

Assessing the efficacy and clinical outcomes following of proximal fibular osteotomy in managing the osteoarthritis of the medial compartment of the knee: A clinical study

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Received: 03-06-2021 / Revised: 09-07-2021 / Accepted: 13-09-2021

Abstract

Background: Knee arthritis involving the medial compartment is usually managed with PFO (Proximal Fibular Osteotomy) compared to high tibial osteotomy owing to minimal/no complications associated. PFO supports lateral tibial plateau. PFO also shifts load laterally from the medial compartment improving function and decreasing the pain. **Aims:** The present study was aimed to assess the efficacy of the proximal fibular osteotomy in managing knee osteoarthritis concerning joint function improvement and pain relief. **Materials and Methods:** In 25 subjects, following proximal fibular osteotomy, VAS (Visual analog scale) was used to assess the pain. As per American Knee Society scores, knee and function subscores were used to assess knee ambulation activities. The subjects were followed at 4, 8, and 12 weeks postoperatively. Radiographs were taken preoperatively and postoperatively to evaluate the knee joint space ratio. Based on the lower extremity radiograph, the hip-knee-ankle angle was evaluated and the results were formulated. **Results:** VAS scores improved significantly from 8.04 ± 1.52 to 2.76 ± 2.36 with a p-value of <0.0001 . Mean knee scores reduced from 44.43 ± 8.92 to 41.26 ± 13.51 , non-significantly with the p-value of 0.3325. Mean function subscores, also improved postoperatively, at 12 weeks, from 69.04 ± 11.14 to 67.65 ± 13.67 non-significantly with the p-value of 0.6952. Improvement was seen radiographically following PFO in 68% (n=17) of study subjects. Knee joint space ratio (medial to a lateral compartment) improved non-significantly postoperatively from 0.42 ± 0.28 to 0.59 ± 0.26 following Proximal Fibular Osteotomy with the p-value of 0.03. **Conclusion:** The present study concludes that Proximal fibular osteotomy is a fast, cost-effective, safe, and simple management strategy for knee osteoarthritis which helps in improving joint range of motion, medial joint space, and pain in the subjects with knee osteoarthritis. Also, PFO is an affordable alternative that can eliminate or delay the need for total knee replacement.

Keywords: high tibial osteotomy, medial compartment osteoarthritis, proximal fibular osteotomy, knee osteoarthritis, osteoarthritis.

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Introduction

One of the most common causes of disability in older subjects is Osteoarthritis. Commonly prevalent Osteoarthritis is knee Osteoarthritis. Disability in knee osteoarthritis is mostly due to limited mobility and pain seen associated with osteoarthritis. Knee joint Osteoarthritis is a chronic and degenerative disorder leading to deformity and limits the range of motion. Osteoarthritis affects approximately 3.8% of the World's population globally. It also affects more females compared to males, and older subjects compared to the younger subjects secondary to decreased bone mineral density caused by osteoporosis[1].

Osteoarthritis can be managed both surgically and conservatively. Commonly employed conservative treatments are analgesics, viscosupplements, injections of platelet-rich plasma and steroids, physical therapy, and/or analgesics. The surgical management strategies include total knee arthroplasty and high tibial osteotomy.

High tibial osteotomy is a technically challenging procedure with associated complications such as non-union, iatrogenic fracture, and/or neurovascular injuries. Total knee arthroplasty is not associated with such complications and has added advantages of functional improvement, deformity correction, and pain relief. However, Total knee replacement is not suggested in young subjects[2].

The most commonly involved structure in the osteoarthritis knee is the medial compartment as it takes approximately 70-80% load in the healthy subjects because the axis lies medial to the knee joint center. Knee arthritis involving the medial compartment is usually managed with PFO (Proximal Fibular Osteotomy) compared to high tibial osteotomy owing to minimal/no complications associated. PFO supports lateral tibial plateau. PFO also shifts load laterally from the medial compartment improving function and decreasing the pain by removing a wedge from the fibula and weakening the lateral tibial plateau support lent by the fibula[3].

Compared to osteotomies, total knee arthroplasty is a complex and expensive procedure needing second intervention following the primary surgical procedure. Also, high tibial osteotomy, despite being the most preferred surgical intervention in young subjects having knee osteoarthritis involving the medial compartment, has certain post-surgical disadvantages. In such cases, proximal fibular osteotomy is an acceptable alternative with distinct advantages of being safer, simpler, and cost-effective. PFO also relieves pain considerably in almost all subjects. PFO also delays or eliminates the need for total knee replacement[4]. Hence, the present study was aimed to assess the

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efficacy of the proximal fibular osteotomy in managing knee osteoarthritis concerning joint function improvement and pain relief.

