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Comparison Of Effect Of McKenzie Exercise And Mulligan With Movement on ROM and Physical Function in subjects with Knee Osteoarthritis- A Randomized Control Trial

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ABSTRACT

Background: Osteoarthritis is a progressive joint disorder marked by the breakdown of articular cartilage and the development of bony outgrowths at joint margins. **Physiotherapy** plays a crucial role in managing this condition. Techniques such as **McKenzie exercises** and **Mulligan's Mobilization with Movement (MWM)** are effective in alleviating pain, enhancing joint range of motion, and improving the performance of daily activities in individuals with **knee osteoarthritis**.
Need Of Study: There is enough evidence available in this subjects with use of McKenzie exercise and Mulligan with Movement but there is a dearth of literature on the superiority of both the treatments, therefore, the present study is undertaken to observe which technique is better.
Aim: To compare the effect of McKenzie and Mulligan with Movement Technique on Range Of Movement and physical function parameters in subjects with Knee Osteoarthritis.
Methodology: 34 participants were included in the study and divided in Group A McKenzie Exercise and Group B Mulligan with Movement. Patients were given intervention for 3 times/week and pre and post outcomes were observed. Data were taken at baseline and after 8 weeks of intervention.
Result: Data analysis was conducted using SPSS21, employing both paired and unpaired t-tests. Statistically significant improvements were noted in both groups, with group B exhibiting more pronounced enhancements. [KOOS (t= 3.61) P<0.05 & ROM (t=2.95) P<0.05].
Conclusion: The efficacy of Mulligan with Movement is greater in improving Range of Motion and physical function as compared to McKenzie exercise in patients of Knee Osteoarthritis.
Keywords: Knee Injury and Osteoarthritis Outcome Score, McKenzie exercise, Mulligan with Movement, Osteoarthritis of knee, Ultrasound

INTRODUCTION

Osteoarthritis (OA) is recognized as a progressive, degenerative condition of the joints that does not primarily involve inflammation. It is marked by the breakdown of articular cartilage and the formation of osteophytes at joint surfaces [3]. While OA can affect any joint due to the natural aging process, it is more frequently observed in load-bearing joints such as the knees, hips, spine, and ankles [3].
Several factors contribute to the development of knee OA, including age-related degeneration, excess body weight, and prior trauma or surgical interventions involving the knee joint. A significant proportion of cases—approximately 80%—affect the medial compartment of the knee, often leading to a varus deformity, commonly known as a "bowlegged" posture. Less commonly, OA affects the lateral compartment, resulting in a valgus or "knock-kneed" appearance [2]. The McKenzie method, also known as Mechanical Diagnosis and Therapy (MDT), was introduced by Robin McKenzie in 1981. It is based on the principle that applying targeted, directional forces can alleviate pain and restore function. The approach involves three phases: assessment, treatment, and

prevention. During assessment, patients perform repeated movements and assume sustained positions to identify patterns of symptom centralization. Based on their responses, patients are classified into derangement, dysfunction, or postural syndromes. Therapy using this method focuses on symptom reduction, centralization, and full functional recovery [8][2].

Brian Mulligan developed the Mobilization with Movement (MWM) approach, which involves applying a sustained accessory glide to a joint by the therapist, accompanied by the patient's active movement to the end range. MWM also includes sustained natural apophyseal glides (SNAGs) for spinal joints. The technique incorporates passive end-range overpressure—akin to stretching—while ensuring it remains within a pain-free range [8]. MWM has also been applied to assess and manage knee conditions, including suspected meniscal involvement [8].

Although "positional faults" corrected during MWM have rarely been radiologically confirmed, they are typically identified and addressed based on clinical examination and technique-specific application. According to the Mulligan Concept, correcting these positional misalignments may help resolve clinical symptoms effectively [8].

To evaluate therapeutic outcomes in knee OA, the KOOS (Knee injury and Osteoarthritis Outcome Score) is frequently utilized. This validated tool assesses five subdomains: pain, symptoms, activities of daily living (ADL), sports/recreation function, and knee-related quality of life (QoL). It is commonly used in orthopedic research, including interventions such as meniscectomy, ligament repair, and joint replacement.

A prospective study conducted over three years highlighted a correlation between the narrowing of the joint cavity and the severity of OA symptoms, whereas the presence of osteophytes did not show a strong association with clinical manifestations [8].

