



Original Article

Effectiveness of Tibio-Femoral Manual Traction and Tibial Rotation in Patients with Knee Osteoarthritis For Improving Pain and Functional Abilities: A Comparison of Two Mobilization Techniques

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ABSTRACT

Knee osteoarthritis (KOA) is becoming an increasingly evident cause of pain and functional disabilities throughout the world, especially in women. It is a degenerative disease leading to changes in the kinetic chain of the lower limb. The role of manual therapy to treat this condition is under the least discussion; especially the practice of Mulligan's concept of manual therapy in the improvement of this condition is almost negligible in Pakistan. **Objective:** To compare the effectiveness of two different mobilization techniques:--tibia-femoral manual traction and tibial rotation in patients with KAO for improving pain and functional abilities. **Methodology:** This quasi-experimental study with a duration of 3 months was conducted after approval from the concerned institutes of study. A sample size of 42 was calculated using G power software for experimental sample size estimation. Participants with grade II-III OA, medial side knee OA, at least one symptomatic knee, and stiffness in the knee were included, whereas participants with recent knee injury, knee strain, congenital knee deformity and previous knee surgery were excluded from the study. The data was collected after taking informed consent from the participant. Participants of study were divided into two groups, 21 group A OA patients received mobilization with tibio-femoral manual traction intervention, while 21 group B patients received mobilization with tibial rotation. Two outcome measurement tools were used. Data regarding pain was gathered through McGill pain questionnaire, whereas data related to functional abilities was collected using WOMAC osteoarthritis index. **Results:** Mean improvement in pain of Group A is 12.10±7.25 and Group B is 11.71±6.82 with P-value=0.862. Whereas improvement in functional abilities in group A is 10.62±.97 and Group B is 35.68±10.68 with P-value= <0.001. **Conclusion:** Mobilization with tibio-femoral manual traction and tibial rotation were equally effective in improving pain. Whereas both techniques were effective in improving functional abilities but mobilization with tibial rotation is more effective as compared to mobilization with tibio-femoral manual traction.

INTRODUCTION

As a noticeable cause of pain and disability, osteoarthritis (OA) is becoming increasingly evident in both developed and underdeveloped countries. Over the age of 55 years, 44% to 70% of individuals are seen to have radiological changes with characteristics of OA and this ratio peaks at 85% with increasing age up to 75 years. The known age for the onset of osteoarthritis development is 50 to 60 years. Knee osteoarthritis (KOA) is known to be the most

significant and ordinary form of arthritis that is affecting millions of people these days [1]. In the middle and older aged subjects, wear and tear of articular cartilage is one of the most important etiological features of KOA [2]. Repetitive use of knee, repetitive knee bending and lifting heavy labor probably increases the likelihood of KOA. OA is acknowledged as chief source of suffering and disability owing to medical as well as surgical intervention and

persistent absence from work which altogether leads to increased socioeconomic cost [3]. OA contributes to increased inconvenience with stair climbing and walking than any other disease and represents as the most usual basis for KOA. Due to the longer working periods in careers and considerable prevalence of OA in middle-aged person, OA leads to reduction in the time given to work and ultimately leads to early retirement [1]. A commanding symptom in OA is pain. Patients with OA has remarkably lower pain pressure threshold (PPT) [4]. Quadriceps strength is strongly linked with knee discomfort as well as participation in society and has principal therapeutic association even when other causative factors are taken into account [5]. Persons with mild knee pain because of KOA have reduced quality of life that is estimated by the pain severity and experience mechanical (but not thermal) hyper-algesic. For individuals who are not still applicants for joint replacement, pain management is designated as a way to improve the quality of life among those individuals [6]. Progression of existing OA and onset of OA at adjacent joints to the knee is due to increased loading rate in lower extremity. Patient tend to adopt an abnormal gait pattern in attempt to unload damaged structures during walking probably by altering moments at adjacent ankle and / hip joint leading to disability [7]. For self-reported awkwardness in carrying out task of lower and upper extremity function, knee pain severity is a most profound risk factor for OA [8]. KOA is prime root of ailment in senior fellows. Load dispensation at knee is influenced by hip, knee, ankle positioning. Various alignment expands threats of medial side OA and valgus sequences raise the uncertainty of lateral side OA progression in primary KOA and this burden of abnormal alignment anticipates decay in physical function. Combinative protocol containing manual therapy, stretching and strengthening exercise applied to the affected side constitutes of full kinematic chain of lower extremity i.e. Ankle, knee, hip and lumbar segment, and had proved advantageous outcomes in victims with KOA [9]. The trouble with actions that needs ambulation and changing positions from sitting to standing is described by those with KOA. Physical dependence results from the interaction of sickness severity, pain, associated conditions, psychosocial contributors, and shortfall in physical capacity like reduced aerobic exertion ability and lower extremity muscle frailty [10]. Painful and reduced joint play of knee joint, deprivation of strength and motor control which protects the sufferers during carrying out practical tasks like sitting , standing, and walking greatly affects action utility in KOA patients [11]. Well managed by physical therapy in which manual therapy has proven to be a source of ease, KOA is a constant source of knee discomfort. Mobilization with movement (MWM) is