Materials and methods

The present study was conducted to assess the efficacy of the proximal fibular osteotomy in managing knee osteoarthritis concerning joint function improvement and pain relief. The present study was conducted at Assistant Professor, Department Of General Medicine, Sri Shankaracharya Institute of Medical Sciences, Bhilai, Chhattisgarh from January 2020 to May 2021 after obtaining clearance from the concerned Ethical committee. The study population was comprised of the subjects visiting the Department of Orthopaedics with knee Osteoarthritis and were advised for proximal fibular osteotomy.

The inclusion criteria for the study were subjects who underwent proximal fibular osteotomy from both the genders, within the age range of 46 years to 74 years and the mean age of 62.84 ± 6.98 years, walking difficulty due to osteoarthritis of the medial compartment of the knee, and the subjects willing to participate in the study. The exclusion criteria were acute trauma, malignant tumors, inflammatory joint disease, abnormal liver/kidney function, and genu valgus. Osteoarthritis was diagnosed by an expert following ACR (American College of Rheumatology) criteria[5]. Informed consent was taken verbally as well as in written format from all the subjects.

For all the subjects, proximal fibular osteotomy was performed under general anesthesia where 2 to 3 cm fibula was removed. Following

proximal fibular osteotomy, free mobilization and full weight-bearing were allowed to all the subjects. VAS (Visual analogue scale) was used to assess the pain in the knee postoperatively. As per American Knee Society scores, knee and function subscores were used to assess knee ambulation activities. The subjects were followed at 4, 8, and 12 weeks postoperatively. Radiographs were taken preoperatively and postoperatively to evaluate the knee joint space ratio of medial/lateral compartment and lower extremity alignment. In all subjects, functional improvements were also assessed on the structured questionnaire.

Based on the lower extremity radiograph, the hip-knee-ankle angle was evaluated. All the study data were collected by two examiners experts in the field. The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and t-test. The data were expressed in percentage and number, and mean with standard deviations. The level of significance was kept at $p < 0.05$.

Results

The present study was conducted to assess the efficacy of the proximal fibular osteotomy in managing knee osteoarthritis concerning joint function improvement and pain relief. The study included a total of 25 subjects who underwent proximal fibular osteotomy from both genders, within the age range of 46 years to 74 years and the mean age of 62.84 ± 6.98 years. The demographic characteristics of the study subjects are depicted in Table 1.

Table 1: Demographic characteristics of the study subjects

Characteristics	Percentage (%)	Number (n)
Age range (years)	46-74	
Mean Age (Years)	62.84 ± 6.98	
Gender		
Females	76	19
Males	24	6
Socioeconomic status		
Upper	28	7
Middle	56	14
Lower	16	4
Weight (kg)	78.89 ± 9.98	
Surgery Duration (min) for unilateral PFO	32.25 ± 9.13	

There were 76% (n=19) females and 24% (n=6) males in the present study. There were 28% (n=7) subjects from the upper-class group, 56% (n=14) subjects from the middle socioeconomic group, and 16% (n=4) subjects from the lower socioeconomic group. The mean weight of the study subjects was 78.89 ± 9.98 kg. The mean surgery duration for unilateral Proximal Fibular Osteotomy was 32.25 ± 9.13 minutes.

On assessing the postoperative clinical and functional improvement in the study subjects following PFO, it was seen that

mean VAS scores improved significantly from 8.04 ± 1.52 to 2.76 ± 2.36 with the p-value of < 0.0001 at 12 weeks postoperatively. Mean knee scores as per the American Knee Society reduced from 44.43 ± 8.92 to 41.26 ± 13.51 . However, this improvement was statistically non-significant with a p-value of 0.3325. Also, mean function subscores, according to the American Knee society improved postoperatively, at 12 weeks, from 69.04 ± 11.14 to 67.65 ± 13.67 non-significantly with the p-value of 0.6952. These results are described in Table 2.

Table 2: Clinical and Functional Outcomes following PFO in the study subjects

Parameters	Preoperatively (Mean±S.D)	Postoperatively (Mean±S.D)	p-value
Mean VAS	8.04 ± 1.52	2.76 ± 2.36	< 0.0001
Mean knee scores	44.43 ± 8.92	41.26 ± 13.51	0.3325
Mean function subscores	69.04 ± 11.14	67.65 ± 13.67	0.6952
Parameter	Percentage (%)	Number (n)	
Postoperative Pain Relief	68	17	-
Functional Improvement	64	16	-
Improvement in range of motion			

Postoperative radiographs were taken of weight-bearing extremity and were compared with the preoperative radiographs (Figure 1).

