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EFFECTIVENESS OF CRYOTHERAPY FOLLOWED BY MUSCLE ENERGY TECHNIQUE IN POST OPERATIVE KNEE STIFFNESS PATIENT

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ABSTRACT

Introduction: Post-Operative knee stiffness is a common condition after any specific knee surgery. In this condition there is stiffness of knee joint causes pain, reduced knee range of motion and its affect on quality of life of individual. There are various therapeutic options available for the condition like stretching exercise, isometric exercise, strengthening exercise. Another therapeutic option is cryotherapy which is effective to reduce pain, inflammation. Manual therapies like muscle energy technique help to restore joint range of motion. **Methodology:** Interventional study conducted on 30 post-operative knee stiffness patients, participants age ranged from 20-40 yrs with all genders included in this study. Conventional physiotherapy intervention applied on 15 participants that was group A, which include hot moist pack , isometric exercise, strengthening exercise, and stretching exercise and group B was recived conventional physiotherapy along with muscle energy technique followed by icing which was experimental group and 15 participants included in group B, all participants were evaluated by pre and post treatment by Visual analogue scale (VAS) to calculate pain intensity , Lower extremity functional scale (LEFS) to measure quality of life of individual, universal goniometer to measure range of motion of joint. **Result:** This study showed that, the post-treatment results showed significantly better outcomes in the group B. Pain levels (VAS) reduced to (4.2 ± 1.08) in group B compared to group A (5.39 ± 1.16) ($p < 0.001$). Functional improvement (LEFS) was greater in the group B (65.13 ± 7.76) than in the group A (41.2 ± 7.61, $p < 0.001$). Flexion range increased to (102.47° ± 12.38°) in group B than (77.67° ± 13.23°) in group A, and extension improved to (1.73° ± 1.10°) in group B than (3.67° ± 1.84°) in group A ($p = 0.002$). **Conclusion:** The study concludes that the experimental group receiving Muscle Energy Technique followed by icing showed significantly better outcomes than the conventional group. Pain levels were lower, functional ability improved, and range of motion increased in both flexion and extension. These results suggest the experimental approach is more effective for managing post-operative knee stiffness.

INTRODUCTION

The main causes of knee stiffness is restricted range, because of scarring adhesions in the quadriceps-femoral apparatus and intra- and extra-articular fibrosis. Post-operative knee stiffness can be caused by total knee arthroplasty, anterior cruciate ligament (ACL) reconstruction, and arthrofibrosis of the knee. Other musculoskeletal traumas that affect the knee joint include burns, patellar tendon repair, and knee arthrotomy.[1] immobilization of the knee can lead to a variety of issues, including altered range of motion, decreased functional ability, a lower quality of life because of limited activities of daily living, knee instability, pain, decreased strength and flexibility, poor balance, abnormal gait when walking, and altered proprioception.[1]

Risk factor for developing postoperative knee stiffness is compromised preoperative ROM, Osteoarthritis or post traumatic arthritis. Etiological factors such as infection, Arthrofibrosis, Complex Regional Pain Syndrome, Associated Diseases, Heterotopic Ossification etc. [2]

The prevalence of stiffness after TKA was 6.1%. [3] according to a European study that gathered samples from 21 countries. The study also revealed that the number of TKA procedures recently increased to 109/100,000 persons, more than doubling the numbers reported in 1998. As a result, immobilization of the knee following surgery can lead to a variety of issues, including altered range of motion, decreased functional ability, poor quality of life because of limited activities of daily living, knee instability, pain,

decreased strength and flexibility, poor balance, abnormal walking gait, and altered proprioception. [4]

There are a number of widely used techniques for treating post-operative knee stiffness[4] Some preventive measures like, neuromuscular electrical stimulation can be used both before and after surgery to increase quadriceps muscle strength following total knee replacement.

Continuous passive motion (CPM) involves passively moving the knee joint through a predetermined intended arc of motion using an external motorized device. And hydrotherapy demonstrated better functional outcomes, including a reduction in pain, stiffness, and functional deficits.[4]

For improve the knee range of motion Give the patient instructions to lie supine on the plinth to enhance knee extension, confirm that the height of the brace is low enough to achieve the maximum 0° knee extension. Give the patient instructions to stay in a prone lying position with a cushion under their stomach and a towel wrapped around their shoulder and ankle for comfort in order to increase knee flexion.

