European Journal of Physiotherapy and Rehabilitation Studies
ISSN: 2668-9928
ISSN-L:2668-9928
Available on-line at: www.oapub.org/hlt

DOI: 10.46827/ejprs.v5i1.217 Volume 5 | Issue 1 | 2025

EFFECT OF MUSCLE ENERGY TECHNIQUE VERSUS MAITLAND MOBILIZATION WITH KIASTM ON PAIN AND DISABILITY IN SHOULDER PERIARTHRITIS: A RANDOMIZED CONTROLLED TRIAL

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Abstract:

Purpose of the Study: To compare the effectiveness of Muscle Energy Technique and Maitland Mobilization coupled with KIASTM in patients with periarthritis of the shoulder joint. **Materials and Methods:** 20 subjects with periarthritis were randomly allocated. The subjects were treated with KIASTM coupled with Muscle Energy Technique (Group I) and Maitland Mobilization (Group II). The treatment was given for 45 minutes a day up to 2 months. The outcome was measured in terms of the shoulder pain and disability index (SPADI). **Results: An** Independent t-test was used to compare the pre-test and post-test values between each group. On comparing the mean values of SPADI of the two groups, the study shows there is a significant increase in the post-test values of KIASTM coupled with Muscle Energy Technique than KIASTM coupled with Maitland Mobilization. **Conclusion:** KIASTM coupled with Muscle Energy Technique is more effective than Maitland Mobilization in reducing pain and disability, enhancing shoulder function among periarthritis subjects.

Keywords: Maitland Mobilization, KIASTM, Muscle Energy Technique, Neer's test, shoulder joint, periarthritis

1. Introduction

The shoulder joint (glenohumeral joint) is a ball-and-socket joint between the scapula and humerus. It is the major joint connecting the upper limb to the trunk. It is one of the most mobile joints in the human body, at the cost of joint stability. The shoulder joint is formed by the articulation of the head of the humerus with the glenoid cavity of the scapula. This characteristic gives rise to the alternate name ‘glenohumeral joint’ for the shoulder joint. Like most synovial joints, the articulating surfaces are covered with hyaline cartilage. The head of the humerus is much larger than the glenoid fossa, giving the joint a wide range of movement at the cost of inherent instability. To reduce the disproportion in surfaces, the glenoid fossa is deepened by a fibrocartilage rim, called the glenoid labrum. As a ball and socket synovial joint, there is a wide range of movement permitted: Flexion, Extension, Abduction, Adduction, Internal rotation, External rotation.

The shoulder joint is one of the most rewarding and functional joints, playing a vital role in daily activities, including occupational, recreational, and performance-based tasks. This joint enable both stability and mobility, which coordinate with upper and lower limb movements during skilled and forceful hand activities. Various joints in the human body are susceptible to disorders, with arthritis being one of the common.

Arthritis of the shoulder joint has been reported since 1872, described as 'Humero Scapular Periarthritis'. The ailment was renamed as 'Frozen Shoulder' in 1934 by Codman and later described as 'Adhesive Capsulitis', by Neviarer in 1945, who reported the occurrence of this ailment amongst 7% -21% of the population. The condition is characterized by painful, stiff shoulders.

Shoulder pain is a commonly encountered problem, with prevalence studies indicating a frequency of 7-20% among the adult general population. Frozen shoulder, also called adhesive capsulitis, is one of the diseases that cause shoulder pain. The incidence of this condition in the general population is between 2% and 5%. It is more common among women aged 40-60 years.

The disease is characterized by pain, loss of function, and loss of joint range of motion (ROM). Its etiology is incompletely elucidated. The pathologic anatomy of frozen shoulder includes synovial inflammation, joint capsule hypertrophy, and the development of fibrous structures. The condition occurs bilaterally in 20-30% of cases. Symptoms typically begin with a sensation of strain during specific movements and generalized shoulder pain with motion in any direction.

