

Systematic Review

EFFECT OF MULLIGAN MOBILIZATION ON PROPRIOCEPTION IN OSTEOARTHRITIS OF KNEE JOINT - A SYSTEMATIC REVIEW

ABSTRACT

Background: Osteoarthritis (OA) of the knee is a degenerative disorder that affects the joint which causes pain, stiffness, swelling, muscle weakness, and functional impairments. Proprioception in the OA knee seems to be impaired when compared with the normal counterparts. Manual therapy is one of the hands-on therapies delivered by physiotherapists. However, there is not much information on how manual therapy affects joint proprioception, although some studies show a positive response. Mulligans' mobilization technique is common for spinal and peripheral joints to correct positional faults.

Aim: To systematically identify and to evaluate the effects of mulligan mobilization on the proprioception of the OA knee.

Methods: Various electronic databases like PubMed Central, Medline, Google Scholar, ProQuest and CINAHL are searched from 2001 to 2021. Multiple search criteria were used in the search of relevant articles based on the selection criteria used. Four articles that fit the criteria were taken based on the PEDro Scores of above 5. The two specialists analysed all the papers. The articles which cover mulligans and proprioception of the knee were only selected.

Results: Four articles that fit the criteria were reviewed which demonstrated baseline comparability and reported point estimates and measures of variability.

Conclusion: This systematic review has concluded that the knee joint proprioception was improved with applying the Mulligans manual therapy, whereas the neurophysiological activity is not well understood.

KEYWORDS: Osteoarthritis Knee, Mulligans Mobilization, Joint position sense, Proprioception, Knee joint sense.

INTRODUCTION

Osteoarthritis (OA) is one of the articular disorders in adults over 60 years [1]. It is likely to increase as the age grows. It is the most prevailing condition which causes disability in the elderly population [2]. World health organization (WHO) has stated that about 9.6% of the men and 18.0% of the women above age of 60 years worldwide have symptomatic osteoarthritis. 80% have the limitation of

movements in the joints, and 25% have difficulty performing major daily activities [3]. In India, 22% - 39% of individuals have OA above 60 years [2].

Studies have identified that knee joint is more prevalent in OA compared with other OA joints; it was found that more than 37% above 60 years have OA Knee [4]. OA has multiple etiologies, such as articular cartilage loss, sclerosis over the subchondral region, bone margin hypertrophy, and alterations in the synovial membranes or the joint capsules [5]. Pain and restriction of motion are the common characteristics of OA [6]. Pain in the OA knee may not be related to the radiographic changes. However, severe radiographic changes with no symptoms were also noted [7].

Impairment in the proprioception is recently noted in the OA, and it may be involved as the pathology in the OA progresses [8]. Proprioceptive deficits could cause knee pain and the limitation of the activity in the knee [9]. There are marked proprioceptive deficits noted in the OA knee compared with people of a similar age without degeneration [10].

It was hypothesized that the mechanoreceptors of the articular cartilages get dysfunctional, which are seen in OA knees. This may lead to delayed proprioception in the knee joint. But there is no evidence to confirm the hypothesis [11]. There is an impairment of the proprioception of the joints, which may be due to the articular cartilage degeneration, and quadriceps weakness would cause deficits in the balance [12]. In addition to that, knee OA has a reduction of the mechanical sensory receptors on the knee ligaments and the soft tissues, which would also cause impaired balance [13].

Management of the OA knee has been categorized as conservative and surgical. Commonly traditional measures are used like drugs [14], braces, physiotherapy modalities [15], orthotics, exercise, and lifestyle modifications [16]. Physiotherapy management is focused on pain reduction, improve muscle strength and maintain joint mobility. Electrotherapy modalities usually recommended are transcutaneous electrical stimulation, Interferential therapy, Ultrasound, and Low-level laser. Most of the treatment efficacy of these modalities is not well known [17]. Aerobic exercises, Quadriceps strengthening and resistance play a significant role in strengthening the knee muscles and reducing the disability [18, 19].

