groups receive treatment for 3 days in a week for about 30 – 40 min duration of treatment protocol is as follows (Table 1 & Table 2)

Table 1: Treatment protocol for experimental group

EXPERIMENTAL GROUP (A)

S no.	Type of treatment	Frequency 3 days/ week for 12weeks	Intensity	Time	Type
1.	Therapeutic ultrasound	One session/day	1 MHz	8 minutes	Continuous mode
2.	End range mobilizations	One session/day	Grade 3 and grade 4	10 – 15 repetitions	Maitland’s technique
3.	Scapular mobilizations	One session/day	Based on the individual tolerance	10 – 15 repetitions	Gliding, rotation and distraction
4.	Codman’s exercises	3 sets/ session/day	Gentle, slow and relaxed movements	10 – 15 repetitions Per set with 30 – 40 sec rest in between sets	Pendular / swinging movements of arm
5.	Wand exercises	3 sets/ session/day	Gentle, slow and relaxed movements	10 – 15 repetitions Per set with 30 – 40 sec rest in between sets	Shoulder range of movements with lightweight wand / stick
6.	Finger walk exercises	3 sets/ session/day	Gentle, slow and relaxed movements	10 – 15 repetitions Per set with 30 – 40 sec rest in between sets	Fingers are used to walk / crawl on the particular surface / material

Table 2: Treatment protocol for control group
Control Group B

S no.	Type of treatment	Frequency 3 days/ week for 12weeks	Intensity	Time	Type
1.	Therapeutic ultrasound	One session/day	1 MHz	8 minutes	Continuous mode
2.	End range mobilizations	One session/day	Grade 3 and grade 4	10 – 15 repetitions	Maitland’s technique
3.	Codman’s exercises	3 sets/ Session/ day	Gentle, slow and relaxed movements	10 – 15 repetitions Per set with 30 – 40 sec rest in between sets	Pendular / swinging movements of arm
4.	Wand exercises	3 sets/ Session/ day	Gentle, slow and relaxed movements	10 – 15 repetitions Per set with 30 – 40 sec rest in between sets	Shoulder range of movements with lightweight wand / stick
5.	Finger walk exercises	3 sets/ session/ day	Gentle, slow and relaxed movements	10 – 15 repetitions Per set with 30 – 40 sec rest in between sets	Fingers are used to walk / crawl on the particular surface / material

Statistical Analysis

Data analysis was performed using SPSS software. Base line including demographic data and pre - treatment scores for outcomes calculated.

- 95% confidence interval was used so that level of significance set at $p \leq 0.005$.
- Pre and post values were measured by using paired t - test with in the groups and the individual t - test is performed between the groups

Variable	Group	Mean Diff \pm SD	p - value
VAS	Experimental - 1	3.19 \pm 1.021	0.002
	Control - 1	4.00 \pm 0.707	
SPADI	Experimental - 1	21.08 \pm 7.016	0.197
	Control - 1	19.04 \pm 3.516	