One of the main complaints in patients with shoulder pain is functional disability. Treatment of shoulder pain is usually aimed at pain reduction and improvement of functional disabilities. Consequently, outcome measurements should include an instrument (e.g., questionnaire) for the evaluation of functional disabilities. There are several self-administered shoulder pain and disability questionnaires. Patients ranked the Shoulder Disability Questionnaire (SDQ) and the Shoulder Pain and Disability Index (SPADI) as the most relevant questionnaires. The SPADI was the least time-consuming; both the SDQ and the SPADI appear to be convenient and easy to complete. The SPADI was originally developed in English. It has been translated and validated in several languages and has shown excellent reliability and responsiveness.

The cases of chronic adhesive capsulitis are reported to be responding well to therapeutic massage with Muscle Energy Technique (MET), leading to decreases in pain and an increase in functional quality. MET is generally classified as a direct technique, in contrast to other manual therapy methods, because the muscular effort is in the form of a controlled position at a specific direction against its counterforce. However, the key objective of this method is to normalize joint range rather than improve joint flexibility. These techniques have been recommended for all joints with restricted range of motion (ROM) identified during the passive assessment.

The correlation between the tightness in a joint capsule and the pattern of motion restriction in a joint was revealed by Hannafin et al. Agonizing shoulder, freezing stage with chronic pain, frozen stage with significant limitation of ROM and thawing phase with progressive improvement in ROM have been identified as the major phases of frozen shoulder. End-range mobilization and intensive mobilization techniques [MT] have been identified as useful approaches for reducing the risk of stiffness or joint contracture progression in patients with adhesive capsulitis. However, MET has been reported to facilitate the release of muscles, promote body healing mechanisms and improve shoulder ROM.

Three phases of clinical presentation:

- Painful freezing phase. Duration 10-36 weeks. Pain and stiffness around the shoulder with no history of injury. A nagging constant pain is worse at night, with little response to non-steroidal anti-inflammatory drugs.

- Adhesive Phase. Occurs at 4-12 months. The pain gradually subsides, but stiffness remains. Pain is apparent only at the extremes of movement. Gross reduction of glenohumeral movements, with near total obliteration of external rotation.
- Resolution Phase. Takes 12-42 months. Follows the adhesive phase with spontaneous improvement in the range of movement. The mean duration from the onset of frozen shoulder to the greatest resolution is over 30 months.

MET is a unique Technique in which the patient provides the corrective force rather than the care provider. MET is defined as the procedure that provides voluntary contraction of the muscle at varying levels of intensity, in a very controlled direction, against a force applied by the care provider. The potential applications of MET include lengthening and strengthening of muscles, increasing fluid flow, and decreasing local edema.

Application of KIASTM as a therapeutic modality has been in practice since the 1940s. Potential heating effect, promotion of tissue relaxation, easing local blood flow, and breaking down of the scar tissue achieved through ultrasound therapy make it a highly useful treatment mode in physiotherapy.

This therapy is used in the treatment of frozen shoulder as well. Availability of the portable KIASTM device makes it a convenient mode, followed at home also. Visual Analog Scale (VAS) and Shoulder Pain and Disability Index (SPADI) are standard clinical tools to assess pain and physical functional disability on a linear scale, both before and after treatment.

Although both MET combined with KIASTM and joint mobilization technique coupled with ultrasound therapy are effective in treating periarthritic shoulder, it would be interesting to determine which technique is more effective in treating periarthritic shoulder. The present study intends to compare the effectiveness of MET coupled with KIASTM therapy and joint mobilization coupled with KIASTM therapy in patients with periarthritic shoulder.

The term "muscle energy" suggests that the effort and energy of a person or patient performing movements provide the primary force involved in the process. It is used to help mobilize restricted joints by stretching hypertonic muscles, capsules, ligaments, and fascia. This leads to improved postural alignment and the restoration of proper joint biomechanics and functional movement.

2. Aim of the Study

The Aim of the study is to compare the effectiveness of Muscle Energy Technique and Maitland Mobilization coupled with KIASTM in improving shoulder function in patients with periarthritic shoulder subjects.

