

Effect of Kaltenborn Traction versus Mulligan Mobilization with Movement as an adjunct to Conventional Exercise on Pain and Functions in Knee Osteoarthritis

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Abstract: Aim: To compare effect of Kaltenborn Traction and Mulligan Mobilization with Movement (Mulligan MWM) along with Conventional Exercise on Pain and Functions in Knee Osteo Arthritis (OA) Patients. Design: A Randomized controlled Study. Methods: 60 knee OA patients diagnosed and fulfilling inclusion/exclusion criteria were randomly allocated into two groups (A and B), where Group A (n=30) received Kaltenborn Traction and Conventional Exercise, where Group B (n=30) received Mulligan MWM and Conventional Exercise. Both groups received 3 sessions on alternate days for a week. Patients Outcome Measures Numerical Pain Rating Scale (NPRS) for pain intensity and Modified Short-Form THE Western Ontario and McMaster Universities Osteoarthritis Index (Modified Short-Form WOMAC) for symptoms and functions, were taken before and at the end of 3 sessions of intervention/treatment. Results: Both the groups showed improvement in NPRS and Modified Short-Form WOMAC at end of 3 sessions. In Group A, NPRS score pain significantly reduced ($p < 0.0001$) and Modified Short-Form WOMAC score also improved ($p < 0.0001$). In Group B, NPRS score pain significantly reduced ($p < 0.0001$) and Modified Short-Form WOMAC score also improved ($p < 0.0001$). There was no statistical difference between both the groups on NPRS score ($p = 0.331$) and Modified Short-Form WOMAC score ($p = 0.147$) which is ($p > 0.05$). Conclusion: Both Kaltenborn Traction and Mulligan MWM along with Conventional Exercise are equally effective and any of them can be used to treat knee OA patients to reduce pain and improve function.

Keywords: Physiotherapy for Knee OA, Manual therapy, conservative management for knee OA, exercise therapy, knee OA, Pain management, Musculoskeletal pain

1. Introduction

Among many musculoskeletal condition, Osteo Arthritis (OA) is also condition which needs special attention because of its prevalence and ailment caused by it. (1, 2, 3) Subcommittee on Osteoarthritis of the American Rheumatism Association, Diagnostic and Therapeutic Criteria Committee defined OA as “a heterogeneous group of conditions that lead to joint symptoms and signs which are associated with defective integrity of articular cartilage, in addition to related changes in the underlying bone and at the joint margins.” (4) Joint pain and loss of joint functions are most common feature of OA. (5)

In 21st century, the global prevalence of knee OA is increasing. Prevalence rate is 16 % in patient aged 20 or above and 22% in patient aged 40 or above, prevalence and incidence increase with age. At continent level, the overall prevalence of knee OA in Asia is 19%. At country level, the prevalence rate of knee OA in India is 21%. (3) The characteristic structural changes in OA include the progressive loss of articular cartilage, increased subchondral plate thickness, formation of new bone at the joint margins (osteophytes) and the development of subchondral bone cysts. (6)

The major elements of the diagnostic evaluation of knee OA are the history, physical examination, imaging studies. Laboratory testing is not so significant in knee OA diagnosis. The major X-Ray findings of OA include

narrowing of the joint space, subchondral bone sclerosis, osteophytes and subchondral bone cyst. (5)

Current management modalities for knee OA are targeted towards symptom control unless the degree of severity dictates the necessity of surgical intervention. (7) So, initially treatment includes patient education, analgesics, exercise, lifestyle modification and if these interventions doesn't help then and then surgical option specific to patient shall be intervened. (8) Physiotherapy has proved to be useful in helping knee OA patients with pain and mobility. (9)

The aim of physiotherapy treatment is to reduce knee joint load, improve range of motion, correct malalignment of lower limb, improve neuromuscular function and hence manage symptoms of OA and improve functions of patients. (10) Physiotherapy interventions includes various exercises (strengthening, flexibility, aerobics, proprioception, neuromuscular training), electrotherapy and electrophysical modalities and manual therapy in managing knee OA. (11, 12)

Manual therapies are hands-on technique and used to correct structure of body, such as joints, soft tissues and nerve tissues. Various techniques of Manual therapies have shown positive short-term effect on pain reduction and improve functions of patients with knee OA. Patients with Knee OA are most likely to be benefited from combination of manual physical therapy & exercise and without any adverse effect. (11)

