

Combined Effect of Mulligan's Techniques With Therapeutic Ultrasound on Anterior Knee Pain in Patients with Chronic Kneeosteoarthritis: A Case Study

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Abstract-

BACKGROUND- Knee osteoarthritis was treated effectively by using Mulligan technique with therapeutic ultrasound. However, others studies has not been found in literature to evaluate the mulligan mobilization with therapeutic ultrasound approach. So, current study analyzed the effects of Mulligan technique with therapeutic ultrasound.

METHODS- single participant with age of 55 year with knee osteoarthritis was recruited randomly from physiotherapy department. Treatment was received by participant in a manner that 2 set of 2 repetitions once. Which results in pain relief? TUG and NPRS were recorded by an analyzer prior to and after treatment.

RESULTS- significant changes were found after treatment in patient with knee OA. NPRS score reduced to zero and TUG score was improved following treatment.

CONCLUSION- knee osteoarthritis patients improved highly in terms of pain relief and their functional activities after treatment with mulligan and ultrasonic therapy.

Keywords- knee osteoarthritis, Mulligan technique, ultrasonic therapy, movement with mobilization (MWM), anterior knee pain.

I. INTRODUCTION

Researchers paid high attention towards knee osteoarthritis as the 11th highest contributors to disability among 129 musculoskeletal conditions .The world-wide age-standardized prevalence of knee OA was accepted as 3.8% with a higher female preponderance (Cross et al., 2014)[1]. Knee OA is characterized by pain in joint, firmness, crackling and restricted range of motion leading to difficulty in walking and stair climbing as well as problem in sit to stand

movements (Bijlsma, Berenbaum, & Lafeber, 2011)[2]. Guide for physical therapy intervention was proposed by American college of rheumatology along with European league. Muscle stretches, resistance training exercises, taping electrotherapy, weight bearing exercises are some example of physical interventions including manual therapy (Fernandes et al., 2013; Hochberg et al., 2012).[3]

Any kind of pain in patients with knee OA in terms of severity can be treated with manual therapy as suggested by American college of rheumatology. However, surgical intervention was not considered in this (Hochberg et al., 2012). Knee OA has been found treatable with manual therapy as evidenced in literature (French, Brennan, White, & Cusack, 2011; Xu et al., 2017).[4]

The aim of Mulligan technique is to gain positive results in terms of pain relief as soon as possible. It could be due to regulation of non-opoid pain sensory pathways resulting from correction of positional fault (French, Brennan, White, & Cusack, 2011; Xu et al., 2017).).[4]

Altered mechanisms of OAM knee could be managed by correcting the shape of articular surfaces, fibre-orientation and thickness of cartilage (Baker, Nasypany, Seegmiller, & Baker, 2013).[5] MWM has been found effective in managing the OA knee. One study suggested that combined effect of MWM and passive mobilization and electrotherapy is effective against electrotherapy alone. Another studies also found equal effectiveness of Mulligan and Maitland mobilization techniques on knee pain and function.

Outcome scales in rheumatology III initiatives focused on the importance of outcome measures in the clinical trials on subjects with OA (Chiarotto, Ostelo, Turk, Buchbinder, & Boers, 2017).[6]

Electrotherapy include ultrasonic therapy, transcutaneous electrical nerve stimulator, interferential therapy and high voltage are modality of choice in treating pain conditions due to musculoskeletal problems. Exercises and manual therapy could not be ignored in managing the musculoskeletal disorders. (7) Ultrasonic therapy is most commonly used modality in clinical practice. It is also in practice for treating in musculoskeletal conditions by other health care personals. Deep tissue treatment is supposed to be carried out by use of therapeutic ultrasound. Ultrasound have two categories in terms of treatment modes i.e. Interrupted and non-interrupted. It is a single way energy transfer system with two kind of transducers such as 1 MHz and 3 MHz, and amplitude densities in between 0.1 watts/cm² and 3 watts/cm².(7)