After orthopedic surgery, including total knee arthroplasty (TKA), cryotherapy is a common and advised nonpharmacological option. The external, superficial administration of cold fluids to the skin surrounding the knee joint is what TKA entails. By lowering the joint's internal temperature, this method slows nerve conduction velocity and may even prevent pain signals from being transmitted, it lessens peripheral blood flow brought on by vasoconstriction, which lowers local edema and inflammation. patients with arthrogenic muscle inhibition, which is frequently seen following total knee arthroplasty surgery, benefit from improved quadriceps activation when the knee joint's temperature is lowered. This enhances the knee joint's active range of motion.[5]

Muscle Energy technique is manual therapy methode, which allows the physiotherapist to exert corrective force without having any control over it. In which individual produce focused voluntary contractions of different intensities. There is three types of muscle contractions that should be performed in MET. isometric, concentric, and eccentric. Consequently, it is a manual therapy to restore the reduced range of motion in any articulation. Through the stimulation of regular muscular movements, this approach can alleviate muscle weakness or contracture and minimise localised oedema. MET reduces sympathetic tone by stimulating the fascia and causing localised vasodilation. The patient can then contract the muscle isometrically and then release the contracted muscle post-isometrically. Moreover, MET causes a reciprocal agonist muscle failure. A physiological neuro-reaction involving Golgi tendon organs is the cause of this behaviour. Furthermore, when the force of a therapist surpasses or partially equals a patient's effort, patient can cause movement by executing an isotonic eccentric contraction or concentric contraction In order to promote muscle stretching, strengthening, and relaxation. MET is a "hands-on" therapy, It is a rehabilitative treatment approach for general pain that aims to lessen discomfort and restore normal joint mobility.[6]

METHODOLOGY

MATERIALS – Data collection sheet, consent form, goniometer, pen, paper, pencile

An Interventional analytical study conducted on post-operative knee stiffness patient

at physiotherapy OPD, Krishna Hospital Karad with Sample size 30

Inclusion - individuals diagnosed with post-operative knee stiffness, individuals with age group 20-40 yrs, individuals with all genders.

Exclusion – individuals with recent history of knee trauma, injuries, infection malignancies, knee instability.

Outcome measures – Visual analogue scale, Goniometer, Lower extremity functional scale (LEFS)

PROCEDURE - The patients came to Krishna hospital physiotherapy OPD post operatively. Here they were clinically diagnosed as post operative knee stiffness after taking careful assessment by physiotherapist. There were total 30 subjects. Each of the subjects was screened as per inclusion and exclusion criteria and they were briefed about study and intervention. Informed consent was taken from the subjects. Initial through musculoskeletal assessment of each subject was taken as per data collection sheet. VAS and GONIOMETRY was taken pre and post interventionally. LEFS was carried out first week and last week. A total number of subjects are 30. They were divided into two groups, group A and B by randomised control methode. For group A was given only conventional physiotherapy regimen and for group B was given conventional methode with cryotherapy and muscle energy technique. After treatment post outcome assessment was taken and scores were noted.

Treatment protocol

Conventional protocol (Group A)

Hot moist pack, isometric exercise, (static hamstrigs, static quadriceps), strengthening exercise (SLR hold , VMO strengthening exercise) , stretching exercise (hamstring , TA stretch)

Experimental protocol (Group B)