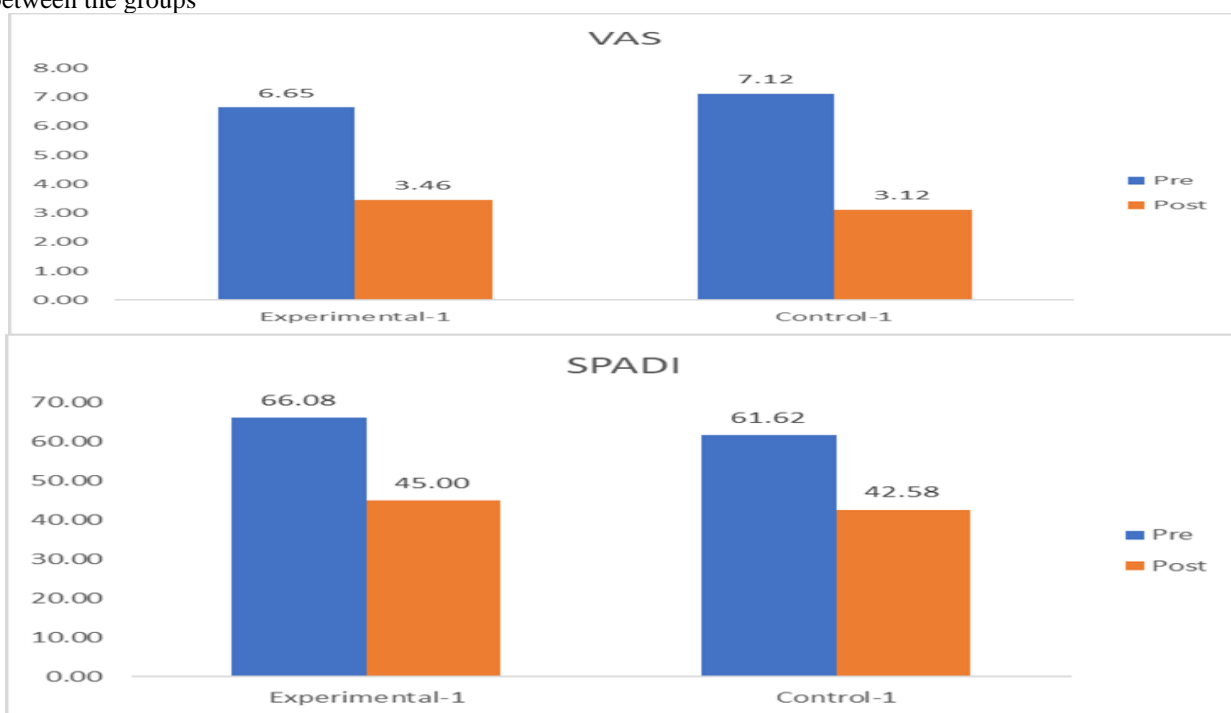


Figure 1: The comparison in tabular form & graphic representation of VAS & SPADI in experimental and control group Analysis of VAS and SPADI has been observed in diabetic adhesive capsulitis individuals (fig 1) t - test was done for all variables, The results shows that there is a significant association. The p - value $p < 0.001$