In recent years, integrative physiotherapy techniques have emerged for the management of knee OA, aiming to shorten treatment duration while maximizing therapeutic outcomes. While both McKenzie exercises and Mulligan MWM have shown evidence of efficacy in managing knee OA individually, comparative data on their relative superiority remains limited. Therefore, this study aims to evaluate the comparative effectiveness of these two interventions.

OBJECTIVES

1. To evaluate the impact of the McKenzie method on knee osteoarthritis patients in terms of enhancing joint mobility and functional capacity.
2. To determine the effects of Mulligan Mobilization with Movement (MWM) on range of motion and physical function in individuals with knee osteoarthritis.
3. To compare the effectiveness of the McKenzie method and Mulligan MWM in improving mobility and physical function in knee osteoarthritis cases.

REVIEW OF LITERATURE

1. **Huibin Long** et al. [**2022**] explored osteoarthritis prevalence using data from the Global Burden of Disease Study 2019, analyzing site-specific patterns across demographics and locations. Their study identified the rising global burden of OA and emphasized the significance of timely preventive strategies and early management [13].
2. **Klaus U. Schlüter-Brust** and **Peer Eysel** [**2010**] conducted a thorough review of recent research on knee OA, utilizing multiple databases. Their analysis highlighted the uncertainty surrounding OA pathophysiology and confirmed the absence of a definitive cure. Treatment strategies span from conservative therapies like physiotherapy to surgical interventions, with a focus on symptom management and joint preservation [14].
3. **Nadia A. Abd Elmeged** and **Amaal H.M. Ibrahim** [**2021**] studied the effects of McKenzie exercises in females with Dowager's Hump. Conducted over 8 weeks, the trial showed that incorporating McKenzie techniques led to substantial reductions in neck pain and improved functional outcomes in the cervical region [15].
4. **Ruqia Manzoor** and **Muhammad Salman Bashir** [**2020**] performed a randomized control trial comparing McKenzie therapy, Muscle Energy Technique (MET), and their combination

in patients with chronic low back pain. The combined intervention proved most effective in enhancing quality of life and decreasing pain severity [16].

5. **M. Holmes** and **T. Neogi** [**2023**] focused on the association between therapeutic alliance, patient adherence, and clinical outcomes in individuals with knee OA undergoing physical therapy. Their findings underscore the role of clinician-patient rapport in improving adherence, which positively influences treatment effectiveness [17].
6. **Mariusz Drużbicki** and **Łucja Kitrys** [**2024**] assessed the post-surgical return to work among working-age individuals who underwent total knee arthroplasty (TKA). Their retrospective pilot study found that return-to-work rates were lower in Poland compared to global figures, partly due to the lack of structured occupational rehabilitation support [18].
7. **Yomna F. Ahmed** and **Rania M. Tawfik** [**2023**] investigated the effects of high-power pain threshold ultrasound (HPPTUS) in patients with stage II knee OA. Results showed that HPPTUS, when combined with conventional therapy, offered more effective pain relief than traditional ultrasound, validating its therapeutic potential [19].
8. **Yan Luo** and **Masoud Rahmati** [**2024**] conducted a systematic review and meta-analysis evaluating the efficacy of therapeutic ultrasound in treating knee OA. They concluded that pulsed ultrasound, particularly under specific parameters, was a safe and effective modality for managing pain and improving joint function [20].
9. **Jay Indravadan Patel** and **Prem Kumar B N** [**2016**] analyzed outcomes of combining McKenzie exercises with TENS in patients with lumbar radiculopathy. Participants receiving the combined treatment demonstrated significantly better improvements in pain, disability, and lumbar range of motion than those treated with general exercise and TENS alone [10].
10. **Zeeshan Mehmood** and **Naveed Anwar** [**2021**] compared Maitland mobilization and Mulligan MWM in knee OA patients. Their quasi-experimental study showed that Mulligan techniques, when paired with supervised exercise, were more effective in reducing pain, enhancing ROM, and improving patient function [6].

MATERIAL AND METHODOLOGY

This randomized controlled trial was carried out over approximately 10 to 12 months following ethical clearance. Participants were selected through convenience sampling from individuals diagnosed with knee osteoarthritis. The data collection took place at the Physiotherapy OPDs of Yogini Vasantdevi Hospital and MDAH, under KPGU, Vadodara. The sample size was estimated using G*Power software (version 3.1.9.7), taking KOOS and ROM values from a prior study by Dr. Richard Rosedale. The reported means and standard deviations were 52 ± 16 for Group A and 61 ± 17 for Group B, yielding an effect size of 0.36. Based on an alpha error of 0.05 and beta error of 0.30 (i.e., 70% study power), a total of 34 participants were determined to be sufficient (17 in each group).