suggested as a potential part of early intervention of KOA, as it is integrated with instant pain relief and improved knee function. Upgrading in the flexion range of motion (ROM) and pain scores in all goals from beginning treatment are noticed as compared to the baseline [12]. A contemporary sort of joint mobilization that includes a therapist applying a painless sustained glide or rotation collaborated with active movement of the limb is a concept of mobilization with movement (MWM) given by Mulligan. In members with KOA, receiving Mulligan mobilization with movement (MMWM), noteworthy betterment regarding knee joint proprioception is statistically eminent [13]. Markedly enhanced pain pressure threshold (PPT), as suggested by the reduced hyper-algesic response to pressure stimulus, pain adjustment that is demonstrated by an overall reduction in deep tissue pressure sensitivity, as well as a decrease in resting pain, is believed to be found with joint mobilization in patients with KOA. Joint mobilization may work by activation of descending pain pathways in patients with painful KOA [14]. MWM with rotation is an effective technique not known by many therapists and mostly practiced by chi practitioners for meniscal injury treatments and KAO. The principal purpose of this technique is to create an opening on side of bone compression which will reduce the pain of the patient. Mulligan Rotation mobilization with movement is performed according to the variability in the patient's condition and patient comfort. For medial side KOA, MWM is performed with tibial external rotation and femoral internal rotation as the patient reports pain relief in this position and is able to perform knee flexion movement passively. For lateral side KOA, tibial internal rotation and femoral external rotation are performed. For treatment of KOA simple MWM technique is used by many physiotherapists but adding tibial rotation to this is something on which work has not been done much more. In foreign countries, chiropractitiners are using this technique but as in Pakistan there are not many trained chiropractitiners so this technique is not performed widely. Physiotherapists are not much aware of this technique and are not incorporating this into the treatment plan for osteoarthritis

METHODS

A quasi-experimental study was done to compare the effectiveness of two mobilization techniques. A total of 42 subjects were included in the study. Participants with grade II-III OA, medial side KOA, at least one symptomatic knee, stiffness in the knee, and willingness to participate were included in the study. Whereas participants with a recent knee injury, knee strain, congenital knee deformity, and ay previous knee surgery were excluded from the study. The data was collected after taking informed

consent from the participant and permission from the ethical board of the respective institute. Participants of the study were divided into two groups, 21 Group OA patients received mobilization with tibiofemoral manual traction intervention for pain and functional abilities. The subject's knee was taken up to the point where the patient feels pain during flexion range of motion. The therapist grasped the patient leg below the knee with both hands, applied grade 2 traction, and repeatedly flexed and extended the knee passively. While 21 group B patients received mobilization with movement (MWM) with tibial rotation for same complaints. Patient was supine lying with therapist standing on affected side of the patient, grasped the lower leg with one hand and femur with other hand and flexed the knee passively to pain limitation. The therapist applied sustained external rotation of tibia on femur and meanwhile passively flexed and extended the knee while maintaining the rotation force. Two outcome measurement tools were used for the purpose of data collection. Data regarding pain was gathered through McGill pain questionnaire whose reliability for sensory is 0.95 and for affective is 0.88. The questionnaire has 3 sub parts of pain rating index, visual analogue scale and scale for pain intensity. While data related to functional abilities was collected using WOMAC osteoarthritis index, reliability of tool for 3 dimensions is Pain: 0.75, 0.81; Stiffness: 0.71, 0.76; Physical function: 0.94, 0.96 respectively. The tool has 3 main dimensions of pain, stiffness and functional abilities which are further divided and make total of 24 items in the questionnaire.

