Immediate Effect of Muscle Energy Technique and Kalternborn Mobilisation Technique on Pain in Diabetic Patients with Periarthritis of Shoulder

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Authors’ contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

ABSTRACT

Background: Periarthritis Shoulder, also known as adhesive capsulitis, is a condition that results in tissue degeneration, thickening of the joint capsule, and a narrowing of the glenoid cavity. Diabetes mellitus is linked to many debilitating musculoskeletal disorders of the hand and shoulder. Prevalence of adhesive capsulitis or frozen shoulder is estimated to be 11-30 percent in people with diabetes. Various interventions have already been used to prevent pain and improve quality of life. Both Muscle Energy Technique and Kalternborn Mobilization Technique are thought to have a pain-relieving effect.

Aim & Objective: The study’s aim is to compare the effects of both techniques on pain in diabetic patients.

Methods/Design: In this study experimental study, the participants will be divided into two groups: Kalternborn Mobilization Technique Group (A) and Muscle Energy Technique Group (B) based on...
inclusion and exclusion criteria. Both interventions include 30-45 min session which will be carried out for duration of four days. Outcome will be Pain and Quality of Life and outcome measures will be evaluated at beginning and at the end of intervention period.

**Result:** Successful Completion of trial of Muscle Energy Technique and Kalternborn Mobilisation Technique will provide evidence for best strategy targeting Pain and quality of life in diabetic patients with Periarthritis of Shoulder.

**Conclusion:** The study will be concluded with the significant effect of Muscle Energy Technique and Kalternborn Mobilisation Technique on Periarthritis shoulder of diabetic patients.

**Keywords:** Kalternborn Mobilization Technique; Muscle Energy Technique; pain; quality of life; diabetic population.

1. **INTRODUCTION**

Periarthritis Shoulder, also known as adhesive capsulitis, is a condition that results in tissue degeneration, thickening of the joint capsule, and a narrowing of the glenoid cavity [1]. It is a common musculoskeletal condition characterized by a painful and progressive restriction of the shoulder joint in a capsular pattern [2]. In 1872, Adhesive capsulitis (AC) was first identified as Periarthritis scapulohumerale, and in 1934, it was renamed Frozen shoulder. (2)Adhesive capsulitis of the shoulder is also known as periarthritis shoulder, frozen shoulder, rigid and painful shoulder, scapulohumeral periarthritis, tendonitis of the short rotators, and adherent subacromial bursitis [3]. The cause of adhesive capsulitis is unknown, while frozen shoulder is divided into two categories: primary (unknown cause) and secondary (known cause, which involves diabetes, depression, thyroid problems, Parkinson's disease, Polymyalgia rheumatica, lung disease, open heart surgery, breast cancer, and cardiovascular disease) adhesive capsulitis [4].

Periarthritis Shoulder includes three stages: First, there’s the early freezing stage (which lasts 2 to 9 months) and includes a progressive loss of range of motion (ROM), increasing discomfort (especially at night), and achy at rest, which is aggravated by arm movements [5]. The second stage is the Frozen Stage (which lasts 4-12 months) during which discomfort reduces, range of motion reduces or ceases entirely, and compensatory movements become visible [5]. Third, the thawing stage (which lasts 4-14 months) entails gradual restoration of mobility and pain relief, with 10-20% of instances affecting the second shoulder within 5 years [5].

Diabetes mellitus is linked to many debilitating musculoskeletal disorders of the hand and shoulder, in addition to micro- and macroangiopathic complications [6]. Shoulder pain is a very prevalent musculoskeletal issue in the general population [7]. The prevalence of one particular pathology, adhesive capsulitis or frozen shoulder, is estimated to be 11-30 percent in people with diabetes and 0-10 percent in people without diabetes [5,8-12], with the highest prevalence found in studies involving patient populations derived from older, more acutely ill patients [8]. The increased occurrence of MSK disorders in DM may be due to connective tissue disorders, neuropathy, vasculopathy, or a combination of these problems [9]. In many shoulder disorders, including Frozen Shoulder, physiotherapy is widely used as a first-line treatment [10]. In such musculoskeletal diseases, physiotherapy modalities and manual approaches are the favoured methods of treatment [11]. Rest/education, analgesia, joint mobilization thermotherapy, massage, corrective exercises and physical therapy, acupuncture, oral and injected corticosteroids, laser therapy, capsular distension, manipulation under anesthesia, nerve blocks, and arthroscopic capsular release are only a few of the remedies for frozen shoulder that have been recommended. To treat pain and muscle guarding, gentle joint mobilisation can be employed to stimulate neurophysiological and mechanical effects [12]. Kalternborn Mobilization is a technique that uses a passive continuous stretch to improve joint mobility without suppressing the articular surface [1]. The forces used to promote joint mobility are categorized into three categories: I–III [1]. Grade I provide a low-intensity distraction with no stress to the joint capsule; it is frequently utilised to ease discomfort. Grade II denotes a power. This type of stimulus is known as “taking up the slack” since it stretches the per articular tissue. Finally, Grade III force provides enough diversion or glide to allow the joint capsule to fully stretch; it is frequently utilised [1]. Muscle energy techniques
are a subset of soft tissue osteopathic (originally) manipulation techniques that include patient-specific, precisely guided and controlled manipulation, as well as patient-initiated isometric and/or isotonic contractions, all aimed at improving musculoskeletal function and pain relief [13]. Muscle energy techniques (MET) extend muscles by combining mechanical and plastic changes in connective tissue. After using muscle energy techniques, biomechanical and neurophysiological mechanisms may cause changes in range of motion and muscle tightness [14].