Manual therapy is recommended in managing OA knee. It alleviates pain and improves range of motion. Commonly prescribed techniques are glide mobilization, soft tissue massage and high-velocity thrust techniques [20]. However, the evidence concerning its efficiency in managing the OA knee is not systematically observed. Mulligan's mobilization is a type of manual therapy that is used in the management of musculoskeletal conditions. Mulligan's mobilization reduces pain and improves the range of motion in the joint. The rationale discussed is by correcting the positional faults [21].

Several studies have demonstrated a sound effect of manual therapy on reducing pain and the functional disability in OA knee [22, 23]. Furthermore, studies have identified with exercises, and very few have done on the isolated effect of manual therapy [24, 25]. Majority of the literature found pain, range of motion, and functions as their primary outcomes, whereas the proprioception and balance are not well studied. Therefore, this systematic review aims to evaluate the mulligan mobilization on proprioception in the OA knee.

METHODS

The literature search was conducted using electronic databases which include PubMed Central, Medline, Google Scholar, ProQuest and CINAHL and the search was limited only to English. The articles which are published after 2000 were selected. The literature search was conducted using the primary keywords like "OA Knee," "Mulligans manual therapy," "Proprioception," "Knee OA," "Osteoarthritis of the Knee," and "Joint position sense."

There are about 120 full-text articles identified in the national and international journals about the Mulligan's manual therapy, and this systematic review includes the qualified articles following PICOS criteria.

PARTICIPANTS: Age above 45 years and diagnosed with OA knee as per American College of Rheumatology or the radiographic diagnosis of OA Knee [26, 27].

INTERVENTIONS: Mulligans manual therapy or Mulligans manual therapy with exercises or other electrotherapy modalities.

COMPARATORS: Exercise therapy or Electrotherapy or combining [27]

OUTCOME: Proprioception of Knee joint or joint position sense.

STUDY DESIGN: Experimental design or Case study or Case series.

Studies that use outcomes as Pain, Range of motion, or muscle strength are not considered, studies that are not in English are rejected, studies of other joints, and studies not focusing on manual therapy techniques or exercises are not included.

STUDY SELECTION

Database search was done, and the duplicate articles were removed. Two specialists reviewed the articles and made sure that the selected theme is suited for the criteria. During the database search, all sources were evaluated and removed the duplicate publication. Two reviewers looked over the articles to make sure they met the criteria for inclusion. After gaining the necessary text articles, all remaining sources were independently screened for eligibility. The two reviewers' inter-rater reliability was high, at 0.80, and a third reviewer was not considered necessary.

DATA EXTRACTION PROCESS

Two reviewers screened the article based on the prefixed parameters from the articles chosen. The parameters include year of the study, number of participants, study design, study duration, treatment applied, outcome measures, and conclusion. Both reviewers discussed and resolved through discussion if any difference of opinion arises.

QUALITY CONTROL

The independent assessors reviewed the study using the Physiotherapy Evidence Database (PEDro) tool is used to assess the quality of the articles. The Pedro tool is used to analyse the methodological quality with RCTs, with a score ranging between 0 to 10, with a higher score indicating superior quality [28]. Any methodological flaws in the study which display low scores in PEDro were not included.

RESULTS

Four articles were only selected from a group of 120 articles, as there was no much seen in the context of the condition. All the chosen articles with a PEDro score of above five were demonstrated baseline comparability and reported point estimates and measures of variability. The results are mentioned in Table 1.