Inclusion Criteria:

- Males and females aged between 50 to 70 years.
- Diagnosis of knee osteoarthritis confirmed radiographically by an orthopedician.
- Persistent knee discomfort lasting more than three months [4][3].

Exclusion Criteria:

- Inability to participate in physiotherapy involving exercise.
- Neurological, cardiovascular disorders, or comorbidities like fever, tumors, or joint pathologies such as bursitis or tendinitis.
- Recent surgical procedures or intra-articular steroid injections within the last six months.
- Structural deformities affecting mobility, severe burns, or lack of informed consent [4][3].

Materials Used: Couch or plinth, Mulligan mobilization belt, foam mattress, consent and assessment forms, writing materials, goniometer, and support straps.

Participant Allocation: The 34 participants were randomly assigned to two groups:

- **Group A:** McKenzie Exercise protocol
- **Group B:** Mulligan's Mobilization with Movement (MWM)

Group A: McKenzie Exercise Protocol : Pre- and post-treatment physiotherapy assessments were conducted. The treatment protocol followed the Mechanical Diagnosis and Therapy (MDT) approach, focused on derangement classification. Directional end-range exercises were selected based on patient-specific responses to repeated movement testing. Exercises included:

1. **Seated Active Knee Extension:** The patient, seated with knees at 90°, extends the leg fully, holds the position for 10–15 seconds, then returns to the starting posture.
2. **Supine Active Knee Extension with Towel Support:** A rolled towel is placed under the knee, and the patient performs full active extension.
3. **Passive Overpressure in Sitting:** With knees extended while seated, overpressure is applied using the hands above the knee.
4. **Standing Knee Extension Over Support:** The patient supports the knee over a stool and applies manual pressure to extend the knee.
5. **Seated Knee Flexion:** From a seated position, the patient bends the knee and draws the heel toward the buttocks.
6. **Standing Knee Flexion Using a Chair:** The foot is placed on a chair and the patient lunges forward to achieve deep flexion.
7. **Kneeling Knee Flexion:** The patient shifts backward while in a four-point kneeling position to increase knee flexion.

Adjunct Therapy: Ultrasound therapy at 3 MHz, continuous mode, with a power output of 1.3 W/cm² was administered [11].

Group B: Mulligan's Mobilization with Movement (MWM) : The intervention involved therapist-assisted MWM techniques with continuous pre- and post-assessments.

1. **Lateral Glide for Flexion:** The patient is prone with the knee bent. The therapist applies a lateral tibial glide using a belt while passively flexing the knee.
2. **Lateral Glide for Extension:** With the knee extended, a lateral glide is sustained as the therapist performs passive extension.
3. **Medial Glide for Flexion:** The tibia is glided medially while the therapist performs passive flexion.
4. **Medial Glide for Extension:** A medial glide is maintained during passive extension of the knee.
5. **Tibial Internal Rotation in Weight-Bearing:** The patient stands with the foot on a raised surface and internally rotates the tibia while performing a squat to enhance flexion.

Adjunct Therapy: A similar ultrasound dosage was applied: 3 MHz frequency, continuous wave, at 1.3 W/cm² [11].

OUTCOME MEASURES

Range of Motion (ROM): ROM assessment provides a measure of joint flexibility and mobility. It is fundamental to both diagnosis and the initiation of physiotherapy. Joint range is influenced by the structure of the joint and the surrounding soft tissues, including muscles, ligaments, fascia, and nerves. Using a goniometer, joint movements—such as flexion, extension, abduction, adduction, and rotation—are quantified in degrees.

Knee Injury and Osteoarthritis Outcome Score (KOOS): KOOS is a validated, patient-reported outcome tool used to evaluate the symptoms and impact of knee osteoarthritis. It covers five dimensions: pain, symptoms, daily living activities, sports/recreational function, and quality of life. Originally derived from the WOMAC index, KOOS is designed to better assess younger or more active individuals with knee joint conditions. Multiple international validations support its use.