The SPADI was developed in an outpatient setting to evaluate current shoulder pain and impairment [15]. The SPADI is made up of 13 parts that assess two domains: pain (5 items) and disability (8 items) [15]. The NPRS (numerical pain reading scale) is a pain measurement scale [16]. The 11-point numerical pain rating scale (NPRS) is a scale that allows patients to rate their pain on a scale of 0 (no pain) to 10 (worst possible pain),1–4 and it was developed by the National Institutes of Health [17]. As an indicator of pain severity, it has been shown to be both concurrent and predictive [17].

1.1 Need for Study

As patients are deprived of their everyday life, occupational and leisure interests during the long time of pain and disability due to Periarthritis of Shoulder, several studies have demonstrated that the Kalternborn mobilisation method improves pain alleviation and end range of motion, and several researchers have concluded that the MET improves the internal rotator's range of motion and power. The research never concentrated on the diabetic population with Periarthritis shoulder. Many studies have utilized Kalternborn Mobilisation technique and Muscle Energy Technique in combination with other exercises for management of Periarthritis of Shoulder which showed very beneficial results on pain and range of motion. So, there is a need to study the separate effects of these techniques on shoulder having this condition. As a result, the study's aim is to compare the effects of both techniques on pain in diabetic patients with shoulder Periarthritis.

1.2 Aim

The aim of this study is to compare the effects of MET and Kalternborn Mobilisation techniques on pain in diabetic patients with shoulder Periarthritis.

1.3 Objectives

1. To study the effects of MET on pain in diabetic patients with Periarthritis of shoulder.
2. To study the effects of Kalternborn Mobilisation technique in diabetic patients with Periarthritis of shoulder.
3. To compare the effects of MET and Kalternborn Mobilisation techniques on pain in diabetic patients with shoulder Periarthritis.

1.4 Hypothesis

- Alternate Hypothesis

There will be significant effect of Muscle Energy Technique over Kalternborn mobilisation on pain in Periarthritis Shoulder patients with Diabetes mellitus.

- Null Hypothesis

There will be no significant effect of Muscle Energy Technique over Kalternborn mobilisation on pain in Periarthritis Shoulder patients with diabetes mellitus.

2. METHODOLOGY

2.1 Study Setting

The participants will be recruited from Physiotherapy OPD of Acharya Vinoba Bhave Rural Hospital Sawangi, Meghe, Wardha, Maharashtra.

2.2 Study Design and Sample Size

The design of study is experimental, which will include two different intervention groups of individuals. The participants number, enrolled in the experimental study will be 40 (n = 40). Randomization of participants will be done in a 1:1 ratio, Group A (Kalternborn Mobilisation Technique) and Group B (Muscle Energy Technique) each for the duration of four days. The participants will be informed about the study's goals and methods, and they will sign written patient consent forms. The study comprised diabetic individuals with shoulder periarthritis who satisfied the inclusion and exclusion criteria. Simple random selection will be used to split them into two groups, Group A and Group B. The primary researcher, a physiotherapy final year student, will do the
randomization and distribution. The study procedure is shown in Figure 1 and the schedule of enrolment, screening, assessment, allocation, intervention, post intervention assessment and follow-up of the study.

2.3 Participants

2.3.1 Inclusion Criteria includes
Diabetic patients with Periarthritis of Shoulder, both Genders, Age: Between 45 and 65 years, those who are willing to participate in the study, those who have the ability to understand and obey instructions.

2.3.2 Exclusion Criteria includes
Patients with periarthritis of Shoulder not having Diabetes Mellitus, age less than 45 years and more than 65 years, those with some other unstable cardiovascular disorder as decided by their doctor, those who have a joint or muscular problem other than shoulder periarthritis.

2.3.3 Participant Timeline
Each patient will be expected to complete four days of treatment in order to assess the technique's immediate impact on pain. Before and after treatment, the outcome measures will be registered.