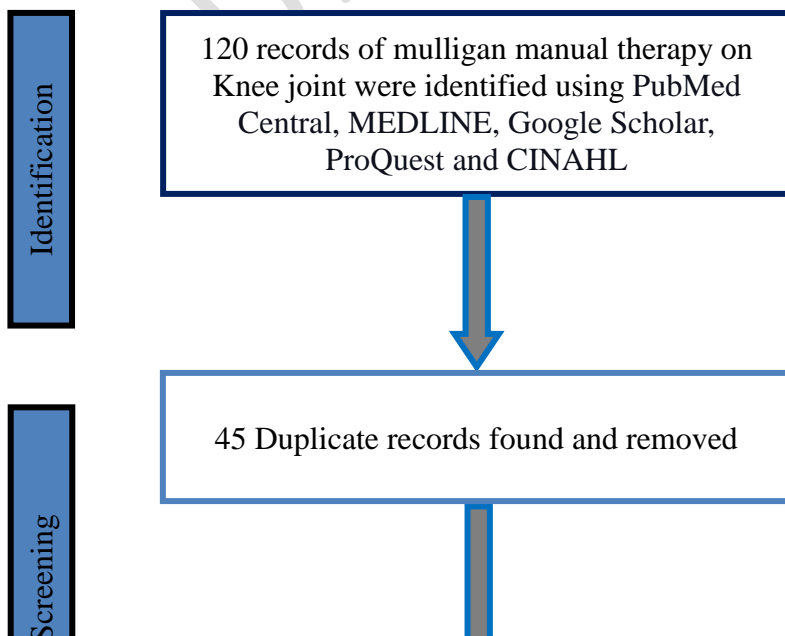


Fig. 1. A PRISMA flowchart illustrating the article selection process for this review

TABLE 1. Summary of the study characteristics of the articles included in this review

S.N	Author/ Year	Groups	No of Participants	Interventions	Duration of treatment	Outcomes	Conclusion
1	Purswani et al., 2021 [29]	Case study	1	Mulligan technique, Joint distraction, and proprioceptive exercises	2 weeks	1) Romberg test 2) NPRS 3) Joint circumference	When treating arthritic cases of the lower extremity, working on proprioception and biomechanics combined should be considered.
2	Jupudi et al., 2017 [30]	Two groups	60	Group A: Mulligan Mobilization with Conventional Group B : Mulligan Mobilization with agility and perturbation exercises	6 weeks	1) Pain (VAS) 2) WOMAC score 3) Goniometer 4) TUG	Mulligan coupled with agility and perturbation exercises is more helpful in enhancing proprioception, strength, range of motion, reducing pain and disability, and developing functional capacity in people with knee osteoarthritis than mulligan itself.
3	Gupta et al., 2015 [32]	Three groups	60	Group A: Proprioceptive + Conventional exercises Group B: Mulligans + Conventional exercises Group C : Proprioceptive + Mulligan + Conventional exercises	2 weeks	1) Proprioceptive Error ROM, 2) Flexion ROM, 3) VAS 4) WOMAC score	Mulligan's Mobilization with Movement (MWM) has been shown to improve knee joint proprioception in osteoarthritis patients.

4	Lalit et al., 201 [33]	Three groups	90 patients	Group A: Maitland mobilization + Conventional exercises Group B: Mulligans + Conventional exercises Group C : Conventional exercises only	1 week	1) VAS 2) WOMAC 3) Proprioceptive testing	Exercises alone can help people with osteoarthritis in improving knee joint proprioception. Exercises alone provide benefits than adding manual therapy approaches.
---	---------------------------	-----------------	-------------	--	--------	--	--

UNDER PEER REVIEW

DISCUSSION

Osteoarthritis of Knee is the most common degenerative disorder in the elderly population. Progression of the OA knee is likely to be caused by increasing the loads in the articular cartilages could cause more damages with remodeling process of cartilage to withstand the loads [34]. Proprioceptive impairments are becoming common cause of the knee pain along with limitation of the activity which is seen in OA knee [35]. Proprioceptive signals arise from the joint, muscles, tendons, and skin which intact the neural control of movements [36].

Numbers of exercise interventions are designed to improve the proprioception on the knee joint as it aids in improvement of the motor recovery [37]. However, there are literatures are on the exercises not on any other form of treatments [38]. Manual therapy has produced a neurophysiological effect in the form of blocking nociception, mechanoreceptors mediated pain gate as spinal cord dorsal horn [39]. Mulligan's gliding techniques which involves the passive accessory glides also correct the positional faults [40].

This study on systematic review revealed substantial concepts on the improvement of proprioception on the OA knee. It also identified that the mulligans aids in improvement of the joint sense along with the improvement of the range of motion and the pain reduction. Most of the articles focus on the functional abilities or the pain or movements.

