

COMPARATIVE EFFECTS OF TWO DIFFERENT MUSCLE ENERGY TECHNIQUES ON FUNCTIONAL DISABILITY IN PATIENTS WITH KELLGREN-LAWRENCE GRADE II AND GRADE III KNEE OSTEOARTHRITIS: A RANDOMIZED CLINICAL TRIAL

Running title: Two different muscle energy techniques in improving functional status among knee OA patients

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ABSTRACT

Objectives: The objective of this recent study was to compare and evaluate the effects of two different muscle energy techniques in improving functional status.

Methods: A single blinded, randomized clinical design was conducted. A number of participants were screened who met the inclusion criteria of the study were selected from public and government hospitals of Faisalabad. The participants were divided randomly into two treatment groups by using the lottery method. The patients were allocated by convenient sampling into two groups. The functional status assessed by using western ontario and mcmaster universities arthritis index. Data was analyzed through SPSS 20.

Results: Both techniques were significantly effective ($p < 0.05$) in improving functional status. PIR was more effective compare to RI.

Conclusion: In osteoarthritis patients, post isometric relaxation muscle energy technique was found to be more effective than reciprocal inhibition muscular energy technique in improving functional activities.

Keywords: Knee Osteoarthritis, Functional disability, Muscle energy techniques

INTRODUCTION

Knee osteoarthritis (OA), also known as degenerative joint disease, is typically the result of wear and tear and progressive loss of articular cartilage. About 73% of people living with osteoarthritis are older than 55 years, and 60% are female (1). With a prevalence of 365 million, the knee is the most frequently affected joint, followed by the hip and the hand (1).

Aging is a suitable basis for identifying particular system contents (mechanical & structural) that are connected with the transition stage of pre-OA since it is the major risk factor for developing osteoarthritis (2). Age-related osteoarthritis of knee is defined as a heeling after tearing illness in which the number of mechanical stress cycles increases with time, producing cartilage disintegration. According to reports²⁵, the chance of having knee OA grows significantly after the age of greater than forty years, and the disease's prevalence enhances with age after 75 years. However, the fact that roughly 50% of people aged 45–75 years does not acquire clinical OA (3).

In a research exploring the association between biochemical markers of arthritis and radiographic grading of osteoarthritis (OA) in knees, the joint space width and radiographic knee OA were shown to have a significant relationship. With each Kellgren-Lawrence grade, the joint space width decreased. TIMP-1 and pyridinoline demonstrated a strong connection with Kellgren-Lawrence grade, but only urine pyridinoline did (4). In another study, a high level of CRP in the blood at the start of the trial was linked to the advancement of knee OA. Serum CRP at the start did not predict progression between the start & the termination of the study, while serum CRP at the end of the study was predictive of progression. Even in the subgroup without radiological knee osteoarthritis female sex was a substantial risk factor (5).

Treatment strategies for knee Osteoarthritis include no pharmacologic, and surgical interventions. No pharmacologic measures include different physical therapy options such as electrotherapy and manual therapy techniques (Mulligan, PNF, METs) and these are recommended for all osteoarthritis patients (6). Different METs techniques (RI and PIR) are very effective and beneficial for knee osteoarthritis. These techniques enhance the range of motion, decrease the level of pain and improve the functional (7).

Objective of study

The purpose of the study was to compare the effects of two different muscle energy techniques in improving functional status.

Hypothesis

Null hypothesis (H₀)

There is no significant difference in effects of two different muscle energy techniques in improving functional status with Knee osteoarthritis.

Alternate hypothesis (H_A)

There is significant difference in effects of two different muscle energy techniques in improving functional status in patients with knee osteoarthritis.

Methods

Study Design

It was a Single blinded Randomized Clinical trial. Data was collected from public and private hospitals of Faisalabad. Duration of the study was 6 months. A permission letter signed by the head of department was used to take permission from respective hospitals. The study received ethical approval from institutional review board. The clinical trial was registered to Iranian registry of clinical trials.

The sample size of the stud was determined using the Open epitool software for precise calculation. Patients were assessed for eligibility; they were selected through convenient sampling methodology that fulfilled the eligibility criteria. Patients were randomly allocated to two groups using lottery method, ensuring an allocation ratio of 1:1 for each group.. Pre, midline and post treatment values were recorded before the start of first session, after treatment of 2 weeks and at the end of last session after 4 weeks.