2.1. Objectives of the Study

- To evaluate the effectiveness of KIASTM combined with the Muscle Energy Technique in improving shoulder function in patients with periarthritic shoulder.
- To evaluate the effectiveness of KIASTM combined with Maitland Mobilization in improving shoulder function in patients with periarthritic shoulder.
- To compare the effectiveness of Muscle Energy Technique and Maitland Mobilization in improving shoulder function in patients with periarthritic shoulder.
- To compare the effectiveness of Muscle Energy Technique and Maitland Mobilization, both combined with KIASTM, in improving shoulder function in patients with periarthritic shoulder.

2.2 Need for the Study

Frozen shoulder can be a primary or idiopathic problem, or it may be associated with another systemic illness. Diabetes mellitus is the most common condition associated with secondary frozen shoulder. The incidence of frozen shoulder among diabetes patients is reported to be between 10%-36%.

The lifetime prevalence of shoulder pain is estimated to be approximately 35% (Guerra de Hoyos et al, 2004). Shoulder problems are believed to be associated with scapular dyskinesia, shoulder muscle tension, spasms, and inflammation such as in rotator cuff syndrome. These issues may also involve adjacent joints including the glenohumeral, scapulothoracic, sternoclavicular and acromioclavicular (Ratcliffe et al, 2014)

Various shoulder rehabilitation techniques, such as Muscle Energy Technique and Maitland Mobilization combined with KIASTM, are commonly used in clinical practice to manage shoulder pain and enhance function.

3. Hypothesis

3.1 Null Hypothesis (HO)

- There is no significant improvement in shoulder function following KIASTM combined with Muscle Energy Technique in patients with periarthritic shoulder.
- There is no significant improvement in shoulder function following KIASTM combined with Maitland Mobilization in patients with periarthritic shoulder.
- There is no significant improvement in shoulder function following KIASTM combined with Muscle Energy Technique and Maitland Mobilization in patients with periarthritic shoulder.

3.2 Alternate Hypothesis (AO)

- There is significant improvement in shoulder function following KIASTM combined with Muscle Energy Technique in patients with periarthritic shoulder.

- There is significant improvement in shoulder function following KIASTM combined with Maitland Mobilization in patients with periarthritic shoulder subjects.
- There is significant improvement in shoulder function following KIASTM combined with Muscle Energy Technique and Maitland Mobilization in patients with periarthritic shoulder.

3. Methodology

Study Design	Experimental study, comparative in nature.
Study Setting	Outpatient Department of Physiotherapy.
Subjects	20 subjects were included in the study.
Project Duration	2 Months.
Study Duration	45 days.
Treatment Duration	45 minutes.
Sampling Method	Convenient sampling method.
Inclusion Criteria	- Age between 35 and 50 years. - Only males were included. - Subjects with chronic periarthritic shoulder
Exclusion Criteria	- Malignancy in the area of treatment - Infectious Arthritis - Metabolic Bone Disease - Neoplastic Disease - Fusion or Ankylosis - Osteomyelitis - Fracture or Ligament Rupture - Arthroplasty - Hypermobility
Materials and Measurement Tool	- Informed consent - Patient information sheet - Shoulder pain and disability index chart - Couch with bed - KIASTM
Variables	**Independent variables:** - Maitland Mobilization - Muscle Energy Technique - KIASTM **Dependent variables:** - Shoulder joint pain and function

4. Procedures

Participants were screened based on the inclusion and exclusion criteria. The procedure involving KIASTM combined with Muscle Energy Technique and Maitland Mobilization were clearly explained to them. The purpose of the study was also described, and informed consent was obtained. Participants were then randomly assigned to Group I and Group II. Group I were received KIASTM combined with Muscle Energy Technique,

while Group II received KIASTM combined with Maitland Mobilisation. Each treatment session lasted 45 minutes.

4.1 Muscle Energy Technique Coupled with KIASTM

The subjects in Group A received Muscle Energy Technique combined with KIASTM therapy for glenohumeral joint restricted flexion, joint restricted abduction, and joint restricted external rotation.

For flexion, the therapist placed one hand at the subject's superior part of the scapula and glenohumeral joint to examine for motion. The other hand of the therapist supported the subject's flexed elbow and stretched the humerus bone at the glenohumeral joint in the sagittal plane to the initial point of resistance. The subject was then instructed to extend their elbow against the therapist's counterforce. The force was maintained for 5 s and allowed to relax for 2 s.