Ultrasound is considered as effective tools in physical therapy and diagnosis both. Acute and chronic soft tissues injuries are managed by therapeutic ultrasound.it promote healing of soft tissues and controls inflammation. (8) It utilizes hand-held devices to make and emit sound waves to the internal injured site. It heat up the deep tissues including muscle, ligament and joints. (9) Ultrasound causes soft tissue massage mechanically thus also produces muscle relaxation along with pain relief. It also relives spasm and improves mobility. (10)

However, there are still too few studies in the literature that would provide conclusive evidence that alternative treatment brings very good and lasting results. This study aims to hypothesize that combined treatment with Mulligan technique and ultrasonic therapy will be an effective treatment method to manage the chronic knee pain and improve functionality.

II. METHODOLOGY

Single subject design, study was conducted on patient with anterior knee pain due to chronic osteoarthritis at the department of physiotherapy.

Subject referred for physiotherapy with clinical and radiological diagnosis of knee osteoarthritis was informed regarding study and screened for recruitment. The patient had to have the following inclusion criteria: age more than 42 years, pain and crepitus in the knee joint during knee movements, duration of pain more than 6 months, and radiological tibiofemoral degeneration with Grades 1–3 according to the Kellgren and Lawrence classification (Kellgren & Lawrence, 1957)[11]

Fig.1



Knee joint X-ray

Exclusion criteria: infected subject, OA secondary to rheumatoid and other inflammatory and autoimmune conditions, acute trauma and fractures in the past 5 months, patellofemoral pain (screened using Clarke's test), and unavailability of radiographs were excluded.

After the participant recruitment, the participant was informed that they would be treated once with two set and two repetitions. Outcome measures were administered and recorded by us properly. The radiological grade of knee OA was recorded, and the offending (painful) knee movement (flexion or extension) was identified according to the participant's subjective report.

Procedure- The accessory glides were performed during the testing procedure in the intervention group in a predetermined sequence of gliding directions, with specific hand placements as described below (Mulligan, 1993):[12]

Medial rotational: The therapist grasped the proximal tibia of the subject with both hands and provided a medially directed rotational force to produce medial rotation.

Fig.2



Lateral rotational: The therapist held the proximal tibia of the subject with both hands and gave a laterally directed rotational force thus created the lateral rotational glide.

Medial translational: The therapist fixed the distal femur of the patient on the medial side with one hand and applied a medially directed rotational force with the other hand placed on the lateral side of the proximal tibia.

Fig.3



Lateral translational: The therapist fixed the distal femur on the lateral side with one hand and applied a laterally directed rotational force with the other hand, placed on the medial side of the proximal tibia.

The mulligan technique was applied in weight-bearing. The participant placed the lower limb with the more painful knee on a low stool and stepped up or lunged forward if the offending movement was extension or flexion, respectively. The participants received support as desired, using their hands from adjacent plinth while performing the instructed movement. Before initiation of the painful movement, an accessory glide was delivered, and the force was sustained until return to the starting position.

Five trials of each glide were given, and the glide direction that minimized or relieved the pain was chosen for the intervention. The treatment for the intervention was comprised of 2 sets with 2 repetitions of pain-relieving glides delivered manually while the participant was performing the painful movement.

Subject with anterior knee pain with chronic osteoarthritis received ultrasonic therapy for 10 minutes after completion of two set. Treatment was given only once.

Outcome measures- The assessor recorded the outcome measures (NPRS and TUG) in both groups immediately before and after intervention, numbered from 0 to 10 and were explained that “0” meant no pain at all and “10” meant worst possible pain imaginable (McCaffery & Beebe, 1994).[13] The participants marked an appropriate number on the scale, which accurately represented the average intensity of pain experienced during the knee movement.

