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## Original Research Article

# A prospective comparative study on knee preservation surgeries in patients with osteoarthritis based on detailed evaluation of radiological parameters pre and post intervention

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## ABSTRACT

Knee osteoarthritis is a common joint disease, with an incidence of 30% of the population older than 60 years. The current belief is that the load is distributed along the mechanical axis, which is generally medial to the centre of the knee. Osteotomies to change the mechanical axis has been long described as a treatment of medial compartment OA, and proximal fibular osteotomy being the recent addition. The authors aimed to evaluate the change in radiological parameters of the knee alignment and assess its statistical significance. It is a hospital based prospective pre and post interventional study done at New Hospital Medical College Kota. The Sample size was calculated to be 34 subjects at  $\alpha$ -error 0.05 and study power 80%. Radiological parameters were assessed in terms of Femorotibial angle, Mechanical axis deviation and Lateral joint space under standard magnification. Radiological parameters depicting the change in knee alignment were found to be statistically significant. Also, it correlates well with that described in other established studies.

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## 1. Introduction

Knee OA is a common joint disease, with an incidence of 30% of the population older than 60 years.<sup>1</sup> Old age, female gender, obesity, knee injury, repetitive use of joints, bone density, muscle weakness, and joint laxity, all play roles in the development of joint osteoarthritis, particularly in the weight-bearing joints.<sup>1,2</sup>

Knee joint bears the maximum burden of human body, and is prone to disease due to its complex structure.<sup>3</sup> Although it has been reported that even in healthy knees the medial compartment bears 60% to 80% of the load, no one has precisely documented what contributes to this uneven load distribution.<sup>4</sup> The current belief is that the load is distributed along the mechanical axis, which is generally

medial to the center of the knee.

In 1958, Jackson<sup>5</sup> was first to describe HTO as a treatment for osteoarthritis knee with ball and socket osteotomy at the level of tibial tubercle. Lateral closing wedge osteotomy, popularised by Coventry<sup>6</sup> in the Anglo American literature and by Judet in France. The opening wedge medial osteotomy, described in France by Debeyre and Artigou in 1972 avoids the majority of the issues associated with closing wedge osteotomy. The biomechanical rationale for proximal tibial osteotomy in patients with unicompartmental osteoarthritis of the knee is “unloading” of the involved joint compartment by correcting the malalignment and redistributing the stresses on the knee joint.

In recent literature proximal fibular osteotomy is described as a treatment of medial compartment osteoarthritis which may delay or may even preclude knee

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replacement. It is believed that the lateral support provided to the osteoporotic tibia by the fibula–soft tissue complex may lead to the nonuniform settlement and degeneration of the plateau bilaterally.<sup>7,8</sup> This may result in the load from the normal distribution shifting farther medially to the medial plateau and consequently lead to knee varus, aggravating the progression of medial compartment OA of the knee joint. With this understanding the authors performed PFO<sup>9</sup> and compared the detailed radiological parameters pre and post-operatively.

## 2. Materials and Methods

It is a hospital based prospective pre and post interventional study done at New Hospital Medical College Kota between 2017 and 2020. The Sample size was calculated to be 34 subjects at  $\alpha$ -error 0.05 and study power 80%. Hence, for purpose of this study 35 subjects were taken. All patients with moderate to severe symptomatic medial compartment OA of the knee, having indication for a surgical procedure and consented were included in the study. Exclusion criteria were post-traumatic or inflammatory arthritis, previous fractures, ligamentous instability and bi or tricompartmental OA.

Institutional ethical committee clearance was taken and all patients underwent same surgery. X-ray, lower limb scanogram and CT scan was done preoperatively and at final follow up. Radiological parameters were assessed in terms of (a) Femorotibial angle<sup>9</sup> (FTA) (b) Mechanical axis deviation (MAD) perpendicular distance from the mechanical axis line to the center of the knee joint line (c) Lateral joint space under standard magnification.<sup>9</sup> To maintain the uniformity and accuracy in the radiological assessment, a consensus about the method was agreed upon by all authors in prior and all assessment were performed by the same person i.e. the second author (S.C.) using the DICOM files.