Study conducted by the Lalit et al., 2012, stated that the mulligans mobilization improves the proprioception may be due to sedation of the agitated, facilitated nervous system, particularly on the dorsal horn by bombarding it with the painless normality. They also concluded that the exercises along with manual therapy would be significant in improving position sense than manual therapy alone [33].

Mulligans mobilization with movement stimulates the mechano-receptors and reduces the pain perception which leads to reorganization of the movement. Pain free movement diminishes the fear of movement and enables the patient to do the movement well and also improves the position sense of the joint [31]. Study done by Gupta et al., 2015 [32], has identified that Mulligan's group decreases pain and improvement in the function is due to the alteration in the alignment of the bone and the joint. The correction of the joint alignment would improve the joint position sense in OA knee.

Jupudi et al., 2017, explained that the mulligans stimulate the golgi tendon organ and muscle spindle activity which sends accurate information about the joint position and reduce the perturbations [30]. They also concluded that mulligans mobilisation with agility and perturbation exercises are improving proprioception, range of motion and pain reduction in knee osteoarthritis. Even though the appropriate mechanism of Mulligan's was not well addressed on the improvement of the proprioception, however the researches has posed that the correction of the positional fault would be the mechanism on the improvement of the joint position sense [20].

LIMITATIONS OF THE STUDY

This systematic review has only three research articles and one case study was included, which is one of the limitations.

CONCLUSION

This systematic review indicated that Mulligan's mobilization has provided virtuous improvement in the knee joint proprioception in addition to the pain reduction or improvement of functional ability. It is clear from these articles that proprioception is well improved by application of the mulligan manual therapy. The superiority of these interventions over other treatment methods is still up for debate. However, more studies need to be analyzed and more studies need to be conducted to identify the appropriate effectiveness of the mulligan mobilization. Furthermore, there is no long term follow up in there which needs to be addressed.

CONSENT

Not applicable.

ETHICAL APPROVAL

Not applicable.

REFERENCES

- 1) Felson DT, Lawrence RC, Dieppe PA, et al. Osteoarthritis: new insights. Part 1: the disease and its risk factors. *Ann Intern Med.* 2000;133(8):635–46
- 2) Pal CP, Singh P, Chaturvedi S, Pruthi KK, Vij A, Epidemiology of knee osteoarthritis in India and related factors. *Indian J Orthop.* 2016;50:518-22
- 3) Symmons D, Mathers C, Pflieger B. Global Burden of Osteoarthritis in year 2000: Global burden of disease 2000 study. *World health report.* 2002;5 Version 2.
- 4) Lawrence RC, Felson DT, Helmick CG, et al. Estimates of the prevalence of arthritis and other rheumatic conditions in the United States. Part II. *Arthritis Rheum.* 2008;58(1):26–35.
- 5) Zhang Y, Jordan JM. Epidemiology of osteoarthritis [published correction appears in *Clin Geriatr Med.* 2013 May;29(2):ix]. *Clin Geriatr Med.* 2010;26(3):355-369.
- 6) Hunter DJ, McDougall JJ, Keefe FJ. The symptoms of osteoarthritis and the genesis of pain. *Rheum Dis Clin North Am.* 2008;34(3):623-643. doi:10.1016/j.rdc.2008.05.004
- 7) Heidari B. Knee osteoarthritis prevalence, risk factors, pathogenesis and features: Part I. *Caspian J Intern Med.* 2011;2(2):205-212.
- 8) Skinner HB, Barrack RL, Cook SB. Age-related decline in proprioception. *Clinical Orthopedics.* 1984;184:208–11.
- 9) VanDijk G.M., Dekker J, Veenhof C, van den Ende C.H. Course of functional status and pain in osteoarthritis of the hip or knee: a systematic review of the literature. *Arthritis Rheum.* 2006; 55: 779-785.
- 10) Hurley MV, Scott DL. Improvements in quadriceps sensorimotor function and disability of patients with knee osteoarthritis following a clinically practicable exercise regime. *Br J Rheumatol.* 1998;37(11):1181–7.

