

# Effect of Mechanical Traction in Osteoarthritis Knee

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**Abstract:** ***Introduction:** Osteoarthritis (OA) of knee is degenerative joint disease which contributes significantly to functional limitation and disability in older people. Pain and joint space reduction is commonly seen in them. Just like manual joint distraction is found to be beneficial likewise mechanical joint distraction can be beneficial. **Objectives:** To find effectiveness of mechanical traction in Osteoarthritis knee. To find effect of conventional therapy (Ultrasound and exercises) and mechanical traction in treating Osteoarthritis Knee. **Methods:** 50 subjects of 50-60 years age, having OA knee were recruited. They were allocated into 2 groups and treated with ultrasound (US), exercises and mechanical traction for 7 sessions over a period of 1 week. Daily assessment was done, pre and post intervention outcomes were measured using Western Ontario and McMaster University Osteoarthritis Index (WOMAC). **Result:** Both the groups showed improvement but there was significant improvement on WOMAC Scale in group treated with mechanical traction, US and exercises. **Conclusion:** Mechanical traction, Ultrasound and exercises are effective in management of Osteoarthritis (OA) knee.*

**Keywords:** Osteoarthritis, Joint Distraction, Ultrasound, Western Ontario and McMaster University Osteoarthritis Index, Mechanical Knee Traction.

## 1. Introduction

Osteoarthritis is degenerative joint disease which causes deterioration of the joint structures leading to narrowing of the joint space. Progressively smaller joint space suggests worsening of Osteoarthritis.<sup>1</sup> Osteoarthritis (OA) is the most common musculoskeletal disorder affecting the synovial joints. Radiographs showed increased joint space width and decreased subchondral sclerosis with joint distraction. Moreover, joint distraction showed significantly better results than debridement.<sup>2</sup>

Prevalence of OA in India is 22% to 39%. The efficacy & underlying mechanisms of joint distraction in treatment of OA Knee is found.<sup>3</sup>

## 2. Review of Literature

Dr. A C A Marijnissen<sup>3</sup>(2007) reported the efficacy & underlying mechanisms of joint distraction in treatment of OA Knee. He reported the efficacy & underlying mechanisms of joint distraction in treatment of OA Knee. He found that joint distraction applies relief of modified skeletal wear & tear of articular cartilage surface forming a joint. Nutrition of the cartilage is maintained due to intra-articular fluid pressure changes during treatment. Additionally subchondral sclerosis is diminished; diminishing modified skeletal stresses on the cartilage after treatment.

Loyola-Sánchez A, Richardson J, Beattie KA, Otero-Fuentes C, Adachi JD, MacIntyre NJ<sup>4</sup>(2012) Effect of low-intensity pulsed Ultrasound on the cartilage repair in 3 people with mild to moderate Knee Osteoarthritis: a double-blinded, randomized, placebo-controlled pilot study. It showed an increase in medial tibia cartilage thickness in the active US therapy Group (90µm; 95% confidence interval, 1-200; P=.05).

## 3. Material and Methods

50 Subjects with Osteoarthritis Knee willing to take treatment for 1 week were recruited for the study. The subjects were screened and were put in either of the groups- group A (Ultrasound and exercises) and group B (Ultrasound, exercises and Mechanical Traction) by simple random sampling using lottery method. A written informed consent was taken from each participant. Ethical clearance was obtained from university's institutional review board. Inclusion criteria were both male and female subjects between 50-60 years of age symptomatically and radiologically diagnosed with Stage I and II Osteoarthritis Knee fulfilling Altman and Colleague criteria for Osteoarthritis of the Knee Joint. Subjects with mainly Tibio-femoral involvement were selected.

Exclusion criteria were other rheumatologic conditions, recent fracture around the knee, open wound or skin disease, secondary osteoarthritis, lower limb deformities, osteoporosis, bone tumors, previous knee surgeries.

Both Groups were treated with low intensity pulsed Ultrasound therapy of intensity 0.2 w/cm<sup>2</sup> for duration of 10 minutes for one week.<sup>4</sup> The exercise program included - Static Quadriceps exercise, Leg Slides exercise and Straight Leg Raising exercise. Each exercise was performed for 10 repetitions in a day. Manual Traction was used as part of the evaluation to assess the effects it has on symptoms. If the traction test relieves or reduces the symptoms then only Mechanical Traction was given.

Weight of patient was assessed and traction force of 1/7<sup>th</sup> kg of body weight was applied to the subject.<sup>5</sup> Mechanical Traction was applied keeping the Hip and Knee of the subject in 90° positions. Intermittent Traction was applied.<sup>6</sup> The intervention was applied continuously for 30 second

hold followed by a 10 second rest period, for total of 6 minutes traction for 7 treatment sessions. <sup>7</sup>

**3.1 Outcome Measure**

Subjects in both the Groups were evaluated pre and post treatment program using WOMAC Scale.

**3.2 WOMAC Scale**

The WOMAC (Western Ontario and McMaster Universities) index is used to assess patients with osteoarthritis of knee using 24 items.