RESULTS

Socio-demographic characteristics of observations are summarized in Table-1. Total 42 subjects were included in the study that were divided equally into two different groups i.e. Group A and Group B. Mean age of subjects in Group A was 46.66 ± 15.56 and in Group B was 57.14 ± 11.77 ($P=0.84$). Out of 21 patients in Group A 9 were hypertensive and 12 were non-hypertensive whereas in Group B 11 subjects were hypertensive and 10 were non-hypertensive ($P=0.537$). Out of 21 subjects in Group A 8 subjects were diabetic and 13 were non-diabetic whereas in Group B 6 subjects were diabetic and 15 were non-diabetic ($P=0.513$). Out of 21 patients in Group A 8 were male and 13 were females whereas in Group B 1 subject was male and 20 were females ($P=0.008$). Out of 21 subjects in Group A 9 subjects were having right sided knee OA, 6 were having left sided knee OA and 6 were having bilateral knee OA whereas in Group B 9 subjects were with right sided knee OA, 7 subjects were with left sided knee OA and 5 subjects were with bilateral knee OA ($P=0.920$). Out of 21 subjects in group A 1 was having grade I OA 16 subjects were having grade II

knee OA and 4 were having grade III knee OA whereas in Group B 3 subjects were having grade I OA, 14 subjects were having grade II knee OA and 4 were having grade III knee OA ($P=0.57$).

Within group comparison of pain: Comparison of pretest and posttest observations for pain within groups is summarized in table 2. Paired sample t-test was applied to compare pre and post-test observations. Mean pain of Group A in pretest measurements was 23.57 ± 9.25 and in posttest measurements was 11.48 ± 5.372 ($P < 0.001$) showing significant improvement in pain with the intervention of Group A (manual traction). Mean pain in Group B for pretest readings was 24.43 ± 8.01 and in posttest reading was 12.71 ± 5.20 ($P < 0.001$) showing significant improvement in pain with the interventions of Group B (tibial rotation)

Within Group Comparison of Functional Abilities: Comparison of pretest and posttest observations for functional abilities within groups is summarized in table 3. Paired sample t-test was applied to compare pre and post-test observations. Mean functional abilities of Group A in pretest measurements was 53.90 ± 15.29 and in posttest measurements was 43.29 ± 12.51 ($P < 0.001$) showing significant improvement in functional abilities with the intervention of Group A (manual traction). Mean functional abilities in Group B for pretest readings was 63.29 ± 9.96 and in posttest reading was 27.43 ± 5.912 ($P < 0.001$) showing significant improvement in functional abilities with the interventions of Group B (tibial rotation).

Between Group Comparison of Pain: A comparison of improvement in pain between groups is summarized in table 4. Independent sample t-test was applied to compare the improvement between groups Mean of difference of pretest-posttest pain measurement in Group A was 12.10 ± 7.25 and in Group B was 11.71 ± 6.82 ($P=0.862$) showing that there was no statistically significant difference in the improvement of pain in both groups and interventions of Group A (manual traction) and Group B (tibial rotation) were equally effective in improving pain.

Between Group Comparison of Functional Abilities: A comparison of improvement in functional abilities between groups is summarized in table 5. Independent sample t-test was applied to compare the improvement between groups Mean of difference of pretest-posttest functional abilities measurement in Group A was 10.62 ± 7.97 and in Group B was 35.68 ± 10.68 ($P < 0.001$) showing that there was a statistically significant difference in the improvement of functional abilities in both groups and intervention of Group B (tibial rotation) was more effective in improving functional abilities as compared to the intervention of Group A (manual traction)

		Group A (manual traction) n= 21	Group B (tibial rotation) n=21	P-value
Age		49.66±15.56	57.14±11.77	0.84
HTN+	Yes	9	11	0.537
	No	12	10	
DM+	Yes	8	6	0.513
	No	13	15	
Gender	M	8	1	0.008
	F	13	20	
Knee Involved	Rt	9	9	0.920
	Lt	6	7	
	Both	6	5	
Grade	I	1	3	0.57
	II	16	14	
	III	4	4	

P-value of ≤ 0.05 is considered statistically significant

Table 1: Socio-demographic profile

Groups	Pretest	Posttest	P-value
Group A (manual traction)	23.57±9.25	11.48±5.372	<0.001
Group B (tibial rotation)	24.43±8.01	12.71±5.20	<0.001