To assess motion during abduction, the therapist cupped the glenohumeral joint with one hand.

The subject was directed to press their elbow towards their body.

4.2 Maitland Mobilization Coupled with KIASTM

The subject was advised to rest at one end of the treatment table in a supine position. Joint mobility was assessed using an ordinal scale and subjects with grade 2 mobility were selected for mobilization.

Applying translatory glide thrust mobilization grade V to the affected shoulder joint (concave surface: glenoid fossa and convex surface: humerus head).

- Grade I - Small amplitude movement at the beginning of available ROM
- Grade II - Large amplitude movement within available ROM.
- Grade III - Large amplitude movement reaching the end ROM.
- Grade IV - Small amplitude movement at the end of available ROM.
- Grade V - High velocity, small amplitude thrust at the end of available ROM (manipulation).

The Group B patients received Mobilization Technique (general) coupled with KIASTM therapy (called MTU hereafter) for glenohumeral joint abduction, joint external rotation, and joint forward flexion.

For shoulder flexion, the subject lay in a supine position with the affected arm resting on the edge of the table. The arm was supported against the therapist's trunk. The therapist grasped the distal humerus with their lateral hand while the medial hand was placed distal to the anterior joint margin, with fingers positioned superiorly. Caudal glide was applied to enhance rotation and improve ROM beyond 90 degrees.

For abduction, the subject was positioned supine with the at rest. The forearm was supported between the therapist's trunk and elbow. The therapist stood on the affected side and placed one hand in the axilla to provide grade 1 distraction. The web space of the other hand was positioned distal to the acromion to apply caudal glide.

5. Data Analysis

4.1 Technique of Data Analysis

The improvement in the reduction of pain and disability was calculated using the pre-test and post-test taken before and after treatment.

The data obtained are analyzed using a paired "t" test.

a. Mean: $d = \sum_n d$

b. Standard Deviation: S.D= $\sqrt{\sum \frac{(d-d)^2}{n-1}}$

c. Paired "t" TEST: $t = \frac{d\sqrt{n}}{S \cdot D}$

Where,

D = calculated mean difference pre-test and post-test

N = sample size

S.D = standard deviation

D = difference between pre- and post-test

d. Unpaired "t" Test

The unpaired "t" test was used to compare the statistically significant difference between Group A and Group B.

Formula:

$$S\sqrt{\frac{(n_{1-1})^{s1^2} + (n_{2-1})^{s}2^2}{n1 + n2 - 2}}$$

$$t = \frac{x_1 - \varkappa_2}{S_{\sqrt{\frac{1}{n1}+\frac{1}{n_2}}}}$$

Where:

n_1 = Total number of subjects in Group I,

n_2 = Total number of subjects in Group II,

x_1 = Difference between pre-test and post-test values of x_2 = Group I, Difference between pre-test and post-test values of Group II,

1 = Mean difference between pre-test and post-test values of Group I,

2 = Mean difference between pre-test and post-test values of Group II.

Table 1 shows the comparative mean value, mean difference, standard deviation & SEM between pre and post-test of Group I.

Table 1: Comparative mean value, mean difference, standard deviation & SEM between pre and post-test of Group I

s.n.	Variables	N	Improvement		Standard Deviation	Standard Error Mean
			Mean	Mean Difference		
1	Pre-test	10	63	34.4	5.6316	1.7074
2	Post-test	10	28.8			

The above values show that there is a significant improvement in shoulder function between pre- & post-test values.

Table 2 shows the comparative mean value, mean difference, standard deviation & SEM between pre- & post-test in group II.

Table 2: Comparative mean value, mean difference, standard deviation & SEM between pre & post-test in group II

s.n.	Variables	N	Improvement		Standard Deviation	Standard Error Mean
			Mean	Mean Difference		
1	Pre-test	10	65.6	30.2	3.569	1.0934
2	Post-test	10	35.4			

The above values show that there is a significant improvement in shoulder function among pre- & post-test values.