Timed up and go test: The intra and inter-rater reliability of this test was found to be excellent, with the intraclass correlation coefficients being 0.97 and 0.96; the minimal detectable change (MDC) was reported as 1.10–1.14 seconds in Grade 1–3 knee OA (Alghadir, Anwer, & Brismée, 2015).[14] The participants sat in a chair comfortably, facing a corridor, and a cone was placed at 3-m distance. Initially, the test was explained and demonstrated by the outcome assessor to the participants. The patient was instructed to get up from

the chair on the assessor's call “go,” walk for 3 meters, turn around, come back, and sit on the chair at a comfortable pace. The time is taken (in seconds) between the patient getting up from the chair and until they sat back on the chair was recorded by the assessor.

RESULTS- participant completed the study. Participant received the intervention in the weight bearing position along with ultrasonic therapy.

Participant was treated with medial and rotational weight glides, and medial and lateral translational glides. Thereafter ultrasonic treatment was provided to the patient. Patient demonstrated better outcome after treatment.

Outcome measures-

Pre-NPRS	5.00
Post-NPRS	4.00
Pre-TUG	11.67 seconds
Post-TUG	10.9 seconds

III. DISCUSSION

This study addressed the effects of Mulligan's techniques with ultrasonic therapy and identified that combined tailored Mulligan's MWM with ultrasonic intervention demonstrated a positive effect on anterior knee pain and functional status in knee OA participant. No adverse events were reported after the treatment procedures. Manual therapy had been considered as pain relieving mechanisms which could be classified as biomechanical, neurophysiological and non-specific (Bialosky et al., 2009; Bishop, M.D et al., 2015).[15]

Mulligan glide could be adjustment positional accountability in connection with biomechanical mechanisms. Instant pain relief could be the result after application of Mulligan technique which is applied passively, thus might be improved abnormal mechanisms of knee with osteoarthritis.

On-the-spot consequences following the treatment could also be assigned to the neurophysiological mechanisms which include the regulation of pain at spinal level (pain gate mechanisms; Neelapala, Reddy, & Danait, 2016),[16] peripheral level (dispersal of inflammatory mediators), and supraspinal level (Malisza et al., 2003).[17]

Many repetitions are also the cause for pain relief performed during Mulligan glide. (Zusman, 2004)[18]

The out-turn of this study showed pain limiting. The upgrade in pain relief found in our study might be due to the non-specific outcome of pain regulation by manual therapy. The non-specific mechanisms include client and therapist assumptions and addressing psychological factors such as fear, catastrophizing, kinesiophobia, and so forth. (Bialosky, Bishop, George, & Robinson, 2011).[15] long duration low intensity ultrasonic therapy reduced pain and restored functional performance in patient with moderate to severe chronic osteoarthritis. (David O Draoer et al.2018)[19] non-specific pain could be reduced with ultrasonic therapy in patients with low back pain.(Gebremedhin Haile et al. 2021)[20]knee joint pain, stiffness and physical activity can be improved with ultrasonic treatment.(Syed Naveed Mumtaz et al. 2017[21]continuous or pulsed both the methods of ultrasonic treatment procedure were found to be effective for reducing pain, promoting healing and enhancement of functional recovery in knee OA subjects.(Nmachukwu et al. 2019)[22]

Except for aforementioned causes the baseline NPRS scores of participant was high (8 and 10) and reduced by 4 and 5 scale points after the treatment successively. Possibly, such huge amounts of pre–post changes in this subject might also be accountable for the overall lower post-treatment pain score. Post-treatment, the participant showed better on timed up and go test.

No other study was found against Mulligan glide in literature by which our outcomes could be compared more precisely.

However, similar outcomes were reported with the Mulligan's squeeze technique (Hudson et al., 2018).[23] Mulligan's movement with mobilization and Maitland techniques (Rao et al., 2018)[24] demonstrated similar outcomes connection with decreasing pain, function, and a pain-less range of motion in subjects with knee OA. As the current study showed similar results associated with knee pain and functional performance, these findings may recommend place of touch process during manual mobilization techniques hardly noticeable.

Strengths and limitations

In patients with knee OA, mostly mobilization approaches are performed. The present study is first to contrast the efficacy of combined Mulligan glide with ultrasonic therapy.