P-value of less ≤ 0.05 is considered statistically significant

Table 2: Within group comparison of pain

Groups	Pretest	Posttest	P-value
Group A (manual traction)	53.90±15.29	43.29±12.51	<0.001
Group B (tibial rotation)	63.29±9.96	27.43±5.912	<0.001

P-value of ≤ 0.05 is considered statistically significant

Table 3: Within group comparison of functional abilities

	Improvement in Group A	Improvement in Group B	P-value
Improvement in pain	12.10±7.25	11.71±6.82	0.862

P-value of ≤ 0.05 is considered statistically significant

Table 4: Between group comparison of pain

	Improvement in group A	Improvement in Group B	P-value
Improvement in functional abilities	10.62±7.97	35.68±10.68	<0.001

P-value of ≤ 0.05 will be considered statistically significant

Table 5: Between group comparison of function abilities

DISCUSSION

The objective of the study was to compare two mobilization techniques to determine which of these is more effective in improving pain and functional abilities. The 2 types of these were mobilization with tibiofemoral manual traction and mobilization with tibial rotation. The results of the study demonstrate that mobilization with tibiofemoral manual traction and mobilization with tibial rotation are equally effective in improving pain whereas mobilization with tibial rotation is more effective for improving functional abilities as compared to tibiofemoral manual traction. The mechanism by which manual therapy reduces pain is already evident in the literature. Activation of descending pain pathway plays an important role in the reduction of pain being experienced by a person with KAO [14]. Local, as well as hypo-algesic effects, are produced by accessory joint mobilization in patients with KAO. As both techniques were the type of manual therapy, one providing traction to the knee joint and other providing tibial rotation to the knee, physiologically both techniques have same mechanism in reducing pain as mentioned above. Mechanically and clinically, both the techniques create a temporary space in the joint as the therapist holds the traction and rotation applied to the knee for some seconds, during the pain receptors in the joints tend to be under continuous pressure due to reduced joint space are relaxed thus reducing the experienced existing pain and discomfort. The same is the result of the study conducted as evident physiologically, mechanically, and clinically that both the techniques are equally effective in improving pain. In patients with KAO alignment of the bones is affected in later stages of arthritis in grades II & III. Medial KAO increases in the risk of varus knee deformity and space on the medial side are reduced and there is an opening on the lateral side, and the kinetic chain of the lower extremity is affected as a whole [9]. Fixed flexion deformity is also a risk in patients with KAO as the soft tissues are also involved along with the bones thus decreasing the joint range of motion [12]. Physiologically, as both the techniques of mobilization reduce the pain these techniques in turn will improve functional abilities. But mechanically the result and the mechanism seem to be different for both techniques. Clinically, tibiofemoral manual traction does not target the alignment of the bones therefore is not as much involved in improving the deformities and functional abilities. Mobilization with tibial rotation targets the most common KAO deformity which develops over the time; the varus deformity which directly affects the functional abilities, as this technique externally rotates the tibia which is internally rotated and is reducing space on the medial side of knee in medial KAO. It targets the affected functional abilities of the subject and improves them by

correcting the alignment. The same is the result of the study conducted as evident clinically that some functional abilities were improved with traction but tibial rotation is more effective in improving the functional abilities as compared to the tibiofemoral manual traction technique. With tibiofemoral manual traction, there was a prominent change in the pre-treatment and post-treatment pain section and stiffness section of the questionnaire being filled for both the groups of the study, whereas with tibial rotation dramatic improvement was seen in pre-treatment and post-treatment reading of the physical function section of the questionnaire with the group receiving this technique. And mean improvement difference of 25 degrees is calculated in the functional abilities of both the groups with the group receiving tibial rotation showing more improvement as the study also explained the clinical significance of this change and difference. The results of this study are somewhat the same as having been physiologically and mechanically explained in the literature available on various databases and the literature being discussed in the literature review section. But clinically there was a gap that how actually the techniques work and improve the pain and functional abilities which has been explained by this study clearly. The results of this study will be helpful for the physiotherapists in their clinical practice in determining the best treatment protocol for KAO which targets the pain and functional abilities of the person.

CONCLUSION

Mobilization with tibio-femoral manual traction and tibial rotation were equally effective in improving pain. Whereas both techniques were effective in improving functional abilities but mobilization with tibial rotation is more effective as compared to mobilization with tibio-femoral manual traction.

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