- 11) Hurley MV. The effects of joint damage on muscle function, proprioception and rehabilitation
Man Ther, 1997; 2 (1) : 11-17
- 12) Hunt MA, McManus FJ, Hinman RS, Bennell KL. Predictors of single-leg standing balance in individuals with medial knee osteoarthritis. *Arthritis Care Res (Hoboken)* 2010;62:496–500.
- 13) Pandya NK, Draganich LF, Mauer A, Piotrowski GA, Pottenger L. Osteoarthritis of the knees increases the propensity to trip on an obstacle. *ClinOrthopRelat Res.* 2005;431:150–156.
- 14) Bruhlmann P., Micheal B.A. Topical diclofenac patch in patients with knee osteoarthritis. *ClinExpRheumatol.* 2003;21:193–198.
- 15) Christensen R., Astrup A., Bliddal H. Weight loss; treatment of choice for knee osteoarthritis. *OsteoarthrCartil.* 2005;13:20–27.
- 16) Crawford DC, Miller LE, Block JE. Conservative management of symptomatic knee osteoarthritis: a flawed strategy?. *Orthop Rev (Pavia).* 2013;5(1):e2. doi:10.4081/or.2013.e2
- 17) Bjordal J.M., Johnson M.I., Lopes Martins R.A.B., Bogen B., Clow R., Ljuggren A.E. Short term efficacy of physical interventions in osteoarthritic knee pain. Systematic review and meta-analysis of randomized placebo-controlled trials. *BMCMusculoskeletDisod.* 2007;8:51.
- 18) Page C.J., Hinman R.S., Bennell K.L. Short term beneficial effects of exercise on pain and function. *Int J Rheum Dis.* 2011;14(2):145–151.
- 19) Peungsuwan P., Sermchap P., Hanmontree P., Eungpinichpong W., Puntumetaka R., Chatchowan U. The effectiveness of Thai exercise with traditional massage on the pain, walking ability and quality of life of older people with knee osteoarthritis. A randomized controlled trial in the community. *PhysTher Sci.* 2014;26:139–141
- 20) Anwer S, Alghadir A, Zafar H, Brismée JM. Effects of orthopaedic manual therapy in knee osteoarthritis: a systematic review and meta-analysis. *Physiotherapy.* 2018 ;104(3):264-276. doi: 10.1016/j.physio.2018.05.003. Epub 2018 Jun 2. PMID: 30030035.
- 21) Westad K, Tjoestolvsen F, Hebron C, The effectiveness of Mulligan’s mobilization with movement (MWM) on peripheral joints in musculoskeletal (MSK) conditions: a systematic review,” *Musculoskeletal Science and Practice.* 2019; 39: 157–163.
- 22) Abbott JH, Robertson MC, Chapple C, Pinto D, Wright AA, Leon dela Barra S, *et al.* Manual therapy, exercise therapy, or both, in addition to usual care, for osteoarthritis of the hip or knee: a randomized controlled trial. 1: clinical effectiveness. *Osteoarthritis Cartilage.* 2013;21(4):525–34,
- 23) Jansen MJ, Viechtbauer W, Lenssen AF, Hendriks EJ, deBie RA. Strength training alone, exercise therapy alone, and exercise therapy with passive manual mobilization each reduce pain and disability in people with knee osteoarthritis: a systematic review. *J Physiother.* 2011;57(1):11–20,
- 24) Deyle GD, Henderson NE, Matekel RL, Ryder MG, Garber MB, Allison SC. Effectiveness of manual physical therapy and exercise in osteoarthritis of the knee. A randomized, controlled trial. *Ann InternMed.* 2000;132(3):173–81.
- 25) Ottawa panel evidence-based clinical practice guidelines for therapeutic exercises and manual therapy in the management of osteoarthritis. *PhysTher.* 2005;85(9):907–71.