Statistical analysis was performed with the SPSS, version 21 for Windows statistical software package (SPSS inc., Chicago, IL, USA). The Categorical data was presented as numbers (percent) and were compared among groups using Chi square test. The quantitative data was presented as mean and standard deviation and were compared by students t-test. Probability was considered to be significant if less than 0.05.

## 3. Observations and Results

31.42% of the patients were in 39-50 years age group and 40% were in 51-60 years age group and 28.57% were in 61-72 years age group. The average age was 55.34 years  $\pm$  8.47 and range is 39 to 72. Predominantly 57.14% were females while 42.85% were males. Seventeen left knee (48.57%) operated while eighteen right knee (51.42%) operated.

**Table 1:** Age distribution

Age	Number of Cases	Percentage (%)
39-50	11	31.42
51-60	14	40.00
61-72	10	28.57
Total	35	100.00
Mean $\pm$ SD	55.34 $\pm$ 8.47	
Range	[39-72]	

The mean follow up period was 8.82 months with standard deviation of 3.30 with maximum of 17 months and minimum of 6 months follow up duration. Most of the patients have follow up of 7 months.

**Table 2:** Followup (Months)

Follow up	Number of Cases	Percentage (%)
6 month	8	22.85
7 month	12	34.28
8 month	3	8.57
9 month	3	8.57
12 month	2	5.71
13 month	2	5.71
14 month	2	5.71
15 month	1	2.85
16 month	1	2.85
17 month	1	2.85
Mean $\pm$ SD	8.82 $\pm$ 3.30	

Preoperative range of motion was 0-129.28° and postoperatively range of motion was 0-132.28. The change was statistically nonsignificant with p value of 0.068.

**Table 3:** Range of motion

Rom	Mean	SD	P value
Pre	129.28	6.20	0.068
Post	132.28	7.31	

The mean preoperative value of Mechanical Axis Deviation was 11.14mm with standard deviation 3.75 and mean postoperative value of was 9.34mm with standard deviation 3.53 and p value was 0.042.

**Table 4:** MAD

Mad	Mean	SD	P value
Pre	11.14mm	3.75	0.042
Post	9.34mm	3.53	

The mean preoperative value of FTA was 182.6 with standard deviation 1.47 and mean postoperative value was 180.03 with standard deviation 1.75 and p value was 0.0005.

The mean preoperative value of lateral knee joint space was 7.2 with standard deviation 1.1 and mean postoperative value of lateral knee joint space was 5.2 with standard deviation 1.1 and p value was less than 0.001.

**Table 5:** FTA

FTA	Mean	SD	P value
Pre	182.6	1.47	0.0005
Post	180.03	1.75	

**Table 6:** Lateral knee joint space

Lateral Joint Space	Mean	S.D.	P<0.001
Pre	7.2mm	1.1	
Post	5.2mm	1.1	

**Table 7:** Complication

Complications		Number of Cases	Percentage (%)
Superficial peroneal nerve palsy	Yes	6	17.14
	No	29	82.85
Common peroneal nerve palsy	Yes	2	5.71
	No	33	94.28

The most frequent complication in this series was superficial peroneal nerve palsy. A total of 6 patients got superficial peroneal nerve palsy of the 35 that were applied amounting to 17.14%. All of these complications were completely recovered within 6 months. A total of 2 patients got common peroneal nerve palsy out of 35 amounting 5.71%. Both were completely recovered.

#### 4. Discussion

HTO has been the surgical treatment of choice for young patients with osteoarthritis of the medial compartment of the knee, and it is aimed at correcting alignment so as to ease degenerative changes. In certain specific indications, PFO is the surgical method of choice for knees with only medial compartmental osteoarthritis. The major advantage of the operation is that it allows unlimited activity to the patient. Whereas efficacy of HTO on the alignment is long established in literature, PFO with significant changes in the alignment are described in recent literatures.