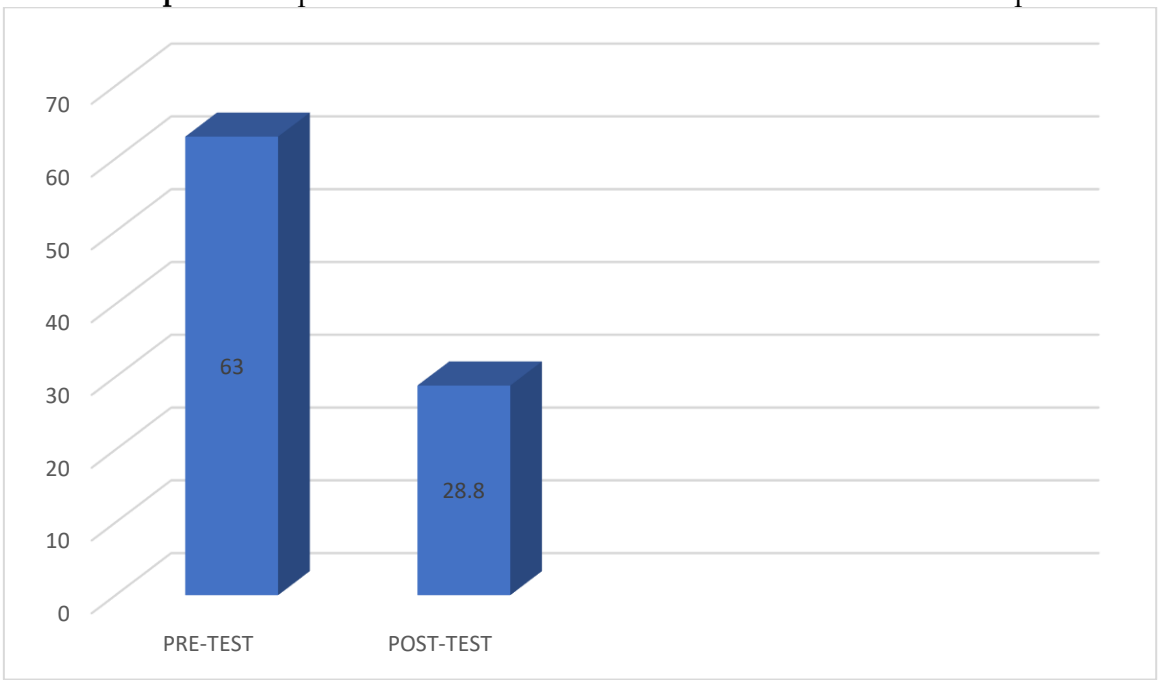
Table 3 shows the comparative mean value, mean difference, standard deviation & paired value between pre- & post-test of shoulder function in Group I and Group II.

Table 3: Comparative mean value, mean difference, standard deviation & paired value between pre- & post-test of shoulder function in Group I and Group II

s.n.	Variables	N	Improvement		P Value	Paired t value
			Mean Difference	Standard Deviation Mean		
1	Group I	10	34.4	4.71144	0.0811	1.9639
2	Group II	10	30.2			

In the paired test, the calculated value is 1.9908. The above values show that there is a significant difference in improving shoulder function between Group I and Group II.

