

A COMPARATIVE STUDY BETWEEN THE EFFECTIVENESS OF MUSCLE ENERGY TECHNIQUES AND KNEE STRENGTHENING EXERCISES IN REDUCING PAIN TO IMPROVE FUNCTIONAL ACTIVITY IN PATIENTS WITH KNEE OSTEOARTHRITIS

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Abstract: Background: Knee osteoarthritis (OA) is a degenerative joint disorder characterized by progressive cartilage degeneration, joint pain, stiffness, and functional limitation. It affects millions Worldwide, with a significant impact on quality of life and healthcare system. The prevalence rate of OA in both rural and urban India was ranging from 33% to 46%

Objectives: To compare the effectiveness of muscle energy technique and knee strengthening exercise in reducing pain to improve range of motion in knee osteoarthritis

Methodology: The experimental study was conducted in patients with features of knee osteoarthritis, 30 patients (45-60 years) was selected for this study consideration of the inclusion and exclusion criteria. the participants were divided into two group A and B. Group A: 15 patients treated with muscle energy techniques with in paraffin wax bath therapy was given for 5 sessions a week and continued for 4 weeks. Group B: patients treated with knee strengthening exercise with in paraffin wax bath therapy was given for 5 session a week and continued for 4 weeks. The outcome measure selected were pain and ROM. Pain was assessed through KOOS (Knee injury and osteoarthritis outcomes score), WOMAC (Western Ontario and McMaster universities osteoarthritis index) and range of motion measured by Goniometry.

Result: The subject who were supervised to attend all the sessions were shown a different in their ROM, WOMAC, KOOS score and reduce pain improve functional activity and range of motion.

Conclusion: Knee strengthening exercise is more effective than muscle energy techniques in reducing pain improve functional activity in knee osteoarthritis.

Keywords: Knee osteoarthritis, Muscle energy techniques, Strengthening exercise, Paraffin wax bath therapy, Pain management, Functional activity, Range of motion (ROM).

1. INTRODUCTION

The name osteoarthritis was introduced in the mid-nineteenth century by surgeon Richard and Vokkmann who distinguished it from rheumatoid arthritis and gout. In the early twentieth century, the Garrads and Hermann senators assumed that osteoarthritis was a whole joint disease and that inflammation plays an important role in disease and central nervous system dysfunction leading to whole joint damage and disease progress by pain and disability.

World Health Organisation reports it as the fourth and eighth most common cause of disability in women and men respectively.

Worldwide, osteoarthritis affects more than 250 million people, over the age of 50 years, commonly affecting women than men. Osteoarthritis is defined as a degenerative non-inflammation joint disease characterized by the destruction of articular cartilage and the function of new bone at the joint surface and margins. (OA can also be called O-old age, A-Arthritis), Osteoarthritis can be classified into two types primary and secondary osteoarthritis.

The knee is the largest and most complex joint of the body. The complexity is the result of fusion of three joints in one. It is formed by fusion of the lateral tibiofemoral, medial tibiofemoral and patellofemoral joints.

The strength of your muscles, your ability to manage your muscle, your fitness can all be enhanced by a good training regimen. Since their decreased physical activity and pain tolerance have left their muscles weaker, patients with knee OA frequently need to do strengthening activity.

Muscle energy techniques (MET) is a type of osteopathic manipulative medicine commonly developed by FRED MITCHELL, SR, D.O IN 1948 designed to improve musculoskeletal function through mobilizing joint and stretching tight muscle and fascia, to reduce pain, and to improve circulation and lymphatics flow.

Paraffin wax bath therapy is an application of molten paraffin wax over the body parts. The temperature of the paraffin wax is maintained at 40-44°C, where its melting points is 51-55°C.

OBJECTIVE OF THE STUDY:

To determine the effects of Muscle energy techniques to increase the knee range of motion.

To determine the effects of knee strengthening exercise can significantly reduce pain and improve function in individuals with osteoarthritis.

To determine the effects of Muscle energy techniques and knee strengthening exercise which can reduce pain and improve functional activity in patients with knee osteoarthritis.

2. REVIEW OF LITERATURE

XIAOQING DING, YI YANG, et al (2024) The studies should explore optimal mixed strengthening exercise programs and conduct comprehensive dose-response analyses to further refine KOA treatment strategies and improve patient care.

KUNAL PATOWARY, SHIPRA SHARMA, ESHA SHARMA, et al (2024) The current study's findings showed that individuals with knee OA who participated in the Muscle Energy Technique (MET) group had greater quadriceps strength and hamstring flexibility.

SUSHMITHA A, GEETHA B. SHETTY, et al (2020) The study results indicate that both hot mustard application and wax therapy can be considered as effective treatments in patients with osteoarthritis of knee for the management of pain.

AM IMOTO, MS PECCIN, VFM TREVISANI, et al (2012) The study shows that quadriceps strengthening exercises included in a rehabilitation program are effective in the improvement of pain, function and quality of life aspects of patients with knee osteoarthritis.