Selection and description of participants

Participants were included who fulfilled the inclusion criteria

Inclusion criteria

Inclusion criteria of this research was

- Age group: forty to sixty year of age (8).
- Gender: Both male and female.
- OA grade: II and III (Kellgren and Lawrence system of classification).
- Side: Unilateral (severe side).
- WOMAC scoring: 65-75 (9).
- Pain score (14-16)
- Stiffness score (5-6)
- Function score (46-53)

Exclusion criteria

- Exclusion criteria of this study was
- Patients with any pathology of low back (10).
- Patients with previous fracture of affected lower limb.
- Patients with surgery of affected lower limb.
- Patients with implant in affected limb.
- Patients with infection in affected limb (11).
- Patients with neurological disorder.

Data Collection Procedure

This, randomized clinical trial employed a convenient sampling technique to recruit eligible subjects who met the inclusion and exclusion criteria. Each participant provided informed consent prior to their involvement in the study. Following the enrollment phase, Lottery method was used to randomly allocate the participant into two treatment groups. It was a single blinded randomization trial. For lottery method, each patient was asked to pick one paper from two pieces of paper, with group A and group B written on them. Participants were divided into treatment groups according to the paper they choose.

Outcome measures

The subjective assessment of patients was made by WOMAC for functional limitation.

Ethical Consideration

All ethical concerns were taken into consideration. To get authorization from the individual hospitals, a permission letter signed by the head of department was utilized. All volunteers were informed about the study's technique, importance, and aim. Only individuals who were willing to

participate in this research were considered. Personal information was kept private. Any participant in the study was not be harmed in any way. The participants' dignity was be respected. Prior to the trial, patients were asked to sign an informed consent form.

Statistical analysis

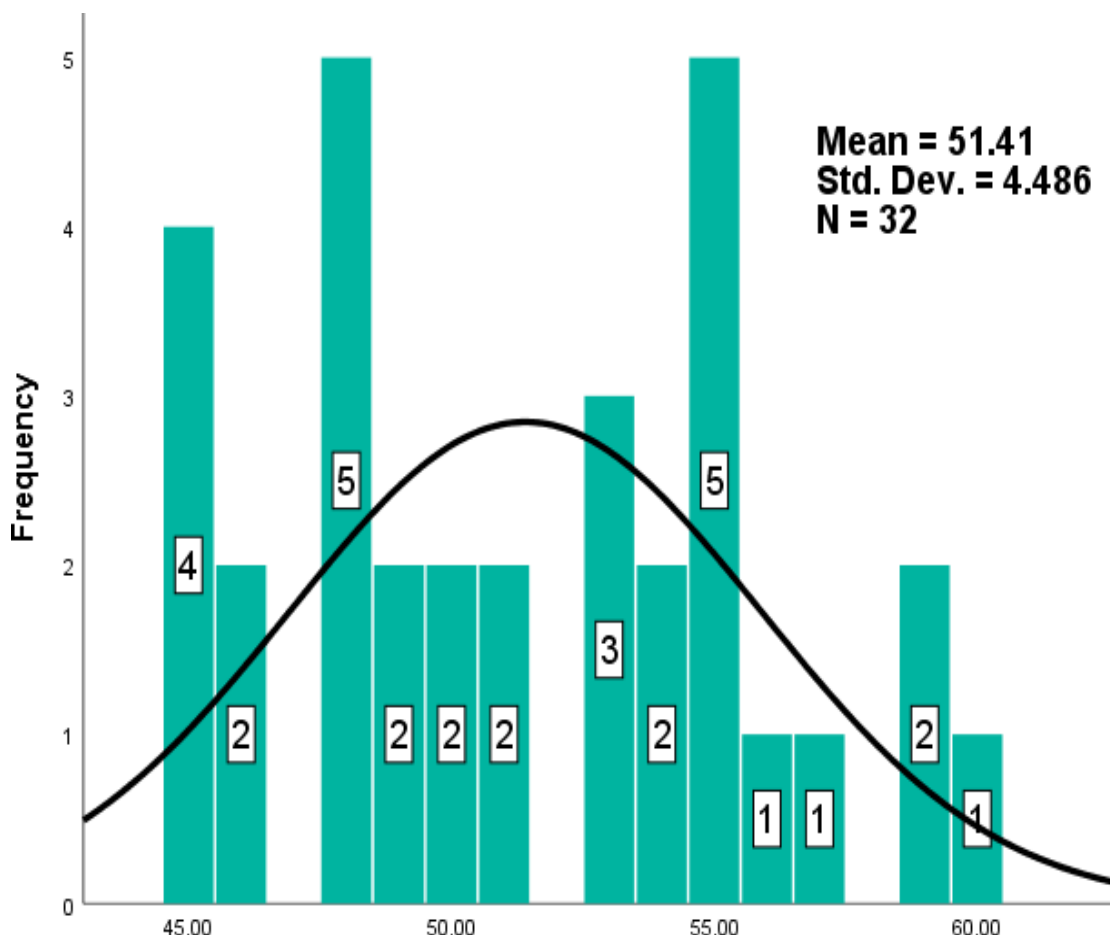
The Shapiro-Wilks test was used to determine the normality of the data. If the significance value of the test statistics is greater than 0.05, the data is considered to be normally distributed. The assumptions of normal distribution were violated by WOMAC. So, for the analysis of data of WOMAC non-parametric tests such as the Friedman test for within-group analysis and the Mann-Whitney U test for between-group analysis were used.