Conventional protocol + muscle energy technique followed by icing

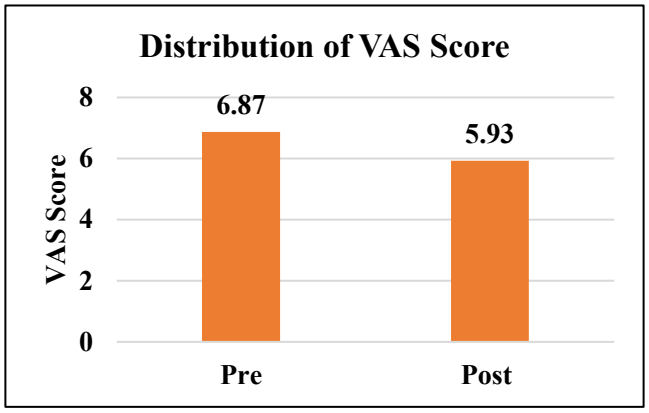
RESULT

Group A

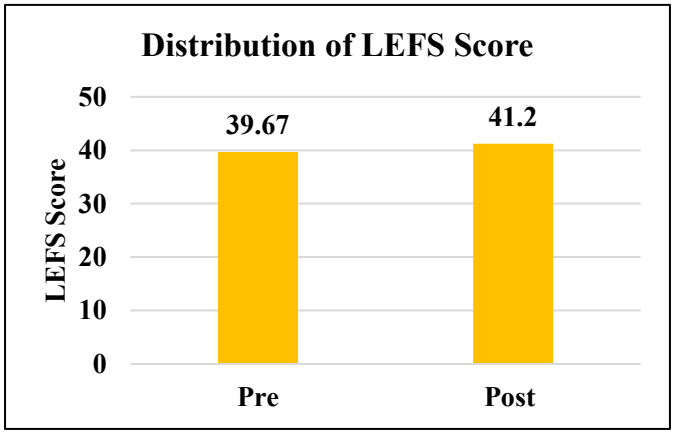
Conventional group

Conventional Group				
Variable		**Pre**	**Post**	**p-value**
VAS		6.87 ± 1.06	5.93 ± 1.16	<0.001*
LEFS		39.67 ± 8.66	41.2 ± 7.61	0.013*
Goniometer	**Flexion**	74.07 ± 13.78	77.67 ± 13.23	<0.001*
	Extension	5.47 ± 1.92	3.67 ± 1.84	0.004*

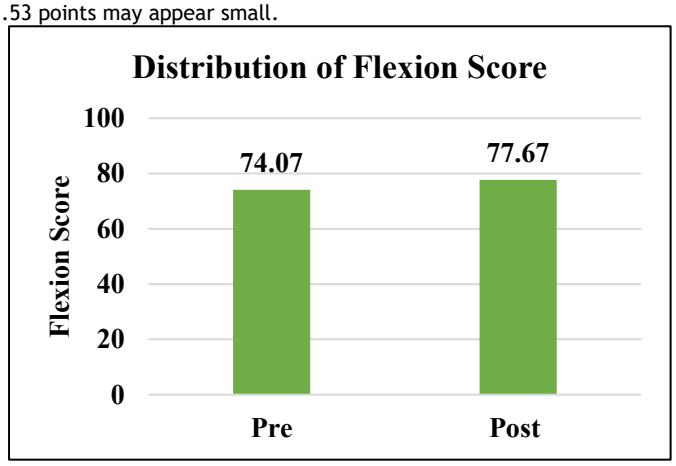
In the conventional group, significant improvements were observed post-treatment. Pain levels (VAS) decreased from 6.87 to 5.93 ($p < 0.001$), indicating effective pain relief. Functional ability (LEFS) improved from 39.67 to 41.2 ($p = 0.013$), reflecting better lower limb performance. Knee flexion increased from 74.07° to 77.67° ($p < 0.001$), and extension improved from 5.47° to 3.67° ($p = 0.004$), showing enhanced joint mobility. Overall, conventional physiotherapy effectively reduced pain and improved function and knee range of motion.



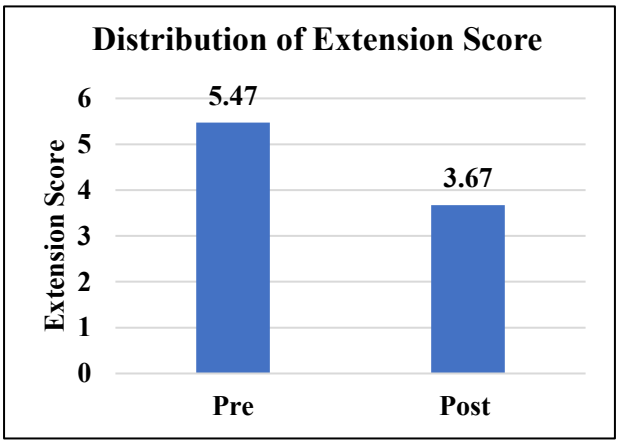
There was a **statistically significant reduction in pain** levels after treatment ($p < 0.001$). The decrease in VAS from 6.87 to 5.93



There was a significant improvement in lower limb function ($p = 0.013$). Although the mean increase of approximately 1.53 points may appear small.