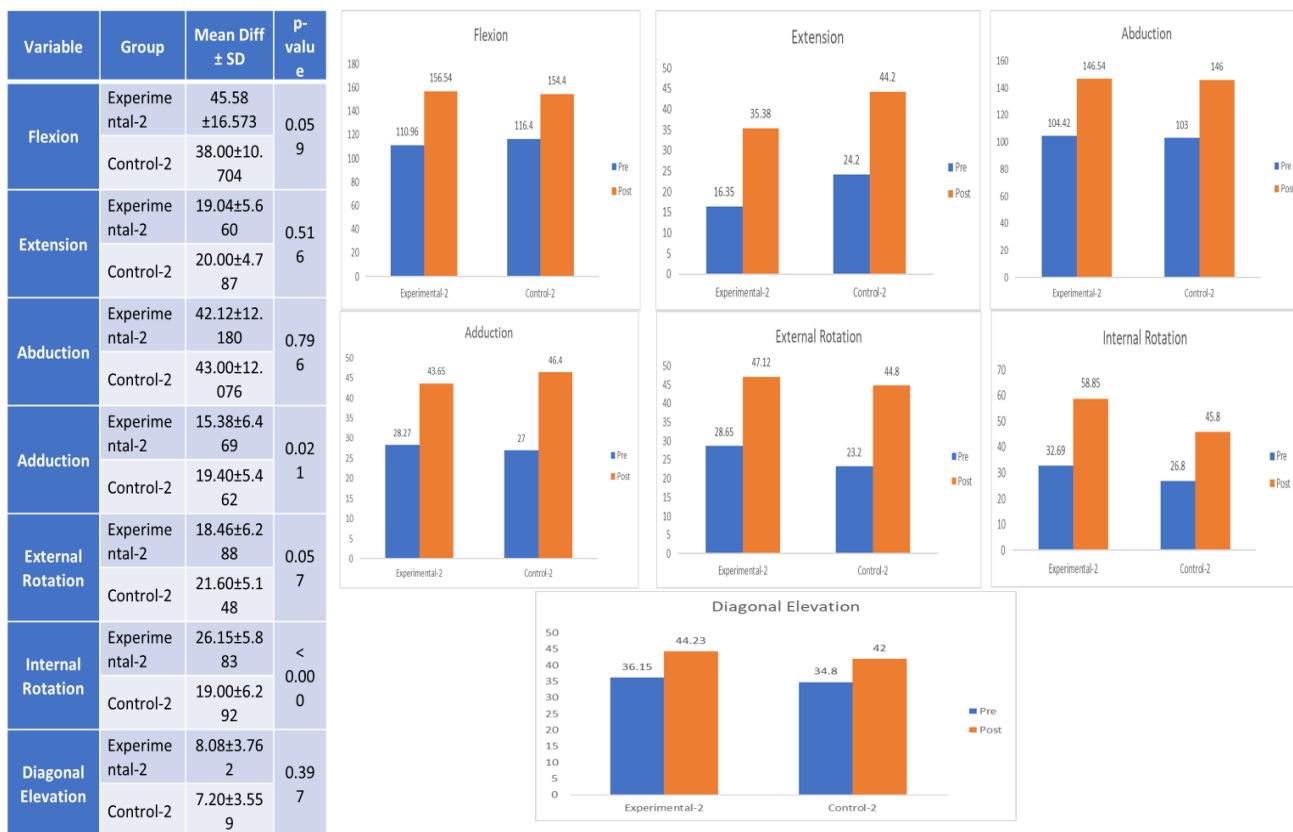


Figure 2: The comparison in tabular form & graphic representation of Shoulder ROM in experimental and control group

Analysis of Shoulder ROM has been observed in diabetic adhesive capsulitis individuals (fig 2)

t - test was done for all variables, The results shows that there is a significant association. The p - value p<0.001