**4. Statistical Analysis**

Statistical analysis for the present study was done manually as well as by using the INSTAT so as to verify the results obtained. Various statistical measures such as Paired t test, Unpaired t test and repeated measure of ANOVA were used for this purpose.

Intra Group comparison (within Group) was analyzed statistically using Paired t test for WOMAC Scale Score, inter Group comparison (between Group) was analyzed statistically using Unpaired t test and daily WOMAC Scale Score assessment was statistically analyzed by using repeated measure of ANOVA. Probability values less than 0.05 were considered statistically significant and probability values less than 0.0001 were considered statistically extremely significant.

**5. Results**

Total 50 subjects were taken for study. The gender ratio of Group A was 12:13 (12 males and 13 females) and Group B was 10:15 (10 males and 15 females) and was statistically not significant. Therefore both the groups are matched with respect to gender.

Age of the participants in the study was between 50 to 60 years. The mean age of the participants in group A was 57.44 years ±2.98 and the mean age of participants in group B was 57.84 years ±3.40. The difference in mean age of two groups was statistically not significant (p= 0.66). Therefore both the groups are matched with respect to age (Table No.1)

**Table No. 1:** Baseline characteristics of participants

Variable	Group A	Group B
Sex	M=12 & F=13	M=10 & F=15
Age (years)	57.44 ± 2.98	57.84 ± 3.40

Intra Group comparison (within Group) using paired t test was done. The table shows the comparison of mean and standard deviation of pre and post values of Group A and B. In the Group A, the mean WOMAC score on pre session on the first day was 70.08 ± 22.82 which was reduced to a mean of 53.48 ± 26.08 after 7 sessions of treatment on 7<sup>th</sup> day. The p value by paired‘t’ test was found to be 0.0002 which is statistically significant (Table No. 2). In Group B, the mean WOMAC score on pre session on the first day was 69.6 ± 24.10 which was reduced to a mean of 13.48 ± 7.26 after 7 sessions of treatment on 7<sup>th</sup> day. The p value by paired‘t’ test found to be <0.0001 which is statistically significant (Table No. 2).

**Table No.2** Intra Group comparison (within Group) using paired t test.

Groups	Pre-interventional Mean ± SD	Post-interventional Mean ± SD	p Value	Inference
Group (A)	70.08 ± 22.82	53.48 ± 26.08	0.0002	Statistically significant
Group (B)	69.6 ± 24.10	13.48 ± 7.26	<0.0001	Statistically significant

Inter Group comparison (between Group) using unpaired t test. On comparing the pre session values, the results between the two groups using unpaired‘t’ test revealed that there was no statistically significant difference seen with p values of 0.8656 . While on comparing the post session values, the results between the two groups using unpaired ‘t’ test revealed that there was statistically extremely significant difference seen with p values of <0.0001 (Table No. 3)

The table shows comparison of mean values and standard deviation of WOMAC scale scores in Group A and Group B. The values were compared by applying unpaired t test. Pre treatment shows that there is no significant difference in the WOMAC scores (p=0.8656), whereas post treatment shows extremely significant difference (p=<0.0001).

**Table 3:** Inter Group comparison (between Group) using unpaired t test.

Groups	Pre-interventional Mean ± SD	Post-interventional Mean ± SD	Inference
Group (A)	70.72 ± 22.42	53.48 ± 26.08	Statistically non-significant
Group (B)	69.6 ± 24.10	13.48 ± 7.26	Statistically significant
p Value	0.8656	<0.0001	

**WOMAC Scale Score**

**Table 4:** Daily assessment using Repeated Measure of ANOVA.

Groups	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	p Value	F Value	Inference
Group (A)	70.72± 22.42	68.64± 22.20	65.6 ± 21.62	59.08 ± 22.18	57.2 ± 23.20	54.72± 24.63	53.48± 26.08	<0.0001	17.441	Statistically significant
Group (B)	69.6 ± 24.10	60.72± 21.33	48.2 ± 18.30	37.64± 15.84	28.56± 15.85	18.72± 11.40	13.48± 7.26	<0.0001	105.53	Statistically significant

The table shows daily comparison of mean values and standard deviation of WOMAC scale scores in Group A and Group B. The values were compared by applying repeated

measure of ANOVA. Statistically it shows significant improvement from 3<sup>rd</sup> day in Group A (p<0.0001, F=17.44),

while it shows extremely significant improvement from 2<sup>nd</sup> day in Group B ( $p < 0.0001$ ,  $F = 105.53$ ).

## 6. Discussion

It causes a loss of joint space leading to Knee Joint deformity which leads to a vicious cycle.<sup>8</sup> The Rehabilitative modalities aimed at interrupting this cycle by altering the biomechanics.