A statistically significant improvement in knee flexion range was observed ($p < 0.001$), with an increase of about 3.6 degrees. This reflects a positive functional gain in knee mobility due to the intervention.

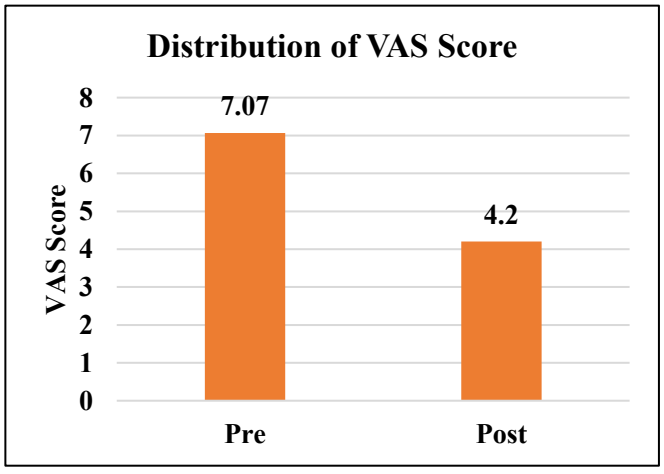


A significant improvement in knee extension was noted ($p = 0.004$), with a decrease in the extension deficit by approximately 1.8 degrees. This suggests that the knee was able to extend more fully post-treatment.

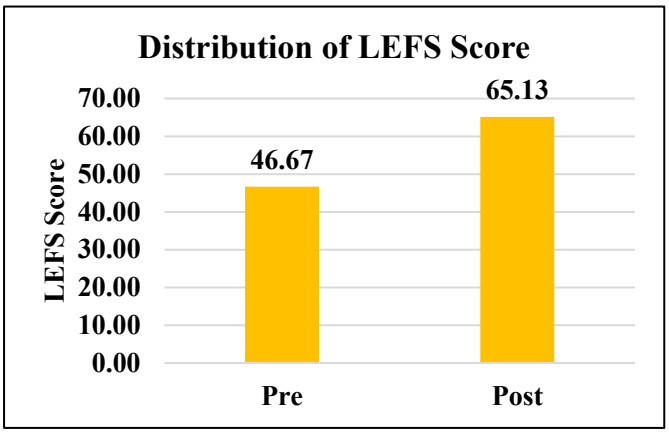
Group B

Experimental Group				
Variable		**Pre**	**Post**	**p-value**
VAS		**7.07 ± 0.96**	**4.20 ± 1.08**	**<0.001***
LEFS		46.67 ± 11.18	65.13 ± 7.76	<0.001*
Goniometer	**Flexion**	65.60 ± 20.38	102.47 ± 12.38	<0.001*
	Extension	5.47 ± 1.41	7.73 ± 1.10	<0.001*

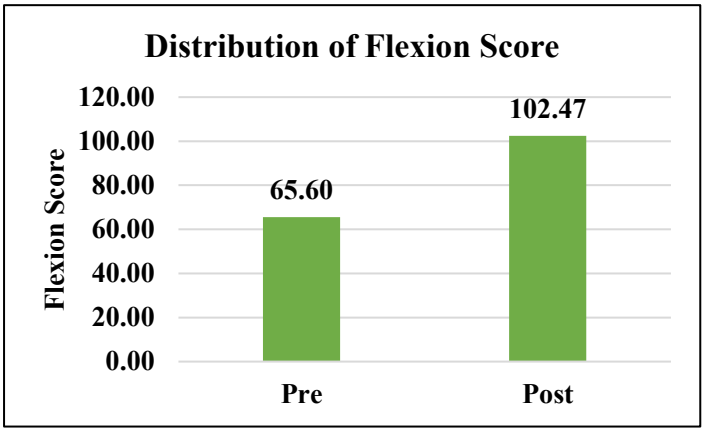
In the experimental group, highly significant improvements were noted post-treatment. Pain levels (VAS) reduced markedly from 7.07 to 4.20 ($p < 0.001$), indicating strong analgesic effects. Functional ability (LEFS) increased substantially from 46.67 to 65.13 ($p < 0.001$), showing enhanced mobility. Knee flexion improved dramatically from 65.60° to 102.47° ($p < 0.001$), and extension increased from 5.47° to 7.73° ($p < 0.001$), reflecting greater joint range. Overall, the experimental approach was highly effective in improving pain, function, and knee mobility.