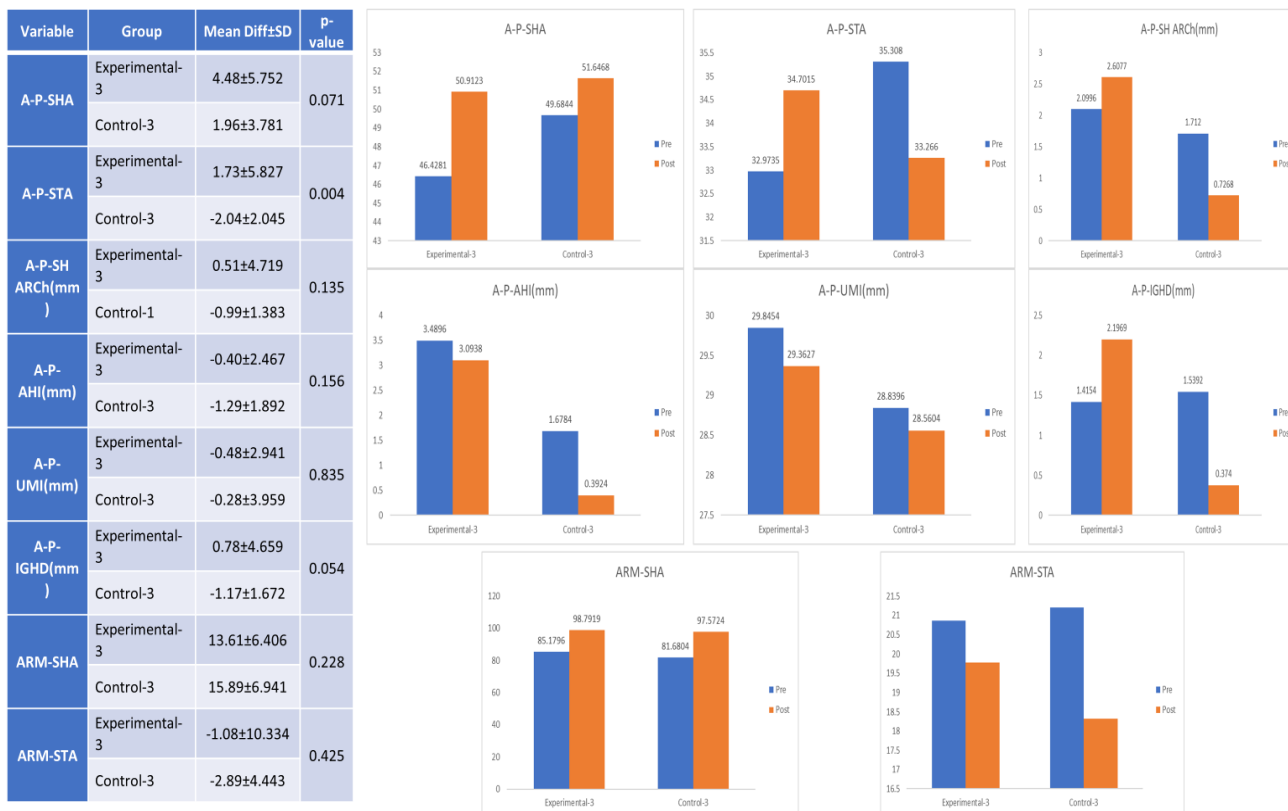


Figure 3: The comparison in tabular form & graphic representation of radiological parameters in experimental and control group

Analysis of radiological parameters has been observed in diabetic adhesive capsulitis individuals (fig 3)

t - test was done for all variables, The results shows that there is a significant association in few variables.

4. Results

This study highlights the efficacy of end - range mobilization combined with scapular mobilization in improving shoulder mobility and reducing pain. The experimental group showed a significant decrease in pain, as measured by the Visual Analog Scale, and demonstrated notable improvements in shoulder movements. While radiological parameters remained unchanged, the Shoulder Pain and Disability Index (SPADI) questionnaire revealed a substantial reduction in pain and disability in the experimental group compared to the control group. These findings suggest that this treatment approach is more effective in enhancing shoulder function and alleviating pain than the control group.

5. Discussion

Pre & post values of Pain between experimental and control group

The difference in the pain between the groups was statistically significant in pre and post values by using ultrasound therapy. Ultrasound's thermal and non - thermal effects may be responsible for its pain - relieving properties. By reducing inflammation and changing how cells work, ultrasound can help alleviate pain. It does this by increasing blood flow, bringing in white blood cells to fight infection, and removing waste products, all of which help to reduce inflammation and relieve pain.¹⁰

Pre & post values of ROM between experimental and control group

Although the difference in range of motion between the groups was not highly significant in parameters, the experimental group still showed improvement compared to the control group. This suggests that combining end - range mobilization with scapular mobilization offers some benefits over using end - range mobilization alone, even if the difference is not dramatic. The results indicate a trend towards improved outcomes with the addition of scapular mobilization, justifying further investigation to fully understand its effects. Lin, et al., in their study, commented that mobilization techniques performed in the specific plane close to the end - range improve the corresponding extensibility of the shoulder capsule and stretch the specific tightened soft tissues have beneficial effects. These findings are in accordance with study conducted by yang, et al.¹¹ They suggested that insufficient scapulohumeral rhythm and posterior tipping of the scapula during arm elevation are important to consider in adhesive capsulitis individuals.

Pre & post values of Functional Status (SPADI) between experimental and control group

The components of SPADI are pain and disability scales. It is self - assessed questionnaire administered among the subjects to evaluate the status of shoulder functions. The mechanism beyond the experimental group, end range mobilization with scapular mobilization has improved the SPADI questionnaire

has been observed. However, our findings showed similar to the reports of Derya Celik study showed the beneficial effect of the mobility exercises along with ultrasound therapy in improving the shoulder functional status is attributed by reducing pain and thus improving the range of motion¹² are the rationale behind the functional independence.

6. Conclusion

This study, part of a Ph. D. thesis to be submitted to SVIMS University, Tirupati, India, investigated the effect of end - range mobilization with scapular mobilization on pain, range of motion, joint space, and functional disabilities in individuals with adhesive capsulitis and type 2 diabetes mellitus. Fifty subjects were divided into experimental and control groups, with the experimental group receiving end - range mobilization with scapular mobilization and conventional therapy, and the control group receiving end - range mobilization with conventional therapy. Analysis revealed significant improvements in the experimental group compared to the control group in parameters like VAS, ROM, and SPADI, although radiological parameters showed no difference between groups but significant changes within groups before and after treatment. This suggests that end - range mobilization with scapular mobilization is more effective than end - range mobilization alone in managing adhesive capsulitis in individuals with type 2 diabetes.

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