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Figure 1: When sitting, Actively extend your knees

Figure 2: Active knee extension while in a supine position

Figure 3: Sitting with the knee extended

Figure 4: Knee Extension when standing

Figure5: Sitting Knee Flexion

Figure6: Knee flexion while standing

Figure7: Knee flexion while in a kneeling position

RESULTS

Descriptive statistical analysis obtained using frequency, percentage, mean, SD, CI, median and IQR. Paired t- test was used for the comparison of Pre and post data within the group. Unpaired t-test was used for the comparison of data between group A and Group B. Data was analysed at 5% level of significance with confidence interval CI at 95%. All the statistical analysis was performed by using IBM SPSS version 29.0.0.

Table 1: Within Group & between Group Analyses

Group	Statistical Analysis
Within Group	Paired T-Test
Between Group	Unpaired T-Test

Table 2: Data representation of Age Distribution among Group A & B

Group	MEAN & SD	t- value	p-value
Group A	59.06 ±10.06	0.71	0.37
Group B	62.30±10.10	0.72	0.38

Table 3:Demographic representation of gender wise distribution of participants in Group A & B

Group	Group A	Group B
Male	10	7
Female	7	10

Table 4: Intra Group Comparison of parameters in Group A

Parameters	Baseline	4 Week	8 Week	T Value	P Value
ROM	100-110	110-118	112-125	18.77	0.002
KOOS Function	52 ±16	60±18	70±17	17.25	0.001

Table 5: Intra Group Comparison of parameters in Group B

Parameters	Baseline	4 Week	8 Week	T Value	P Value
ROM	100-110	110-124	115-135	16.56	0.002
KOOS Function	52 ±16	65±20	82±19	18.71	0.001

Table 6: Data represent comparison of post-procedure parameters of Group A and Group B on Week 8. Unpaired t-test

Parameters	Group A	Group B	t-test	P Value
ROM	112-125	115-135	4.0997	0.0003
KOOS Function	63±17	71±19	7.8890	0.0001

Interpretation:

Unpaired t-test was used for the comparison of ROM and KOOS function between Group A and Group B as given in Table which showed significant improvement with P value at 0.017 and 0.014 respectively. It shows that the treatment given in Group B was more effective as compared to group A. Although there was significant improvement in patients of Group A post-intervention, but the patients of Group B responded better than Group A.

The mean and SD of Group A in ROM is 110.451 and 7.67 and for Group B is 113.902 9.81. Similarly, mean and SD of Group A in KOOS is 59.72 and 6.53 and for Group B is 63.18 and 9.33.

The following tables shows pre- and post- treatment data of both the groups including Standard deviation.