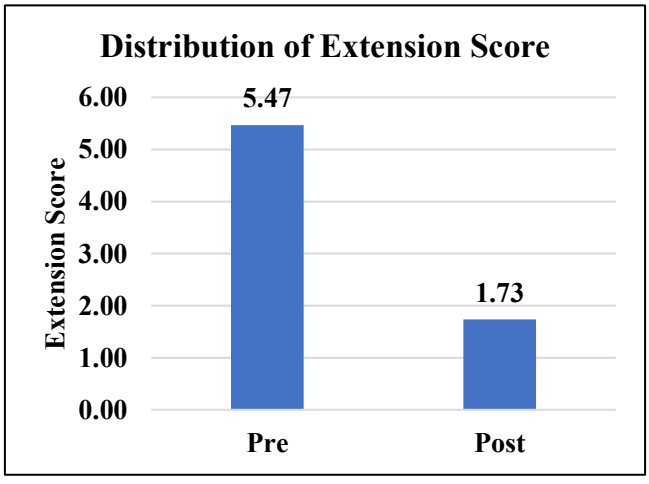
There was a highly significant reduction in pain intensity after the intervention, as shown by the VAS score dropping from 7.07 to 4.20. The p-value < 0.001 confirms this change is statistically significant. The mean reduction of nearly 2.87 points indicates that the experimental treatment (likely Muscle Energy Technique followed by Icing) was very effective in relieving post-operative knee pain.



The LEFS score increased significantly from 46.67 to 65.13, with a large gain of nearly 18.5 points, which indicates marked improvement in functional ability of the lower limb. The low p-value (<0.001) means this improvement is highly significant and unlikely due to chance. This suggests that participants were able to perform more daily activities and movements involving the knee joint with greater ease and reduced limitation after the intervention.



Knee flexion showed a substantial improvement from 65.60° to 102.47°, which is an increase of nearly 37 degrees. This large gain reflects a major enhancement in joint mobility and flexibility following the experimental treatment. The improvement was statistically significant, as indicated by the p-value < 0.001. Such improvement is especially important for post-operative patients, as it indicates the intervention helped restore functional range in the knee joint.



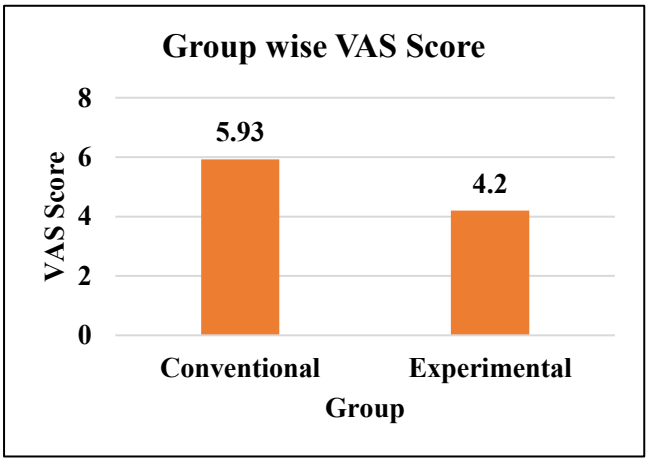
Here, the extension range increased from 5.47° to 7.73°, suggesting the knee could extend further after the intervention. Note that depending on your method of measurement, this could reflect either reduced extension lag.