RESULTS

Descriptive Analysis

The interpretation of the demographic data i.e., age, gender and OA Grade is given below.

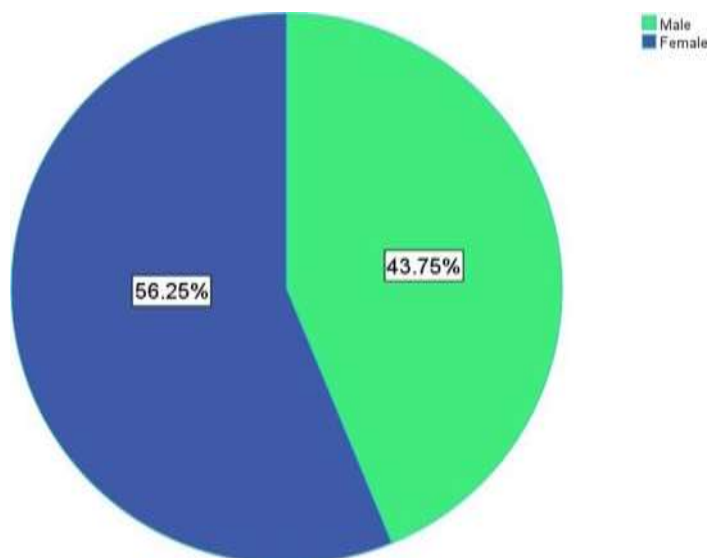
Age distribution



The age of the participants is given below.