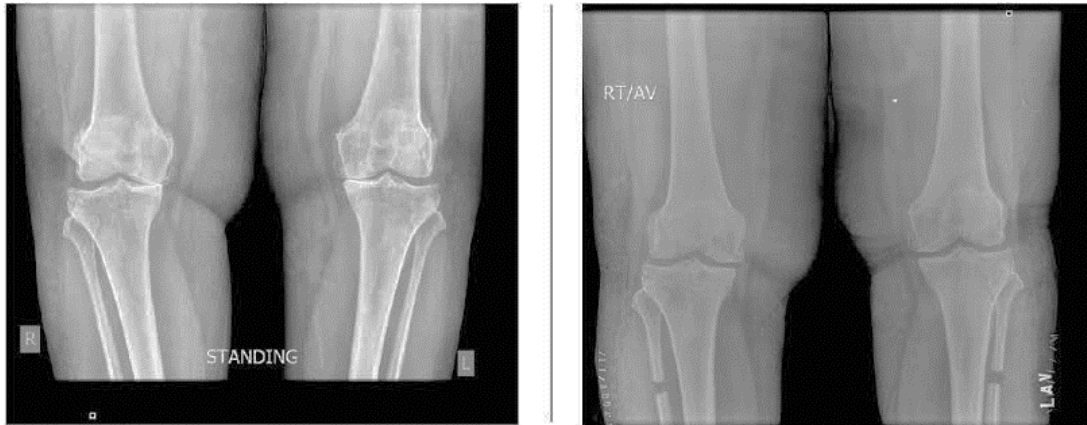


Fig. 1: Preoperative and postoperative radiographs following PFO (Proximal Fibular Osteotomy) in the study subject

Improvement was seen radiographically following PFO in 68% (n=17) of study subjects. Knee joint space ratio (medial to the lateral compartment) improved non-significantly at 12 weeks postoperatively from 0.42 ± 0.28 to 0.59 ± 0.26 following Proximal Fibular Osteotomy with the p-value of 0.03. Also, confirmed alignment correction in the lower extremity was seen in 20% (n=5) of study subjects (Table 3).

Table 3: Radiographic Outcomes following PFO in the study subjects

Parameters	Preoperatively (Mean \pm S.D)/ % (n)	Postoperatively (Mean \pm S.D)/ % (n)	p-value
Radiographic improvement	-	68% (n=17)	-
Knee joint space ratio	0.42 ± 0.28	0.59 ± 0.26	0.03
Alignment correction	-	20% (5)	-

Discussion

The present clinical study was conducted to assess the efficacy of the proximal fibular osteotomy in managing knee osteoarthritis concerning joint function improvement and pain relief. The study included a total of 25 subjects who underwent proximal fibular osteotomy from both genders, within the age range of 46 years to 74 years and the mean age of 62.84 ± 6.98 years. There were 76% (n=19) females and 24% (n=6) males in the present study. There were 28% (n=7) subjects from the upper-class group, 56% (n=14) subjects from the middle socioeconomic group, and 16% (n=4) subjects from the lower socioeconomic group. The mean weight of the study subjects was 78.89 ± 9.98 kg. The mean surgery duration for unilateral Proximal Fibular Osteotomy was 32.25 ± 9.13 minutes. These demographics were comparable to the studies of Sprenger TR et al[6] in 2003 and W Dahl A et al[7] in 2010 where authors assessed comparable demographic characteristics as the present study.

On assessing the postoperative (at 12 weeks) clinical and functional improvement in the study subjects following PFO, it was seen that mean VAS scores improved significantly from 8.04 ± 1.52 to 2.76 ± 2.36 with the p-value of <0.0001 . Mean knee scores as per the American Knee Society reduced from 44.43 ± 8.92 to 41.26 ± 13.51 . However, this improvement was statistically non-significant with a p-value of 0.3325. Also, mean function subscores, according to the American Knee society improved postoperatively from 69.04 ± 11.14 to 67.65 ± 13.67 non-significantly with the p-value of 0.6952. These results were consistent with the results of Yanz ZY et al[8] in 2015 and Duivenvoorden T et al[9] in 2013 where authors reported similar clinical and functional outcomes following Knee osteotomy for Osteoarthritis.

Postoperative radiographs were taken at 12 weeks, of weight-bearing extremity and were compared with the preoperative radiographs. Improvement was seen radiographically following PFO in 68% (n=17) of study subjects. Knee joint space ratio (medial to a lateral compartment) improved non-significantly from 0.42 ± 0.28 to 0.59 ± 0.26 following Proximal Fibular Osteotomy with the p-value of 0.03. Also, confirmed alignment correction in the lower extremity was seen in 20% (n=5) of study subjects. These results were consistent with the findings of Subhash DY et al[10] in 2018 and

Wang X et al[11] in 2017 where authors reported similar radiographic improvement after PFO for knee Osteoarthritis.

Conclusion

Within its limitations, the present study concludes that Proximal fibular osteotomy is a fast, cost-effective, safe, and simple management strategy for knee osteoarthritis which helps in improving joint range of motion, medial joint space, and pain in the subjects with knee osteoarthritis. Also, PFO is an affordable alternative that can eliminate or delay the need for total knee replacement. However, the present study had few limitations including a smaller sample size, geographical area biases, recall bias, and single-institution nature. Hence, more longitudinal and prospective studies with larger sample sizes, and longer monitoring periods are needed to reach a definitive conclusion.

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Conflict of Interest: Nil

Source of support: Nil