Volume 12 Issue 3, March 2023

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Traction creates a distraction effect on joint, which increases the joint space. Kaltenborn traction is one of the manual therapy technique which is useful for treating pain in musculoskeletal condition and also proven effective in knee OA. ⁽¹³⁾ The gradation of Kaltenborn traction are as follows: (Grade 1-Small amplitude traction is applied where no stress is placed on the capsule, it is used for pain relief. Grade 2-Enough traction is applied to tighten the tissue around the joint, it is used for initial treatment to determine how sensitive the joint is and once the joint reaction is known the treatment dosage is increased or decreased or maintained accordingly. Grade 3-Large amplitude traction to place stretch on joint capsule and surrounding peri-articular structure, it is used to stretch the joint structure and thus increase jointplay.) The primary treatment effect is to stretch the periarticular soft tissues, increased mobility of hypo mobile joints and overall distraction at the narrowed medial joint space. ^(13, 14)

“Mulligan Mobilization With Movement (Mulligan MWM) is the application of sustained passive accessory glide during to a joint while patient perform movement which was previously found to be problematic. ” ⁽¹⁵⁾ Few high qualities studies have found Mulligan MWM is effective in pain reduction and improving functions, have studied immediate and short-term effect in knee OA. (16, 17, 18, 19)

There are very few studies who have done comparison between the different manual therapies along with conventional exercises in knee OA patients. So, the objective of this study was to determine which manual technique Kaltenborn Traction or Mulligan MWM when given along with conventional exercises protocol which is more effective in knee OA patients on pain reduction and improving functions.

2. Methods

Design and Participants: This study is a Randomized Controlled study. A Group of patients who received Kaltenborn Traction and Conventional Exercise were compared to Group of patients who received Mulligan MWM and Conventional Exercise. Inclusion criteria were 1) Age ranging from 45-70 years. ⁽¹⁷⁾ 2) Fulfilling American College of Rheumatology (ACR) clinical/radiographical criteria ⁽²⁰⁾ – [At least one of the following three items along with osteophyte in knee X-ray-> (Age> 50 years old, Morning stiffness <30 minutes, Crepitus on knee motion)]. Exclusion criteria were 1) Knee or lower limb surgery 2) Had reported any corticosteroid use within past 6 months (orally or intraarticular in knee joint) ⁽¹⁶⁾ 3) Associated with any other pathology like:-Fracture, bursitis, backache, radiating pain to the leg 4) Any contraindication to manual therapy. ⁽²¹⁾ From June 2021-April 2022, 67 patients who met the inclusion/exclusion criteria were consented and recruited for the study. Out of 67 patients, 60 patients completed the intervention (30 in each group) and were included in Analysis. Demographic characteristics of patients in both groups are presented in table 1 & 2. Approval was obtained by Institutional Ethics Committee for Biomedical and Health Research (IECBHR), Medical college no. IECBHR/84-2021 and SSG Hospital, Baroda.

Outcome measures: Numerical Pain Rating Scale (NPRS) Score and Modified Short-Form WOMAC Score was taken at baseline and at end of intervention (i. e., after 3 sessions).

Description of NPRS: The NPRS (ICC =0.88) is uni-dimensional measure of pain intensity, in which a patient selects a whole number (0-10 integers) that best reflects the integrity of their pain. The patient is asked to make average pain ratings felt by the patient. ^(22, 23)

Description of and Modified Short-Form WOMAC: Short form WOMAC scale was given Whitehouse et al for total hip and knee replacement. Studies had proven Modified Short Form WOMAC scale is equally reliable and valid as traditional WOMAC scale in evaluating knee OA (which is managed conservatively). Patient is asked to circle on a scale of 0-4 for each item that best relates to their experience of pain, stiffness and functional activity. Internal consistency: (Cronbach’s alpha: 0.92 to 0.97), Validity is found to be Good. ⁽²⁴⁾

Procedures: Consent was taken and explanation about study intervention was given to the patient prior to enrolment in the study. A clinical history and complete physical and functional physiotherapy examination was done in each case. Patient were randomized using lottery method.

Group A: was given Kaltenborn Traction and Conventional Exercise Group B: was given Mulligan MWM and Conventional Exercise

Both groups received intervention for 1 week which includes 3 sessions on every alternate day. Total 67 patients were enrolled in study, and final analysis was done on 60 patients due to loss of follow up.

Intervention: GROUP A was given Kaltenborn Traction along with conventional exercises.

Kaltenborn Traction (25, 21): The patient sits on the plinth with knee over the edge, the knee is positioned in its resting position (i. e., 25 degrees of knee flexion) passively by the therapist. Pull on the long axis of the tibia to separate the joints surfaces. Therapist gave Grade-2 traction with both the hands, for 3 cycles (one cycle consist of 10 seconds traction and 5 seconds rest). If pain decreased therapist gave treatment in same position with Grade-2 only. If pain increased, therapist decreased the dosage to Grade-1 and gave treatment with Grade-1 in same position.