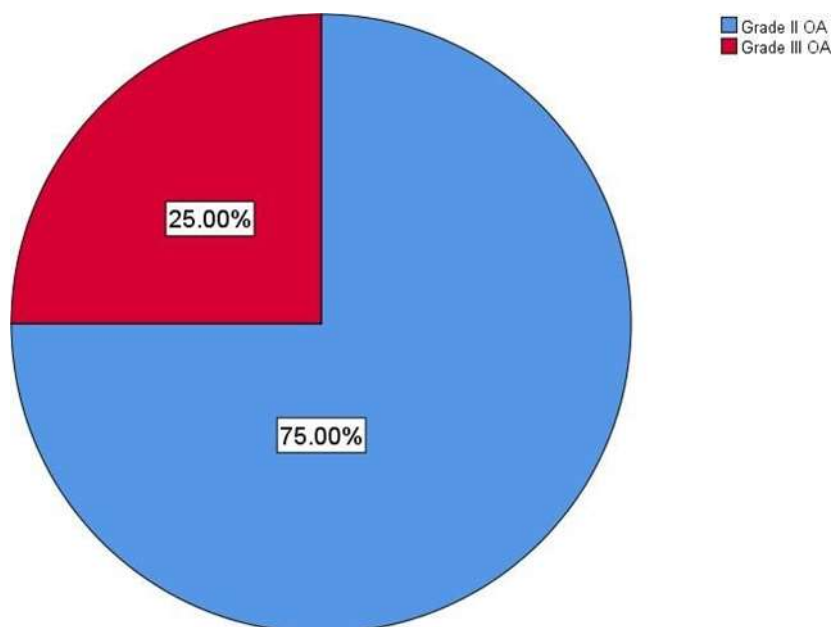
Gender Distribution

The distribution of gender is given below



Knee OA Grade

The distribution of grades of OA among participants is given below



WOMAC Questionnaire Within Group Analysis

Table 1 Friedman test WOMAC questionnaire within group analysis

Groups		N	Mean	Std. Deviation	50th (Median)	Asymp. Sig.
Post-Isometric Relaxation	WOMAC at baseline	15	68.2000	3.32093	67.0000	0.002
	WOMAC after 2nd week	15	46.8667	3.64234	46.0000	
	WOMAC after 4th week	15	25.6000	6.52249	23.0000	
Reciprocal Inhibition	WOMAC at baseline	15	68.4000	3.48056	67.0000	0.003
	WOMAC after 2nd week	15	53.4000	4.11964	53.0000	
	WOMAC after 4th week	15	39.8667	6.71743	43.0000	

The table 1 given above shows the descriptive statistics and Friedman test statistics of WOMAC questionnaire for group A participants, the data shows that the mean of WOMAC questionnaire at baseline was 68.20 ± 3.32 and the mean of WOMAC questionnaire after 4th week was 25.60 ± 6.52 . The table shows that the significance value is below 0.05 i.e., $p=0.002$, which means that Post-isometric relaxation has reduced the pain, stiffness and functional disability by 42.6 points as assessed by WOMAC questionnaire in patients with knee osteoarthritis with anterior pelvic tilt.

The table above shows the descriptive statistics and Friedman test statistics of WOMAC questionnaire for group B participants, the data shows that the mean of WOMAC questionnaire at baseline was 68.40 ± 3.48 and the mean of WOMAC questionnaire after 4th week was 39.87 ± 6.71 . The table shows that the significance value is below 0.05 i.e., $p=0.003$, which means that reciprocal inhibition has reduced the pain, stiffness and functional disability by 28.54 points as assessed by WOMAC questionnaire in patients with knee osteoarthritis with anterior pelvic tilt.

WOMAC Questionnaire Between Group A and B

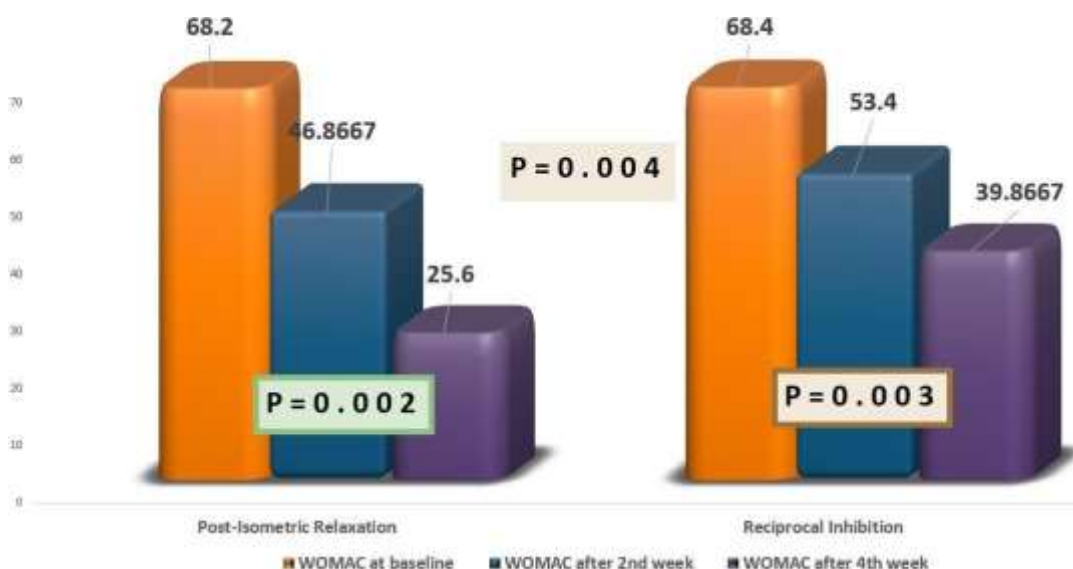
Table 2 Mann Whitney test WOMAC questionnaire between group A and B