KRISNA YUARNO PHATAMA, MD, ABDUL AZIZ, et al (2021) The Indonesian version of the KOOS was determined to be valid and reliable and is therefore an objective instrument for evaluating knee ligament injury and knee osteoarthritis in the Indonesian population.

STUDY DESIGN:

This study was designed as an experimental study conducted in the Physiotherapy Outpatient Department of Adhiparasakthi College of Physiotherapy located in Melmaruvathur. A convenient sampling method was employed to select participants. The data collection was carried out over a period of four weeks with five sessions per week.

INCLUSION CRITERIA:

Both male and female, Mild to moderate knee osteoarthritis, Kellgren and Lawrence scale (Grade 2 and 3), Age group between 45-60 years, Unilateral or bilateral involvement of osteoarthritis.

EXCLUSION CRITERIA:

Fracture around the knee joint, Cardiovascular disease, Renal condition patients, Malignancy or tumor around the knee joint

3. METHODOLOGY

A total of 30 subjects were chosen from APCOPT and assigned to two groups, namely Muscle energy technique with paraffin wax bath therapy (n=15) and the Knee strengthening exercises with paraffin wax bath therapy (n=15), based on inclusion and exclusion criteria.

KOOS (Knee injury and osteoarthritis outcome score), WOMAC (Western Ontario and McMaster universities osteoarthritis index) and, Range of motion were taken as a outcome measure.

TREATMENT TECHNIQUE:

Muscle energy technique with paraffin wax bath therapy

Knee strengthening exercises with paraffin wax bath therapy

1. Muscle Energy Technique

This technique is divided into two types

A) Post Isometric Relaxation

B) Reciprocal Inhibition

A) Post Isometric Relaxation (PIR)

The subject will be supine with their hips 90 degrees flexed. The individual will be instructed to flex their knee with 20% more force. The quadriceps, the agonist muscle, will experience resistance for 5 seconds during the contraction. With a 5-second rest interval in between each set, there will be 3 sets of 10 repetitions each.

B) Reciprocal Inhibition

The subject will be positioned in the same 90-degree supine position. The individual will be instructed to flex their knee with 20% more force. While resistance is being given to the quadriceps, the contraction will be sustained for 5 seconds. With a 5-second rest interval in between each set, there will be 3 sets of 10 repetitions each.

2. KNEE STRENGTHENING EXERCISE

All the exercises should be repeated for ten times. Both groups are equally received wax bath and flexibility exercise to knee joint. Stretches hold on 30 sec for 3 times

1) ISOMETRIC QUADRICEPS EXERCISE

Patient position: supine lying

Position of therapist: standing at side of patient

Procedure: The patient will perform this exercise while lying supine with the affected leg straightened and the unaffected leg bent. A towel will be put below the knee and pressure.

2) ISOMETRIC HAMSTRING EXERCISE

Patient position: supine lying

Position of therapist: standing at side of patient

Procedure: The patient will perform this exercise while lying supine with the affected leg straightened and the unaffected leg bent. A towel will be put below the ankle and pressure.

3) STRAIGHT LEG RAISE

Patient position: supine lying

Position of therapist: standing at side of patient

Procedure: Ask the patient slowly raise the affected leg keep the knee is straight and lift the leg up to 45. Then slowly the leg back to floor.

4) PILLOW SQUISH EXERCISE

Patient position: crook lying

Position of therapist: standing at side of patient

Procedure: Ask the patient to place a pillow between the knees and squish the pillow by squeezing your knees together.

OUTCOME MEASURES:

WOMAC: The Western Ontario and McMaster Universities Arthritis Index is used to assess patients with OA knee. This scale includes the measurements of the levels of functional mobility and pain levels of the participants based on their subjective ratings out from 0-4.

WOMAC INDEX: pain, joint stiffness and, degree of difficulty in accomplishing daily life activities. (28) The pain subscale includes five questions about pain, the stiffness subscale includes two questions about stiffness; and, the physical function subscale includes 17 questions about the degree of difficulty in accomplishing activities of daily living.

KOOS: Knee Injury and Osteoarthritis Outcome Score (KOOS). A self-report questionnaire known as the Knee Injury and Osteoarthritis Outcome Score

(KOOS) evaluates five outcomes: daily activities, sport and recreation function, pain, symptoms, and knee-related quality of life. It can be calculated in percentages, with 100 signifying no problems and 0 signifying severe problems.

KOOS INDEX: The KOOS's five patient-relevant dimensions are scored separately: Pain (nine items); Symptoms (seven items); ADL Function (17 items); Sport and Recreation Function (five items); Quality of Life (four items). A Likert scale is used and all items have five possible answer options scored from 0 (No problems) to 4 (Extreme problems) and each of the five scores is calculated as the sum of the items included.

ROM (UNIVERSAL GONIOMETER); The Universal goniometer (or international standard goniometer) is the most commonly used tool for measuring range of motion at larger joints such as knee.

4. RESULT

Data analysis was performed using statistical software SPSS v26.0 applying paired sample t tests to compare pre and post intervention outcomes within both groups. Group A (treated with Muscle energy technique) and Group B (Knee strengthening exercises). For outcomes, ROM, WOMAC and KOOS was used.