One set consists of 6 cycles of traction and total 3 sets were given in one session as a treatment.

Conventional Exercises (7): Isometrics Quadriceps Setting – (instructions-press on towel placed below your knee, with knee muscle by making it tight and hold for 10 secs, 3 sets and 10 repetitions for each leg), **Straight leg raise** – (instructions-raise your leg straight by keeping knee extended, 2 sets and 10 repetitions for each leg), **Hip abduction in side lying** – (instructions-raise your leg by straight keeping knee extended, 2 sets and 10 repetitions for each leg), **Last degree knee extension** – (instructions-straighten/extend your knee on extension board, 2 sets and

10 repetitions for each leg), **Self-stretching of hamstrings muscle** – (instructions-touch your toes with hands, by keeping knee straight/extended, 30 seconds hold and 10 seconds rest, 5 repetitions for each leg), **Mini Squats** – (instructions-squat down, 1 set and 15 repetitions).

GROUP B was given Mulligan MWM along with conventional exercises.

Mulligan MWM (15, 18, 19, 12): MWM consisted of sustained manual glide of tibia (either medial, lateral, anterior, posterior or rotation) during active knee flexion and extension. If patient complains of pain in supine lying (non-weight bearing position), the assessment and treatment had been done in supine lying. Glides was assessed in following order: frontal plane (medial/lateral) glides, sagittal plane (anterior/posterior), and then transverse Plane (internal/external rotation) for 3 repetitions each. Glides which reduced pain to minimum level was chosen for MWM treatment. If patient had pain in supine position glides was assessed in weight bearing position in same order as mention in supine lying. In the treatment, therapist kept patients knee in mid-range position passively and tied the belt around ankle and ask the patient to hold the end of the belt with hands. The glide was given from mid-range position of knee, then glide was sustained while patient performs full range of flexion and extension of knee with the help of belt.

One set consisted of 10 repetitions of Mulligan MWM glide and total 3 sets were given in one session as a treatment.

3. Results

Statistical Analysis

Data analysis was done using MedCalc statistical software Version 18.2.1 (trial version); Microsoft word and Excel have been used to generate graphs and tables.

Table 1: Baseline Characteristics

Characteristics	Variables	Group A %	Group B %
Total	N	30	30
Gender	Male	5 (17%)	7 (23%)
	Female	25 (83%)	23 (77%)
Unilateral Or Bilateral Involvement	Unilateral	16 (47%)	17 (57%)
	Bilateral	14 (53%)	13 (43%)

Table 2: Baseline Characteristics

Characteristics	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Age	53.76	6.79	55.16	9.71	=0.5
NPRS Score	6.23	2.0	5.6	1.4	=0.16
Modified Short – Form WOMAC Score	31.76	6.84	28.93	8.22	=0.15

Both the groups are found to be homogenous and are therefore comparable.

Intra-Group Comparison

Paired t test was used to compare the Scores of NPRS and Modified Short-Form WOMAC.

Table 3: Intragroup Comparison of NPRS Scores Pre and Post Intervention

	NPRS			
	Group A		Group B	
	Pre-Score	Post-Score	Pre-Score	Post-Score
N	30	30	30	30
Mean	6.23	1.6	5.6	1.3
SD	2.01	1.22	1.4	1.15
T Value	18.77		28.15	
P Value	P<0.0001		P<0.0001	

The p-value obtained is <0.0001. Thus, there was significant difference in NPRS Score in both groups at 99% confidence interval.

Table 4: Intragroup Comparison of Modified Short-Form WOMAC Scores Pre and Post Intervention

	Total WOMAC Score			
	Group A		Group B	
	Pre-Score	Post-Score	Pre-Score	Post-Score
N	30	30	30	30
Mean	31.76	10.33	28.93	8.47
SD	6.84	3.50	8.22	4.11
T Value	24.70		18.98	
P Value	p<0.0001		p<0.0001	

The p-value obtained is <0.0001. Thus, there was significant difference in Modified Short-Form WOMAC Scores in both groups at 99% confidence interval.

Inter Group Comparison

Table 5: Intergroup Comparison of NPRS Scores

	NPRS Score	
	Group A	Group B
N	30	30
Mean	1.6	1.3
SD	1.22	1.15
P Value	P=0.331	

Difference between two observations was taken to compare the improvement between both the groups. P-value obtained was 0.331 at 95% confidence interval which shows no significant difference.

Table 5: Intergroup Comparison of Modified Short-Form WOMAC Scores

	Modified Short-Form WOMAC Score	
	Group A	Group B
N	30	30
Mean	10	8.46
SD	3.97	4.1
P Value	P = 0.147	

P-value obtained was 0.147 at 95% confidence interval which shows no significant difference between both the groups.