Reviewing various studies it was analyzed that the use of Ultrasound, Short Wave Diathermy and Manual Traction were the lines of treatment accompanied by exercise program for Osteoarthritis of Knee Joint.<sup>9,10</sup>

This study was undertaken considering all the mentioned points and the aim of this study was to evaluate the effect of Ultrasound and Mechanical Traction in Osteoarthritis Knee Joint. Based on principles of Skeletal Traction the traction force was designed that was 1/7<sup>th</sup> of the body weight and based on Manual Traction the treatment period was designed. But if the traction force was applied to the straight leg then effective force was not applied at the Knee Joint alone.

Usually Bohler-Braun frame and Thomas splint which are used mainly for lower limb traction in fractured cases can't be used effectively for Knee Joint traction because by using them we can't adjust the Hip and Knee Joint in 90° flexion which was required for effective distraction of the Knee Joint in Osteoarthritis. Thus there was need to design a new frame which can overcome above limitations and can be easily used to give effective traction to the Osteoarthritis Knee Joint.

Hence "Krishna Knee Traction Frame" was designed to position the patient in Hip and Knee 90° flexion so as to apply required effective distraction force to the Knee Joint in Osteoarthritis.

The study was carried out and the result was drawn by using WOMAC score as the outcome measure. 50 patients (22 Males and 28 Females), (20 Right and 30 Left side affected) diagnosed as unilateral Osteoarthritis Knee between the age Group of 50-60 were drawn from the Krishna College of Physiotherapy, OPD for study purpose. They were evaluated and were divided into two Groups by simple random technique. Group A Included 25 subjects treated with Ultrasound and exercises, Group B included 25 subjects treated with Ultrasound, exercises and Mechanical Traction.

A pre treatment outcome measure using WOMAC scale was done. The specific treatment protocol was followed as per the Group for 1 week and the post treatment outcome using WOMAC scale were documented accordingly. An exercise program was designed and a proper ergonomic advice was given.

Intra Group comparison (within Group) was analyzed statistically using Paired t test for WOMAC Scale Score, inter Group comparison (between Group) was analyzed statistically using Unpaired t test and daily WOMAC Scale

Score assessment was statistically analyzed by using repeated measure of ANOVA.

Intra Group comparison (within Group) was analyzed statistically using Paired t test for WOMAC Scale Score. This shows that there is extremely significant difference Group A ( $p = 0.0002$ ) and Group B ( $p < 0.0001$ ).

Inter Group comparison (between Groups) was analyzed statistically using unpaired t test. This shows that that pre session there was no statistically significant difference seen with p values of 0.8656. While on comparing the post session values, the results between the two Groups using unpaired 't' test revealed that there was extremely significant difference seen with  $p < 0.0001$ .

To evaluate daily WOMAC Scale Score assessment statistically repeated measure of ANOVA was used. This shows that there is extremely significant difference in Group B ( $p < 0.0001$ ,  $F = 105.53$ ).

When a paired 't' test was performed to evaluate the effect of treatment given in Group A and Group B using WOMAC scale score it showed that there was significant improvement. Group A ( $p = 0.0002$ ) and Group B ( $p < 0.0001$ ). The given treatments were significantly effective but Group B showed considerable improvement as compared to Group A. The region behind that might be Mechanical Traction overcomes the joint space reduction. A strengthening program can be designed to improve muscle strength and maintain the improvement for longer period.

In this study an attempt was made to analyze the effect of Ultrasound, Mechanical Traction and exercises program in reducing pain in Osteoarthritis Knee patients. This study was done to investigate the reduction of symptoms after the application of Mechanical Traction along with conventional therapy in Osteoarthritis Knee patients and its post treatment evaluation in a standardized manner using WOMAC scale. The result shows significant improvement with Mechanical Traction along with conventional therapy.

The result of current study shows that Mechanical Traction had significant effect ( $p < 0.0001$ ) in management of Osteoarthritis Knee Joint both statistically and clinically.

The improvement in functional outcome after application of Mechanical Traction may be because of relief of abnormal pressure on nociceptive receptor systems. Effects of Intermittent Traction included increased vascular and lymphatic flow (suction aspiration effect) which tends to reduce stasis, edema and coagulates in chronic congestions. Traction stimulates proprioceptive reflexes and helps to tone muscles, which tend to reduce fatigue and restore elasticity and resiliency. Radiographs showed increased joint space width and decreased subchondral sclerosis. Moreover, joint distraction showed significantly better results than debridement.<sup>11</sup>

## 7. Conclusion

Various conservative approaches are used in treating Osteoarthritis of Knee Joint but present study shows that

Ultrasound and exercises alone shows minimal effect in reduction of pain than compared to Mechanical Traction along with Ultrasound and exercises. Present study shows that Mechanical Traction was more effective in decreasing pain and improving quality of life than using conventional therapy alone.

## 8. Further Scope

In the inclusion criteria patients with primary OA Knee grade I, II were selected where as in future it can also be studied for other grades. Subjects with mainly Tibio-femoral involvement were selected, where as in future it can also be studied for Patella-femoral involvement. Radiographs and MRI can also be used to compare pre and post treatment efficacy. Long term follow up may prove the efficacy of the treatment. Further effect of mechanical traction can also be studied in knee stiffness subjects.

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