Changes in GONIOMETER of the participants the mean \pm standard deviation of Group A in pre-test and post-test is 10.933 ± 5.81214 , and paired difference is 14.15199 ± 7.71468 . The mean \pm standard deviation of Group B in pre-test and post-test is 19.800 ± 5.906 , and paired difference is 23.07086 ± 16.52914 .

The mean \pm standard deviation of Group A and B pre-test in independent sample test is 80.600 ± 9.37169 and 79.1333 ± 9.28799 , then post-test is 91.5333 ± 11.99921 and 98.9333 ± 7.84189 .

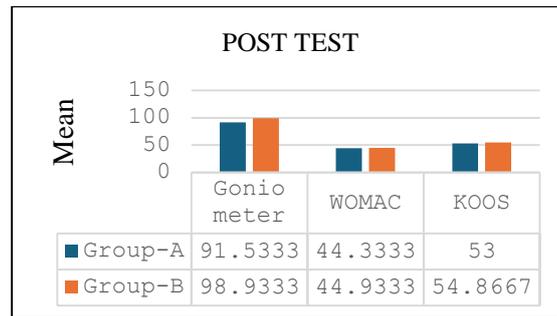
Changes in WOMAC of the participants the mean \pm standard deviation of Group A in pre-test is 48.3333 ± 11.59844 , in post-test is 44.3333 ± 11.59844 and paired difference is 0. The mean \pm standard deviation of Group B in pre-test is 52.9333 ± 18.26185 , in post-test is 44.9333 ± 18.26185 and paired difference is 0.

The mean \pm standard deviation of Group A and B pre-test in independent sample test is 48.3333 ± 11.59844 and 52.9333 ± 18.26185 , then post-test is 44.3333 ± 11.59844 and 44.9333 ± 18.26185 .

Changes in KOOS of the participants

The mean \pm standard deviation of Group A in pre-test is 49.0000 ± 11.45800 , in post-test is 53.0000 ± 11.45800 and paired difference is 0. The mean \pm standard deviation of Group B in pre-test is 46.8667 ± 10.44623 , in post-test is 54.8667 ± 10.44623 and paired difference is 0.

The mean ± standard deviation of Group A and B pre-test in independent sample test is 49.0000 ± 11.45800 and 46.8667 ± 10.44623 , then post-test is 53.0000 ± 11.45800 and 54.8667 ± 10.44623 .



5. DISCUSSION

30 samples knee osteoarthritis were included in this study to find out and compare the effectiveness of Muscle Energy Technique and Knee strengthening exercises to reduce pain and enhance improve functional activity. The purpose of this study is to analyze the effects of Muscle Energy Technique and Knee strengthening exercises to reduce pain among knee osteoarthritis. This study has done the treatment technique for 4 weeks. 30 samples were divided into 2 groups each consists of 15 participants. Group A Muscle Energy Technique (15) and Group B Knee strengthening exercises (15). These two techniques give good result in reducing pain.

6. CONCLUSION

From the results and statistical analysis, this study concluded that knee strengthening exercises is more effective than muscle energy technique in pain reduction and improves the functional activity, range of motion in knee osteoarthritis.

LIMITATIONS:

The limitations of the study were conducted on a small sample size, Duration of the study was less, this study was conducted only with particular age group.

SUGGESTIONS:

Long term follow up is needed to evaluate whether there occurs any sustained or carry over effect after treatment to establish greater efficacy of the treatment, the study should be undertaken in large scale, for more reliability and validity, the long-term study must be carried out.

REFERENCES

- [1] Ding X, Yang Y, Xing Y, Jia Q, Liu Q, Zhang J. Efficacy of lower limb strengthening exercises based on different muscle contraction characteristics for knee osteoarthritis: a systematic review and network meta-analysis. *Frontiers in Medicine*. 2024 Sep 25; 11:1442683.
- [2] Patowary K, Sharma S, Sharma E. the effectiveness of muscle energy techniques (met) on muscle strength and flexibility in patients with knee osteoarthritis—a.
- [3] Gandek B, Roos EM, Franklin PD, Ware Jr JE. A 12-item short form of the Knee injury and Osteoarthritis Outcome Score (KOOS-12): tests of reliability, validity and responsiveness. *Osteoarthritis and cartilage*. 2019 May 1;27(5):762-70.
- [4] Textbook of Orthopaedics - John ebnezar 5th edition.
- [5] Essential of Orthopaedics and Applied Physiotherapy - Jayant joshi 3rd edition.
- [6] M. v. Natarajan, Natarajan's Textbook of orthopaedics and traumatology
- [7] B.D. Chaurasia's Human Anatomy (volume 2) 7th edition Anatomy of the lower limb.
- [8] Joint Structure and Function, 5th edition (Cynthia C. Norkin).
- [9] Therapeutic Exercise Foundations and Techniques, Carolyn Kisner, Lynn Allen Colby, 4th edition.
- [10] Orthopaedic assessment-David magee, 6th edition.