	WOMAC at baseline	WOMAC after 2nd week	WOMAC after 4th week
Mann-Whitney U	121.500	26.000	21.000
Wilcoxon W	257.500	146.000	141.000
Z	-.251	-3.597	-3.807
Asymp. Sig. (2-tailed)	.802	.000	.000
Exact Sig. [2*(1-tailed Sig.)]	.809	.001	.004

The table 2 given above shows the test statistics of the Mann-Whitney U test conducted on WOMAC questionnaire between group A and B. Looking at the table we see that the pre-test values at baseline for the WOMAC questionnaire was not statistically significant between both groups, which means that the sample was drawn from the similar population and no significant difference was present at the baseline values (p=0.809).

By looking at the above table, it can be seen that the post treatment values of group A and B have a significance value below 0.05 i.e., $p = 0.004$, which means that there is statistically significance difference in results produced by Post-isometric relaxation and the reciprocal inhibition on pain, stiffness and functional disability as assessed by WOMAC questionnaire, it can be seen, by looking at descriptive statistics table that the Post-isometric relaxation has significant results as compared to reciprocal inhibition on disability in patients with knee osteoarthritis with anterior pelvic tilt.

Figure 1 WOMAC questionnaire between group A and B



DISCUSSION

The recent study showed that knee OA patients with an average age of 53 years, a female predominance of fifty eight percent and males of forty two percent which indicates the characteristic of people who are prone to develop knee OA. Grade II osteoarthritis was more common than grade III osteoarthritis.

Post isometric relaxation, on the other hand, was more beneficial in terms of improving functional status. Patients with grade 2 OA improved better than those with grade 3. The rear thigh muscular flexibility increased considerably ($P<0.001$) when Hussain et al. used MET in OA for 6 weeks with a regimen (2 sessions per week, 12 sessions). The use of MET decreased discomfort and increased knee range of motion (12).

In recent study MET 12 sessions were employed, which decreased functional disability ($P<0.000$) in patient of knee osteoarthritis. Chaitow et al discovered the immediate and long-term effects of manual stretch and MET on back thigh muscular flexibility, concluding that MET was more effective than manual stretch in enhancing back thigh muscle flexibility by 20 percent (13).

This recent study showed that PIR muscle energy technique significantly improved functional status ($P<0.001$ in OA patients with grades 2 and 3. This approach also helped their everyday activities by reducing discomfort and increasing hamstring flexibility. The comparative effectiveness of PIR and RI on hamstring flexibility was explored Heidari et al. They applied the PIR approach in a single session (3 reps per set). Both treatments improved hamstring muscle extensibility and knee ROM significantly ($p<0.001$). PIR was also found to be more effective in reducing pain intensity in our research. By reducing discomfort and increasing hamstring muscle flexibility, this approach increased the patient's level of activity (14).

CONCLUSION

PIR muscle energy technique and RI muscle energy technique were proven to be beneficial in improving functional activities in osteoarthritis patients after treatment sessions. However, PIR outperformed RI approach in terms of improving functional activities.

Recommendations

- Further trials are recommended with larger sample size and to evaluate long term benefits of the treatment techniques by obtaining follow ups of patients for extended period.
- A double or triple blinded study design is recommended for future studies.
- It would be beneficial to organize training sessions and workshops for physiotherapists and rehabilitation specialists to familiarize them with the most effective application of both techniques. Proper training can ensure optimal outcomes for patients.
- While this study focused on knee osteoarthritis, in further researches same therapeutic approach can apply on osteoarthritis of other joints.
- Researchers should consider follow-up sessions with patients after the completion of therapy to monitor the longevity of the therapeutic effects and determine if and when repeat sessions are needed.

CONFLICT OF INTEREST

There are no conflicts of interest that the authors of this work need to disclose.

Funding

No external funding was received for this study.

Data Availability statement

The datasets generated and analyzed in this study are not publicly available due to privacy and confidentiality concerns, ethical restrictions, legal or contractual obligations, and intellectual property considerations. However, the corresponding author is open to sharing the datasets upon reasonable request.

Limitation of study

This study is restricted by certain factors. Firstly in the recent study sample size was small which can disturb the validity and generalizability of results. Secondly, long term effects were

not assessed due to short duration so it is not known whether the effects of treatment could be maintained for long period of time or not.

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