4. Limitations

Short duration of intervention that is clinical outcomes didn't completely improve, hence duration of intervention and total session for complete recovery is not known. Study was done on small sample size. Hence, difficult to generalize the result to the whole population. Follow up of

patients was not maintained after the intervention; hence long-term benefits of intervention were not known. Nowadays knee OA occurs in young age group as well, patients <45 years of age were not included in study.

5. Discussion

This study consisted of two groups; Group A (Kaltenborn Traction) and Group B (Mulligan MWM). Group A were given Kaltenborn Traction in addition to Conventional Exercises and Group B were given Mulligan MWM in addition to Conventional Exercises. Treatment was given for 3 sessions on alternative days for 1 week, pain and functions were assessed at baseline and after 1 week. There were no significant differences in outcomes of both the groups. Both the groups showed equal reduction in pain (NPRS) and improvement in Functions (Modified Short-Form WOMAC).

In present study there was significant reduction in pain in both the groups, mean NPRS difference in group A it was -4.63 and in group B it was -4.3, which is more than minimally clinically important changes in chronic musculoskeletal pain intensity on NPRS scale (-1 is minimum and -2 is "much better" improvement).⁽²⁶⁾ In present study, NPRS change in both the groups was much more than the change in same conventional exercises group of [Sathiyavani Dhanakotti study]⁽⁷⁾.

In present study there was significant improvement in Modified Short-Form WOMAC in both the groups (in Group A 31.76+/-6.84 to 10.33+/-3.5 and in Group B 28.93+/-8.22 to 8.47+/-4.11). In present study, modified short-form WOMAC change in both the groups was much more than the change in same conventional exercises group of [Sathiyavani Dhanakotti study]⁽⁷⁾ significant improvement in both the outcomes than outcomes of [Sathiyavani Dhanakotti study]⁽⁷⁾ which is due to the additional effect of manual therapy techniques given in both the groups in present study.

Possible reason for no difference observed between Kaltenborn Traction and Mulligan MWM is the mechanism by which it works on knee OA patients. Mechanical force is driven by manual therapy, Mechanical Change and Neurophysiological Responses are produced due to it. Mechanical change produced by Kaltenborn Traction is joint distraction⁽¹³⁾ and by Mulligan MWM is malalignment correction⁽²⁷⁾, these two responses are different but there is no difference in outcomes observed in present study. Hence this Mechanical change mechanism is found to be less reliable which also correlates with the mechanism model given by [Bialosky⁽²⁸⁾]. Neurophysiological Responses is the possible mechanism for pain reduction and improving functions after the manual therapy techniques as stated in many studies.^(11, 28, 29) Neurophysiological Responses occurs from both the peripheral and central nervous systems. The peripheral system – mediated responses results from inflammatory changes and pain relief mediators.⁽¹¹⁾ The central nervous system responses results from supraspinal inhibitory pain mechanisms modulating pain from higher centers.⁽²⁸⁾ Such responses is observed by manual therapy in many studies, although same responses doesn't seem to be delivered by sham or control or exercise or other

intervention.^(13, 17-19)

The findings of present study, Group A are consistent with findings of Antony Aseer study in which they have given six session in 1 week of Kaltenborn Traction in addition to conventional exercises in knee OA patients.⁽¹³⁾ Group B findings are consistent with findings of Takasaki study in which they have given Mulligan MWM independently for 3 sessions but with 2-3 days break and in present study only 1 day break is given, and has shown significant improvement following MWM.⁽¹⁸⁾

To the best of our knowledge, this was first randomized control trial comparing Kaltenborn Traction and Mulligan MWM in addition to conventional exercises. And thus, the findings can't be compared to any other same study. Knee OA patients were randomly allocated in two groups, to know the possible mechanism as stated by Bialosky model. There was no difference in age distribution, gender distribution and UL BL knee OA patient distribution in both the groups.

Funding

No funds were used for this research work.

Acknowledgements

The author would like to thanks Parents and Ancestors for their struggles and sacrifices for giving me this chance to grow and learn. Much gratitude to all the books, lessons, authors, journals and researchers for sharing their knowledge. And gratitude to each of the patients who participated in this study and every other patient who has been source of the learning. May each of stay healthier throughout life and achieve their aspirations. And would like to thank my guide Dr. Sweta Shah, all professors and tutors of Government college of Physiotherapy for their generous guidance. Thanks to Orthopedic Residents and Biostatistics Residents for your help whenever needed. And to all the seniors and juniors who helped in completion of this study.

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