- 26) Altman R, Asch E, Bloch D, Bole G, Borenstein D, Brandt K, *et al.* Development of criteria for the classification and reporting of osteoarthritis: classification of osteoarthritis of the knee. Diagnostic and Therapeutic Criteria Committee of the American Rheumatism Association. *Arthritis Rheum.* 1986;29(8):1039–49
- 27) Belo JN, Berger MY, Koes BW, Bierma-Zeinstra SM. The prognostic value of the clinical ACR classification criteria of knee osteoarthritis for persisting knee complaints and increase of disability in general practice. *Osteoarthritis Cartilage.* 2009;17(10):1288–92, <http://dx.doi.org/10.1016/j.joca.2009.04.002>.
- 28) Da Costa BR, Hifiker R, Egger M. PEDro's bias: summary quality scores should not be used in meta-analysis. *J Clin Epidemiol.* 2013;66(1):75–7, <http://dx.doi.org/10.1016/j.jclinepi.2012.08.003>.
- 29) Purswani S, Dass B, Chitpure T, Malani R, Effect of Manual therapy with proprioception training in patient with osteoarthritis knee with pedal odema. A case reports. *Annals of RSCB.* 2021; 25(4): 17122—17127.
- 30) Jupudi M, Kumar S, Mohan L, Effect of Mulligan's mobilization adjunct to agility and perturbation exercises in subjects with knee osteoarthritis. *IJARND.* 2017;2(11):58—64.
- 31) Demirci S, Kinikli GI, Callaghan MJ, Tunay VB. Comparison of short-term effects of mobilization with movement and Kinesiotaping on pain, function and balance in patellofemoral pain, *ActaOrthopTraumatolTurc.* 2017. <https://doi.org/10.1016/j.aott.2017.09.005>
- 32) Gupta RK., Heggannavar A, Quantitative effects of proprioceptive exercises and mulligan's MWM in subjects with osteoarthritis knee- A randomized controlled trial. *International Journal of Therapies and Rehabilitation Research* 2015; 4 (4): 191-200
- 33) Lalit SY, Suhas MB, Amita M, Effect of Manual Therapy Techniques on Knee Proprioception in Patients with Osteo-arthritis of Knee. *IJOPT,* 2012; 6(3): 285—290.
- 34) Arthur Prochazka, Proprioception: clinical relevance and neurophysiology, *Current Opinion in Physiology,* 2021; 23.
- 35) Pai YC, Rymer WZ, Chang, Sharma L, Effect of age and osteoarthritis on knee proprioception. *Arthritis Rheum,* 1997; 40: 2260—2265.
- 36) Dechaumont-Palacin S., Marque P., De Boissezon X., Castel-Lacanal E., Carel C., Berry I., *et al.*, Neural correlates of proprioceptive integration in the contralesionally hemisphere of very impaired patients shortly after a subcortical stroke: an FMRI study. *Neurorehabil. Neural Repair.* 2008; 22, 154–165. [10.1177/1545968307307118](https://doi.org/10.1177/1545968307307118)
- 37) Dietz V. Proprioception and locomotor disorders. *Nat. Rev. Neurosci.* 2002; 3, 781–871. [10.1038/nrn939](https://doi.org/10.1038/nrn939)
- 38) Aman JE, Elangovan N, Yeh IL, Konczak J. The effectiveness of proprioceptive training for improving motor function: a systematic review. *Front Hum Neurosci.* 2015;8:1075. [doi:10.3389/fnhum.2014.01075](https://doi.org/10.3389/fnhum.2014.01075)
- 39) French, H.P., Brennan, A., White, B., Cusack, T. Manual therapy for osteoarthritis of the hip or knee - a systematic review. *Man. Ther.* 2011;16 : 109–117. <https://doi.org/10.1016/j.math.2010.10.011>

- 40) Bhagat, M., Neelapala, Y.V.R., Gangavelli, R. Immediate effects of Mulligan's techniques on pain and functional mobility in individuals with knee osteoarthritis: A randomized control trial. *Physiother. Res. Int. J. Res. Clin. Phys. Ther.*2020; 25: e1812.

UNDER PEER REVIEW