As the study is a single session pre–post designs, others therapeutic influences could be ignored like any

pharmaceutical effects. However, following limitations could be considered regarding this study: The sample size of the study is one, and only the recent impacts of combined treatment of Mulligan's techniques and therapeutic ultrasound were analyzed. As the current study intended to examine the combined effects, restricting the isolated treatment. Also long terms impacts could be examined in future study.

Future recommendations

Knee OA is a chronic state so long-term investigations in the context of efficacy of Mulligan approach with therapeutic ultrasound could be followed up. Positional fault correction might be quantified in future studies as well.

IV. CONCLUSION

Mulligan's techniques along with therapeutic ultrasound produced down-grading knee pain and improving functional activities in person with knee OA. In addition to the directional forces causing the correction of positional faults, the study provides initial support for non-specific mechanisms of pain relief of Mulligan's techniques.

Implications for physiotherapy practice

The consequences of the current study demonstrated that Mulligan's techniques along with therapeutic ultrasound are productive in proving recent pain relief in subject with knee OA. However, touch input during treatment cannot be neglected. Therefore, Mulligan's mobilizations along with therapeutic ultrasound can be used effectively in short-term pain-relieving treatment option in subjects with knee OA.

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REFERENCES

- [1] Cross, M., Smith, E., Hoy, D., Nolte, S., Ackerman, I., Fransen, M., ... Laslett, L. L. (2014). The global burden of hip and knee osteoarthritis: Estimates from the Global Burden of Disease 2010 study. *Annals of the Rheumatic Diseases*, 73(7), 1323–1330. <https://doi.org/10.1136/annrheumdis-2013-204763>
- [2] Bijlsma, J. W., Berenbaum, F., & Lafeber, F. P. (2011). Osteoarthritis: An update with relevance for clinical