Group wise result

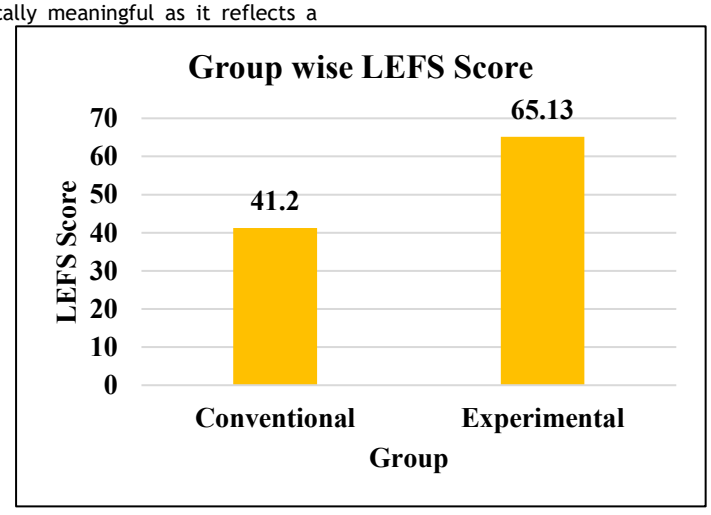
Variable	Conventional Group	Experimental Group	p-value
VAS	5.39 ± 1.16	4.2 ± 1.08	<0.001*

LEFS		41.2 ± 7.61	65.13 ± 7.76	<0.001*
Goniometer	**Flexion**	77.67 ± 13.23	102.47 ± 12.38	<0.001*
	Extension	3.67 ± 1.84	1.73 ± 1.10	0.002*

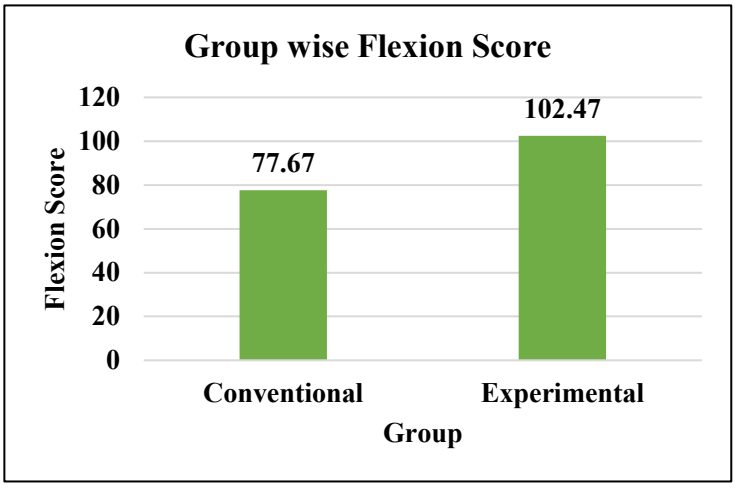
Post-treatment comparisons showed significantly better outcomes in the experimental group. Pain (VAS) reduced more in the experimental group (4.2 ± 1.08) than in the conventional group (5.39 ± 1.16), with $p < 0.001$. Functional improvement (LEFS) was greater in the experimental group (65.13 ± 7.76) versus the conventional group (41.2 ± 7.61). Knee flexion improved significantly (102.47° vs. 77.67°, $p < 0.001$) and extension was better (1.73° vs. 3.67°, $p = 0.002$), indicating superior outcomes in the experimental group.



Pain levels significantly decreased in both groups, but the experimental group had lower post-treatment pain scores. The mean VAS score in the conventional group was 5.39, while in the experimental group it was 4.20, showing a mean difference of 1.19 points. This difference is clinically meaningful as it reflects a better pain reduction outcome in the experimental group. The p-value of <0.001 confirms that this difference is highly statistically significant, indicating the experimental treatment provided superior pain relief compared to conventional physiotherapy.