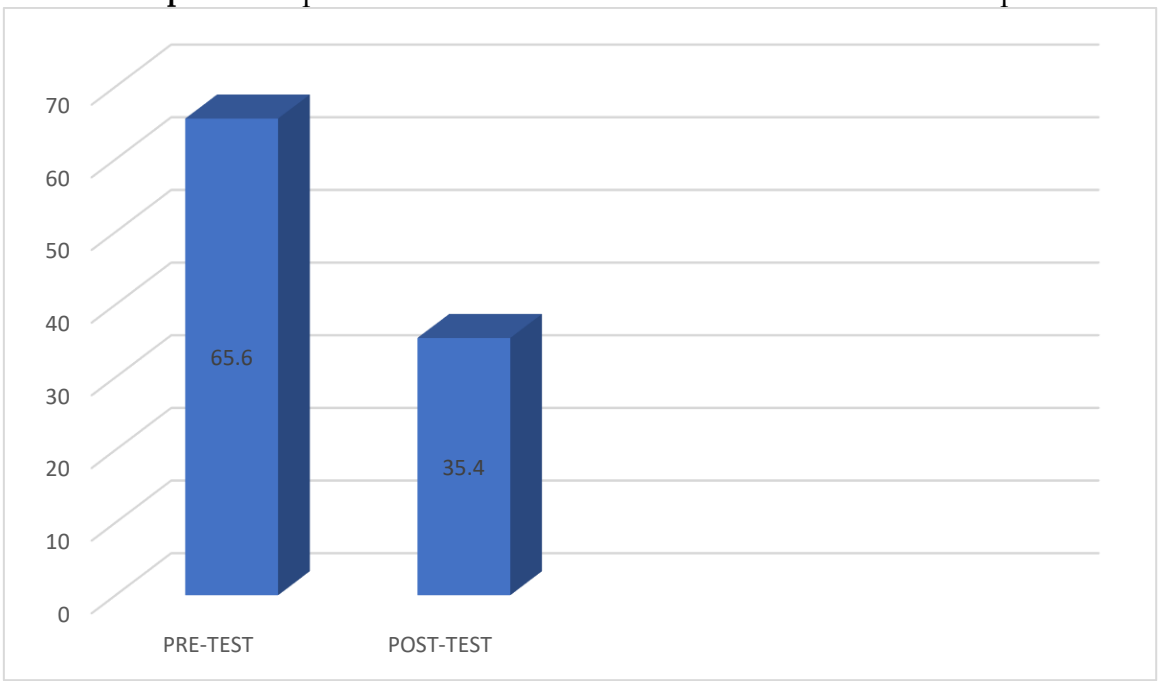
Graph 1: Comparison Between Pre-Test and Post-Test Means in Group I



Note: The bar diagram shows pre-test and post-test mean values of the group.

Pre-test and post-test values are 63 and 28.6, respectively. This shows that there is an improvement in the mean value of the pre- and post-test of Group I.

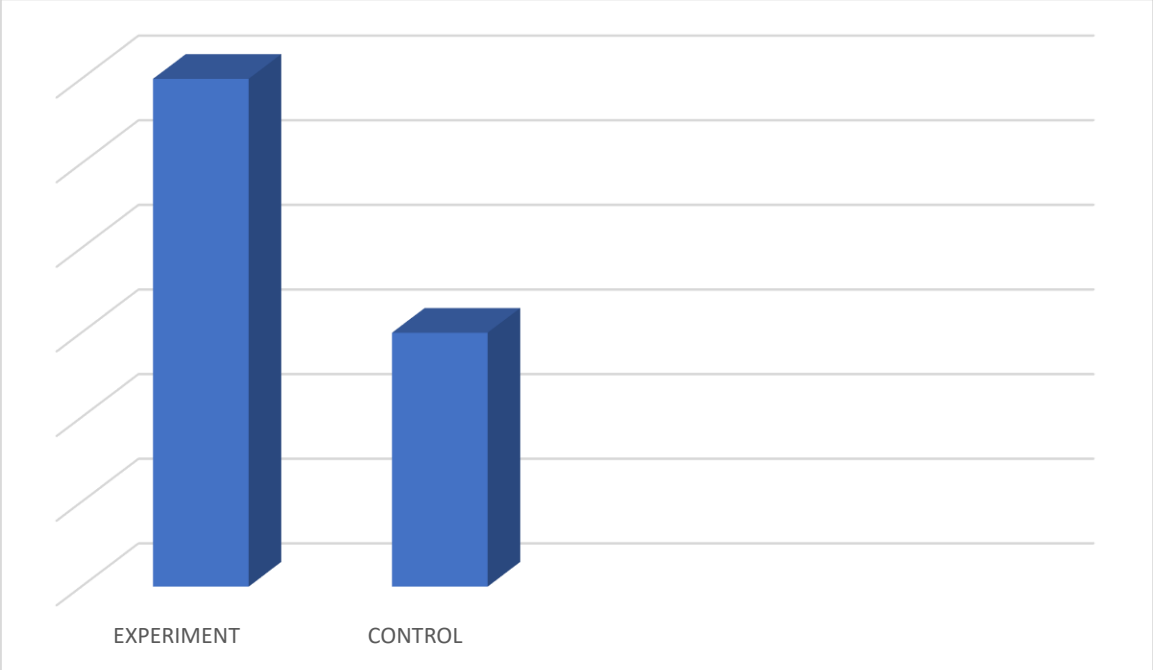
Graph 2: Comparison between Pre-test and Post-test Means in Group II



Note: The bar diagram shows the pre-test and post-test mean values of the group.