![Fig. 1. Shows the study procedure](image-url)
2.4 Recruitment

The health care practitioners working under DMIMSU are invited to refer the prospective patients to our In-patient department (IPD) and Out-patient department (OPD). The patients who are already undergoing rehabilitation in our IPD and are diagnosed with Periarthritis Shoulder will be systematically assessed for the eligibility in the study as per inclusion and exclusion criteria. After enrolment in the study participants will be randomized in one of the group A or B and accordingly will undergo the rehabilitation program for four days with intermediate assessments. Informed patient consent will be taken before allocation and after explaining the purpose of the study, procedure, prospective benefits and after effects of intervention.

2.5 Implementation

Research coordinator and principal investigator will supervise randomization. Participants will be asked to manually select from the envelope, sealed group allocation for the recruitment into either group.

2.6 Blinding

Tester(s) will be blinded to assign the subjects to the group. To ensure binding, subjects will be mandated not to reveal any details of their treatment to the tester.

2.7 Study Procedure

The 40 participants in the study will be split into two groups: Group A and Group B. Each group will contain 20 participants. Prior to beginning care, pain will be measured using the NPRS and SPADI scales.

After the treatment, the pain will be measured again using the NPRS and SPADI scales.

Group A will be treated with Kalternborn Mobilisation Technique for pain management.

Group B will be treated with Muscle Energy Technique for pain management

Treatment intervention for pain management:

- **Kalternborn Mobilisation Technique**

  Heat the tissues using hot fermentation for 5 to 10 minutes before using this procedure to improve circulation and relax the muscles. Following muscle relaxation, Kalternborn mobilisation Grade I and Grade II distraction are used. The patient will be in supine position with the arm in resting position. The therapist will stand at the patient’s side, facing toward his or her head. Now grade I distraction is applied for 7 to 8 seconds and then a 3 to 4 second rest is given. Now repeat the cycle for 5 times. If pain continues grade II distraction is given in the same way.

- **Muscle Energy Technique**

  Three motions will be targeted:

  i. MET for increasing flexion of the Shoulder Joint: Therapist will stand in front of the patient. For palpation of the movement, one hand will be put on top of the involved shoulder. The other hand will support the flexed elbow and shoulder of the patient in the sagittal plane. For 3 to 5 seconds, the patient will be asked to extend against a 25% resistance applied by the therapist in the flexion direction. Instead of single contraction, series of rapid, low amplitude contractions can also be used. There will be a 2-second rest now. Slack is taken up, and the same action is repeated with the therapist adding resistance. The procedure is repeated three times.

  ii. MET for increasing Extension of the Shoulder joint: Therapist will stand in front of the patient. For palpation of the movement, one hand will be put on top of the involved shoulder. The other hand will support the patient’s flexed elbow and shoulder. Now patient will flex the shoulder while therapist is applying 25% resistance in the extension direction for 3 to 5 sec. Now rest is given for 2 sec and slack is taken up. Now the technique is repeated for 3 times.

  iii. MET for increasing Shoulder Abduction: Therapist will stand in front of the patient. One hand will be placed on top of the shoulder. The other hand will support the patient’s flexed elbow and flexed shoulder. Now the patient can perform 3 to 5 seconds of adduction against 25% resistance applied by the therapist. Slack is now taken up after a 2-second pause. The procedure is now repeated three times.
**Outcome Measures**

i. **Numerical pain rating scale**

This scale is a unidimensional measure of pain intensity. The scale has been validated several times. The 11-item NPRS scale is the most widely used among them. It ranges from 0 to 10, with 0 denoting no pain and 10 denoting the most excruciating pain imaginable. For self-completion, it can be used verbally or graphically. It is a valid and reliable scale for pain intensity.

ii. **Shoulder Pain and Disability Index**

It is a two-dimensional self-administered questionnaire the pain dimension is made up of five questions about the severity of a person’s pain. Eight questions are used to determine functional tasks. A patient will complete the scale in 5 to 10 minutes. It is reliable and valid region-specific scale for the shoulder.

**2.8 Data Collection and Management**

**2.8.1 Data collection**

Information about study given at time of recruitment (elaborating the purpose, nature, procedure, benefits and after effects of the intervention) with all baseline tests and assessment will be repeated after the session. 1st – Before the intervention 2nd – After the session.

Data will be collected in designed database and Primary Investigator will supervised study and make sure the accuracy, precision, authenticity of data and safety of participants. All the data (hard copies of assessment forms, signed consent forms, etc.) will be stored securely in the study setting. The administrator access rights will lie with the principal investigators (PI).