- practice. *The Lancet*, 377(9783), 2115–2126. [https://doi.org/10.1016/S0140-6736\(11\)60243-2](https://doi.org/10.1016/S0140-6736(11)60243-2)
- [3] Fernandes, L., Hagen, K. B., Bijlsma, J. W., Andreassen, O., Christensen, P., Conaghan, P. G., ... Lohmander, L. S. (2013). EULAR recommendations for the non-pharmacological core management of hip and knee osteoarthritis. *Annals of the Rheumatic Diseases*, 72(7), 1125–1135. <https://doi.org/10.1136/annrheumdis-2012-202745>
- [4] French, H. P., Brennan, A., White, B., & Cusack, T. (2011). Manual therapy for osteoarthritis of the hip or knee—A systematic review. *Manual Therapy*, 16(2), 109–117. <https://doi.org/10.1016/j.math.2010.10.011>
- [5] Baker, R. T., Nasypany, A., Seegmiller, J. G., & Baker, J. G. (2013). The Mulligan concept: mobilizations with movement. *International Journal of Athletic Therapy and Training*, 18(1), 30–34. <https://doi.org/10.1123/ijatt.18.1.30>
- [6] Chiarotto, A., Ostelo, R. W., Turk, D. C., Buchbinder, R., & Boers, M. (2017). Core outcome sets for research and clinical practice. *Brazilian Journal of Physical Therapy*, 21(2), 77–84. <https://doi.org/10.1016/j.bjpt.2017.03.001>
- [7] Gebrimethin Haile, T. T. (2021). effectiveness of ultrasound therapy on management of chronic non-specific low back pain: A systemic review. *journal of pain research*, 1251-1257.
- [8] Dobson, F., Hinman, R. S., Roos, E. M., Abbott, J. H., Stratford, P., Davis, A. M., ... Hansen, P. (2013). OARSI recommended performancebased tests to assess physical function in people diagnosed with hip or knee osteoarthritis. *Osteoarthritis and Cartilage*, 21(8), 1042–1052. <https://doi.org/10.1016/j.joca.2013.05.002>
- [9] Nmachukwu Ifeoma, E. a. (2019). effects of ultrasound therapy on pain intensity of patients with knee osteoarthritis- A systematic review of evidence. *African journal of health sciences and technology*, 61-68.
- [10] YED Naveed Mumtaz, S. H. (2017). role of ultrasound therapy in osteoarthritis knee. *Pak Armed Force*.
- [11] Kellgren, J. H., & Lawrence, J. S. (1957). Radiological assessment of osteoarthrosis. *Annals of the Rheumatic Diseases*, 16(4), 494–502. <https://doi.org/10.1136/ard.16.4.494>
- [12] Mulligan, B. R. (1993). Manual therapy rounds. *The Journal of Manual & Manipulative Therapy*, 1(4), 154–156. <https://doi.org/10.1179/jmt.1993.1.4.154>
- [13] McCaffery, M., & Beebe, A. (1994). *Pain: Clinical manual for nursing practice*. London: Times Mirror International Publishers Limited
- [14] Alghadir, A., Anwer, S., & Brismée, J. M. (2015). The reliability and minimal detectable change of Timed Up and Go test in individuals with grade 1–3 knee osteoarthritis. *BMC Musculoskeletal Disorders*, 16(1), 174. <https://doi.org/10.1186/s12891-015-0637-8>
- [15] Bialosky, J. E., Bishop, M. D., George, S. Z., & Robinson, M. E. (2011). Placebo response to manual therapy: Something out of nothing? *The Journal of Manual & Manipulative Therapy*, 19(1), 11–19. <https://doi.org/10.1179/2042618610Y.0000000001>
- [16] Neelapala, Y. V. R., Reddy, Y. R. S., & Danait, R. (2016). Effect of Mulligan's posterolateral glide on shoulder rotator strength, scapular upward rotation in shoulder pain subjects—A randomized controlled trial. *Journal of Musculoskeletal Research*, 19(03), 1650014.
- [17] Malisza, K. L., Stroman, P. W., Turner, A., Gregorash, L., Foniok, T., & Wright, A. (2003). Functional MRI of the rat lumbar spinal cord involving painful stimulation and the effect of peripheral joint mobilization. *Journal of Magnetic Resonance Imaging: An Official Journal of the International Society for Magnetic Resonance in Medicine*, 18(2), 152–159. <https://doi.org/10.1002/jmri.10339>
- [18] Zusman, M. (2004). Mechanisms of musculoskeletal physiotherapy. *Physical Therapy Reviews*, 9(1), 39–49. <https://doi.org/10.1179/108331904225003973>
- [19] David O Draper, D. K. (2018). effect of low intensity long duration ultrasound on the symptomatic relief of knee osteoarthritis: a randomized, placebo controlled double-blind study. *journal of orthopaedic surgery and research*.
- [20] Gebrimethin Haile, T. T. (2021). effectiveness of ultrasound therapy on management of chronic non-specific low back pain: A systemic review. *journal of pain research*, 1251-1257.
- [21] Nmachukwu Ifeoma, E. a. (2019). effects of ultrasound therapy on pain intensity of patients with knee osteoarthritis- A systematic review of evidence. *African journal of health sciences and technology*, 61-68.
- [22] SYED Naveed Mumtaz, S. H. (2017). role of ultrasound therapy in osteoarthritis knee. *Pak Armed Force*
- [22] Hudson, R., Richmond, A., Sanchez, B., Stevenson, V., Baker, R. T., May, J. ... Reordan, D. (2018). Innovative treatment of clinically diagnosed meniscal tears: A randomized sham-controlled trial of the Mulligan concept “squeeze” technique. *The Journal of Manual & Manipulative Therapy*, 26(5), 254–263
- [23] Rao, R. V., Balthillaya, G., Prabhu, A., & Kamath, A. (2018). Immediate effects of Maitland Mobilization versus Mulligan Mobilization with Movement in osteoarthritis knee—A randomized crossover trial. *Journal of Bodywork and Movement Therapies*, 22(3), 572–579. <https://doi.org/10.1016/j.jbmt.2017.09.017>