Chart 1: Standard Deviation Of Post 4 week and Post 8 week result of Group A

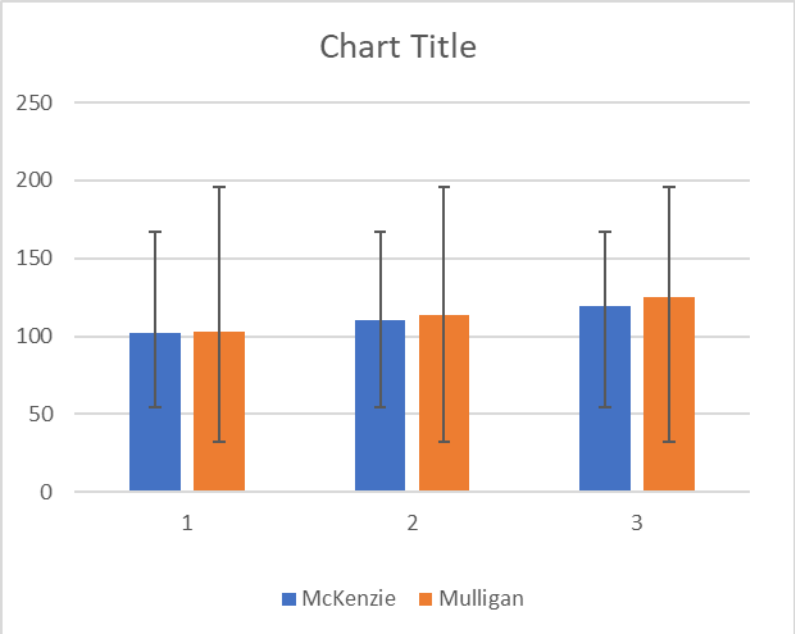

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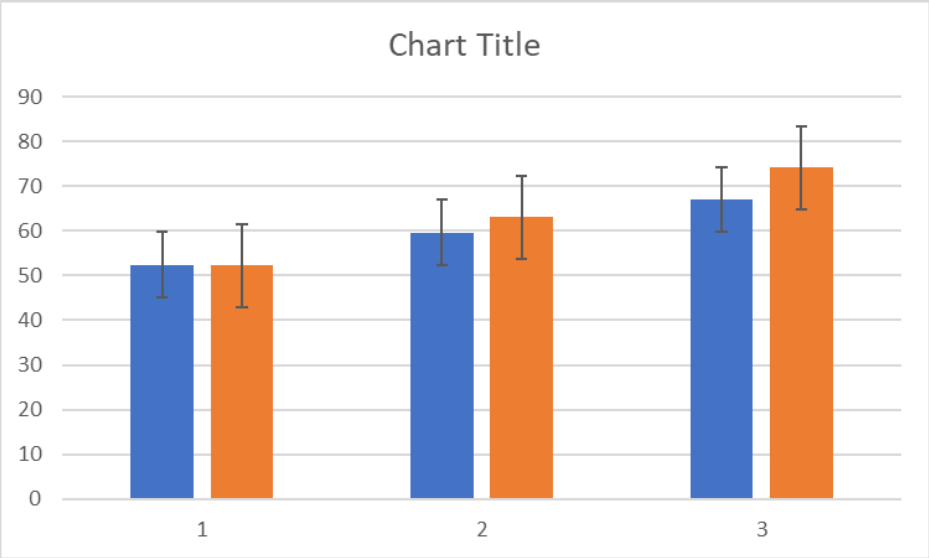
Chart 2: Standard Deviation Of Post 4 week and Post 8 week result of Group B



DISCUSSION

Participants in Group A (McKenzie group) demonstrated significant improvements in pain reduction and knee range of motion (ROM) following 4 and 8 weeks of intervention ($p = 0.002$). The use of the derangement classification in McKenzie therapy may have contributed to decreased joint stiffness and pain, leading to enhanced mobility. These findings suggest that the McKenzie method, originally developed for spinal conditions, is also beneficial in managing symptoms associated with knee osteoarthritis (OA). The observed improvements may be attributed to normalization of joint mechanics and enhanced proprioceptive feedback, including better quadriceps strength and joint position sense.

The McKenzie technique appears to interrupt the cycle of patellofemoral friction exacerbated by tight musculature and limited joint space. When paired with ultrasound therapy, this combination showed a notable reduction in pain and enhancement in joint mobility among patients with knee OA [16].

On the KOOS scale, Group A demonstrated significant progress in activities of daily living after both 4 and 8 weeks of treatment ($p = 0.001$). Improvements in tasks such as stair climbing, sitting cross-legged, and light jogging were reported. The treatment plan, tailored based on patient-specific directional preferences (extension or flexion), allowed for more targeted symptom relief. If a movement caused worsening of symptoms, it was immediately adjusted, and only exercises yielding functional improvement were continued. Such customized, task-specific exercises likely mimicked daily movements (e.g., chair transfers, stool sitting), contributing to functional restoration. Incorporating functional and task-oriented activities is essential for the effective management of hip and knee OA [13].

In Group B, participants receiving Mulligan Mobilization with Movement (MWM) exhibited statistically significant improvements in pain and physical functioning ($p = 0.002$). This technique demonstrated superior outcomes in ROM enhancement and symptom reduction compared to the McKenzie approach. MWM works by activating joint mechanoreceptors, modulating pain via the gate control mechanism, and promoting reflexive muscular relaxation [4].

When paired with ultrasound therapy, MWM showed even greater efficacy in reducing pain and improving functional mobility. Compared to the McKenzie protocol, the combination of MWM and ultrasound provided superior gains in ROM and decreased discomfort. These findings reinforce the value of Mulligan's mobilization techniques as part of a multimodal approach in knee OA rehabilitation [4].

Overall, the findings suggest that Group B (MWM) was more effective than Group A in improving both range of motion and physical function in individuals with knee osteoarthritis.

CONCLUSION

The study concludes that both McKenzie exercises and Mulligan with Movement (MWM) are effective in enhancing knee joint mobility and KOOS outcomes in individuals with knee osteoarthritis.
However, Mulligan with Movement (MWM) demonstrated greater efficacy in restoring range of motion, improving KOOS scores, and enhancing activities of daily living (ADL) and quality of life (QoL) in this patient population.

CONFLICT OF INTEREST

Authors have no conflict of interest.

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