Pre-test and post-test values are 65.6 and 35.4, respectively. This shows that there is an improvement in the mean value of the pre- and post-test of Group II.

Graph 3: Comparison of Group I and II



Note: Comparison of Group I (Muscle Energy Technique with KIASTM) and Group II (Maitland Mobilization with KIASTM).

5. Results

The total number of subjects in the study was 20 (n=10 in each group). The subjects were divided into two groups (Group I & Group II). Group I received KIASTM combined with Muscle Energy Technique. Group II received KIASTM combined with Maitland Mobilization.

Pre- and Post-test values for shoulder pain and disability in Groups I and II are shown in Tables 1 & 2, respectively. In Group I (KIASTM combined with Muscle Energy Technique), the mean pre-test and post-test values were 63 and 28.6, respectively, and the mean difference is 34.4, standard deviation is 5.6316, with SEM 1.7074.

The result showed that for KIASTM coupled with Maitland Mobilization, group II, the mean values of pre-test and post-test values were 65.6 and 35.4, respectively, and the mean difference is 30.2, standard deviation is 3.569, with SEM 1.0934. The paired 't' value for comparative analysis was 1.9639 at the 0.005 significance level, with a p-value of 0.0811. Therefore, the null hypothesis is not rejected, indicating that the results were not statistically significant.

Hence, this study concludes that group I shows a significant improvement in shoulder function compared to group II. It is concluded that Group I, which received KIASTM combined with Muscle Energy Technique, will be more effective than Group II, which received KIASTM combined with Maitland Mobilization.

6. Discussion

Shoulder pain and disability are common contributors to dysfunction in shoulder complex abnormalities. The scapula plays a major role in shoulder kinematics. Scapular dysfunction may occur due to muscle weakness or injury to the shoulder complex.

In this study, the effect of KIASTM combined with MET and Maitland Mobilization on shoulder function was assessed using SPADI scale. After 45 days of intervention, the results showed a significant improvement in shoulder function.

KIASTM, combined with the Muscle Energy Technique was effective, reducing SPADI scores from 63 to 28.8, with a mean difference of 34.4. And the KIASTM coupled with Maitland Mobilization were from 65.6 to 35.4 with the mean difference of 30.2. Hence, KIASTM combined with Muscle Energy Technique showed greater improvement in SPADI scores compared to KIASTM combined with Maitland Mobilization. There was a significant difference in outcomes between the groups receiving MET and Maitland Mobilization, both coupled with KIASTM.

7. Conclusion

The study aims to explore the effectiveness of KIASTM coupled with Muscle Energy Technique in the treatment of periarthritis of the shoulder to enhance shoulder function by reducing shoulder pain and disability.

In this study, we used KIASTM coupled with Muscle Energy Technique and Maitland Mobilization. The aim of the study is to find the effectiveness of KIASTM with Muscle Energy Technique to enhance shoulder function among periarthritic shoulder

This study concluded that the KIASTM with Muscle Energy Technique in periarthritic shoulder is more effective than KIASTM with Maitland Mobilization in periarthritic shoulder condition.

8. Limitations and Future Recommendations

8.1 Limitations

- This study was limited to a small sample size of 20 subjects.
- Study researches concentrated only in improving shoulder function.
- Short duration of study.
- The long-term retention of training was not studied.
- Only one measurement tool (SPADI) was used for shoulder pain and disability.

8.2 Future Recommendations

- Sample size can be increased.
- Studies can be done with various durations.
- Studies can be done with larger samples.
- Further studies can include other measuring tools.

It is recommended to do the studies with specific age and gender.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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