**2.8.2 Data Management**

Under the supervision of the chief investigators, data will be collected and reported. The consistency of the research documentation will be thoroughly examined. At the conclusion of the study, an allocation blinded statistician will be given the Excel spreadsheet to conduct the necessary analysis, after which the groups will be unblinded. The trial's data will be held in a safe, locked storage area with limited access for later review by a biostatistician and the principal investigator. Checklists are used to prevent data loss due to insufficient staff procedures.

**2.9 Statistical Analysis**

The SPSS 27.0 U version will be used to perform statistical analyses. The group impact will be compared using analysis of variance (ANOVA). Individual studies will be checked for homogeneity of the two study groups using the student’s examination. Both statistical tests should be conducted with a 95 percent confidence interval to assess the effect of two measures (p-value 0.05). Mann-Whitney test U will be used to compare Groups at the start of the study.

**2.10 Bias**

Measures will be taken to prevent this from happening attrition bias by giving reminder calls prior to each intervention and by providing travel assistance to those who need it. So, we expect a low percentage of dropouts.

**3. RESULT**

Successful completion of this study will provide evidence on the best treatment strategy out of MET and Kalternborn Mobilisation Technique for diabetic patients with Periarthritis Shoulder to improve their pain and quality of life and result of this study will lead us to better understanding on both treatments. Once the study result is complete data will be analysed using paired t-test and will be submitted in form of research paper.

**4. DISCUSSION**

Periarthritis Shoulder is a clinical condition in which there is painful restriction in both active and passive movements of the shoulder due to any pathology in the shoulder joint. Patients are deprived of their everyday life, occupational and leisure interests during this long time of pain and disability. The aim of this study is to compare the effects of MET and Kalternborn Mobilisation techniques on pain in diabetic patients with shoulder periarthritis. According to empirical research, certain physical therapy methods and modalities are strongly recommended for pain relief, increased ROM, and functional status in adhesive capsulitis patients, while others are...
The efficacy of one therapy approach vs another, on the other hand, is debatable [18]. In patients with adhesive capsulitis, both traditional physiotherapy and MET combined with traditional physiotherapy are effective in relieving pain, improving range of motion, and improving functional capability, but the group that received MET combined with traditional physiotherapy was found to be more effective in relieving pain, improving range of motion, and improving functional capability [19]. In frozen shoulder patients, the posterior Maitland and Kalternborn mobilisation procedures are useful in relieving discomfort and range of motion. As a result, both methods are recommended for such patients [1]. There have been several studies comparing different methods for treating periarthritis shoulder. The research never concentrated on the diabetic population with periarthritis shoulder. Both Muscle Energy Technique and Kalternborn Mobilisation Technique are thought to have a pain-relieving effect, although there isn’t enough data to say which technique is more effective than the other. As a result, our study aims to compare the effects of both techniques on pain in diabetic patients with shoulder periarthritis. Outcome measures will assess efficacy of intervention and successful completion of trial will provide evidence for best strategy (detailed and effective) targeting pain in diabetic patients with periarthritis of shoulder.

**GROUP A PATIENTS TREATMENT PLAN:**
**KALTERNBORN MOBILISATION TECHNIQUE**

- Heat the tissues using hot fermentation for 5 to 10 minutes.
- Kalternborn mobilisation Grade I and Grade II distraction are used.
- Grade I, II distraction is applied for 7 to 8 sec and then a 3 to 4 sec rest is given.
- Repeat the cycle 5 times

**GROUP B PATIENTS TREATMENT PLAN:**
**MUSCLE ENERGY TECHNIQUE**

- Three motions will be targeted:
- MET is given for increasing flexion, extension and abduction range.
- For each movement patient has to perform the movement as explained by therapist against 25% resistance provided by the therapist for 3 to 5 sec
- Now a rest is given for 2 sec
- The procedure is repeated 3 times

**Fig. 2. Muscle energy technique**
5. CONCLUSION

The study will be concluded with the significant effect of Muscle Energy Technique and Kalternborn Mobilisation Technique on Periarthritis shoulder of diabetic patients.

CONFIDENTIALITY

The study program will be explained to the participant, the principal investigator will take subjective information. The consent form will include the confidentiality statement and signatures of the principal investigator, patient and a witness. If required to disclose some information for the study, consent will be taken from the patient with complete assurance of his confidentiality.

CONSENT

Principal Investigators will obtain the written informed consent from the participant on a printed form (local language) with signatures and give the proof of confidentiality.

ETHICAL APPROVAL

The study is getting approval from Institutional Ethics Committee of Datta Meghe Institute of Medical Sciences, Deemed to be University, The participant individuals of the study and DMIMSU who will fund it will be able to retrieve findings of study. En rolled subject's data will be stored securely for at least 5 years. After completion of study and publication of results data will be stored in the DMIMSU data repository.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

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