Since there has been no general consensus regarding the measurement of correction that should be considered in all cases, in our series the detailed methodology of measurement was agreed upon among all the authors. The measures which can be taken are FTA, MAD, Hip Knee Ankle Angle And Lateral and Medial Knee Joint Space. Various authors have used different method with merits and demerits of each. FTA is the easiest to measure and follow but least precise due to normal variations of length of femur, tibia and femoral neck shaft angle in different populations. MAD on tibial plateau on the other hand is most precise and doesn't get affected variations in population but is most difficult to measure and follow.

In this study average age of patients was 55.34 years  $\pm$  8.47 which correlates well with Zong-You Yang et al<sup>9</sup>

(2015) as 59.2 years, Xiaohu Wang et al<sup>10</sup> (2017) as 63.96 years, Guoping Zou et al<sup>11</sup> (2017) as 62.3 years, and all showed female predominance.

In our study mean preoperative range of motion was  $129.28^\circ \pm 6.20^\circ$  which increased to  $132.28 \pm 7.31^\circ$  postoperatively the change was statistically non significant.

In our study, the mean FTA was  $182.6^\circ \pm 1.47$  preoperatively and after correction postoperatively mean angle was  $180.03^\circ \pm 1.75$  the decrease was statistically significant with p value of 0.0005. In the study by Zong-You Yang et al<sup>9</sup> mean FTA angle was  $182.7^\circ \pm 2.0^\circ$  preoperatively and postoperatively, angle was  $179.4^\circ \pm 1.8^\circ$  this decrease was also statistically significant with p value  $<.001$ . In the study by Guoping Zou et al<sup>11</sup> mean FTA was  $183.4 \pm 2.5$  preoperatively and postoperatively angle was  $168.9 \pm 1.3$  decrease was again statistically significant.

In our study, the mean MAD was  $11.14 \pm 3.75$ mm preoperatively and postoperatively mean MAD was  $9.34 \pm 3.53$ mm, the decrease was statistically significant with p value of 0.042. In our study, the mean preoperative value of lateral knee joint space was 7.2 with standard deviation 1.1 and mean postoperative value of lateral knee joint space was 5.2 with standard deviation 1.1 with p value  $<.001$ . In the study by Zong-You Yang et al<sup>9</sup> mean Lateral Knee Joint Space was  $12.2 \pm 1.1$  preoperatively and postoperatively, it was  $6.9 \pm 0.7$  the decrease was statistically significant with p value  $<.001$ .

In the present study the mean follow up period was 8.82 months with standard deviation of 3.30 with maximum of 17 months and minimum of 6 months follow up duration. Most of the patients have a follow up of 7 months. Zong-You Yang et al<sup>9</sup> reported 4 (3.6%) nerve injury (n=2) in 4 (3.6%) patients. In the study of Xiaohu Wang et al<sup>10</sup> no postoperative complications were observed, including wound infection, delayed healing or nerve damage. The most frequent complication in our series was superficial peroneal nerve palsy amounting to 17.14%. All of these complications were completely recovered within 6 months. A total of 2 patients got common peroneal nerve palsy out of 35 amounting 5.71%. Both were completely recovered.

#### 5. Conclusion

Statistically significant changes in the radiological parameters of knee alignment in our study correlates well with that in the other studies and further supports the role of PFO and can be an alternative to HTO. However, the study has many limitations (a) long term effect of osteotomy on the alignment (b) correction of varus FTA on progression of degenerative changes is not studied because long follow up is required for this assessment. (c) our study has not included those patients with bicompartamental or tricompartmental OA.

The encouraging results indicates the need of Multicentric studies with long follow up and comparison

with other treatment methods to draw further firm conclusions.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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