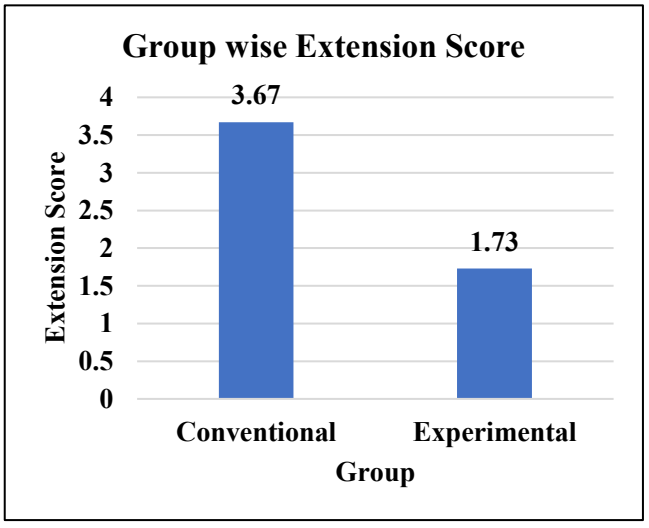


Post-intervention functional ability was much higher in the experimental group. The mean LEFS score in the conventional group was 41.2, while in the experimental group was 65.13. The difference of 23.93 points is clinically significant, reflecting much better recovery of daily functional activities like walking, climbing stairs, or standing. A p-value of <0.001 indicates this improvement is statistically significant, suggesting that the experimental protocol resulted in superior functional rehabilitation outcomes.



Knee flexion improved in both groups, but the experimental group achieved a much higher range of motion. The average flexion in the conventional group was 77.67°, while the experimental group reached 102.47° an improvement of approximately 24.8 degrees.

The p-value of <0.001 confirms the difference is statistically highly significant, emphasizing the effectiveness of the experimental intervention in improving joint flexibility.



Knee extension was better in the experimental group, with an average of 1.73° extension lag, compared to 3.67° in the conventional group. The p-value of 0.002 shows this difference is statistically significant, confirming the superior effect of the experimental treatment on improving extension ROM.

DISCUSSION

This study aimed to compare the effectiveness of conventional physiotherapy and an experimental intervention including Muscle Energy Technique followed by Icing in managing post-operative knee stiffness. The outcome measures included visual analogue scale, lower extremity functional scale, and goniometer. A total of 30 participants were included in study divided into two equal groups. All genders included in the study.

The experimental group demonstrated a greater reduction in pain levels VAS (4.2 ± 1.08) compared to the conventional group VAS (5.39 ± 1.16), with $p < 0.001$, indicating high statistical significance. MET is known to reduce pain through mechanisms such as autogenic inhibition, reciprocal inhibition, and restoration of muscle length. Icing further contributes by lowering nerve conduction velocity and reducing inflammation, enhancing the analgesic effect[7]. This combination provides both neuromuscular and cryo-therapeutic effects in controlling post-operative pain.

Significant improvements in functional capacity were seen in the experimental group LEFS (65.13 ± 7.76) compared to the conventional group LEFS (41.2 ± 7.61), with $p < 0.001$., who reported that MET improves lower limb function by reducing muscle tightness and enhancing joint mobility, allowing better performance in daily activities. Enhanced function may also be attributed to early pain reduction, and helps to improve quality of life of individuals.[10]

The experimental group achieved significantly greater knee flexion (102.47° ± 12.38°) than the conventional group (77.67° ± 13.23°) with $p < 0.001$. MET improves joint ROM by stretching shortened muscles and enhancing capsular mobility through isometric contractions [8]. This finding aligns with studies showing that MET is more effective than static stretching in improving flexibility and tissue extensibility. Reduced guarding due to pain inhibition from icing also contributes to improved range of motion.[7]

Improvement in knee extension was also greater in the experimental group (1.73° ± 1.10°) versus the conventional group (3.67° ± 1.84°) with $p = 0.002$. While small in magnitude, this improvement is clinically important as full extension is necessary for efficient gait. MET helps to reduce The pain, and it is helps to improve the daily functional activity. Additionally, MET can expand the knee joint's range of motion for both flexion and extension.[9]

These results suggest that the experimental protocol (MET followed by icing) shows superior clinical outcomes compared to conventional physiotherapy alone. The intervention targets both neuromuscular and inflammatory components, thereby producing greater improvements in pain, function, and range of motion.

CONCLUSION

The present study concluded that both conventional physiotherapy and the experimental intervention were effective

in improving outcomes in post-operative knee stiffness; however, the experimental group showed significantly superior results. Participants who received the experimental treatment, which included Muscle Energy Technique followed by icing, exhibited greater reductions in pain, significantly improved lower limb function, and marked enhancements in knee joint range of motion. Muscle Energy Technique and icing into rehabilitation protocols can provide faster and more effective recovery for patients with post-operative knee stiffness.

LIMITATION

Study is limited by a small sample size (n=30), Short duration of intervention which reduce the generalizability and long-term applicability of results.

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