

Original Research

To Evaluate The Efficacy Of Proximal Fibular Osteotomy As A Viable Alternative Treatment Method For Alleviating Pain And Improving Functionality Inpatients of Osteoarthritis of Knee

Dr. Ranjay Kumar¹, Dr. Ayush Banka², Dr. Vinod Kumar Singh³, Dr. Dilip Kumar Chaudhary⁴

^{1,2}Senior Resident, Department of Orthopaedics, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

³Professor and Head of Department, Department of Orthopaedics, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

⁴Assistant Professor, Department of Orthopaedics, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

Corresponding Author: Dr. Ayush Banka

Senior Resident, Department of Orthopaedics, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

Email: ayushbanka12gmail.com

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ABSTRACT

Background: Osteoarthritis of the medial compartment of the knee (OA) is a physically and mentally distressing illness that makes daily activities difficult for the affected person. Proximal fibular osteotomy (PFO) is one way to decompress the medial compartment and alleviate discomfort. PFO is a simple surgical method that helps functional improvement and also significantly reduce pain in patients with knee OA.

Aim and objectives: To evaluate the efficacy of Proximal Fibular Osteotomy as a viable alternative treatment method for alleviating pain and improving functionality in patients of osteoarthritis of knee.

Materials and Methods: The purpose of this interventional cohort study was to assess the efficacy of proximal fibular osteotomy (PFO) as an alternative therapeutic method for alleviating pain and enhancing functional outcomes in individuals suffering with medial compartment knee osteoarthritis (OA). Initially, a cohort of 80 patients was chosen for the research. Among them, 60 patients agreed to participate and received PFO in a trauma hospital after providing written informed permission. All the patients with experiencing significant symptoms and damage in the inside area of the knee joint, known as the medial compartment, ranging from mild to severe, Patients who required a surgical operation and Patients who possess the capacity to provide informed consent for the surgical procedure were included in this study. The main measure of interest was the change in the femoro-tibial angle (FTA) before and after the operation, as seen on weight-bearing radiographs. Knee pain was evaluated on a visual analogue scale (VAS). The American Knee Society Score (KSS) was used to record knee ambulation activities before and after the operation.

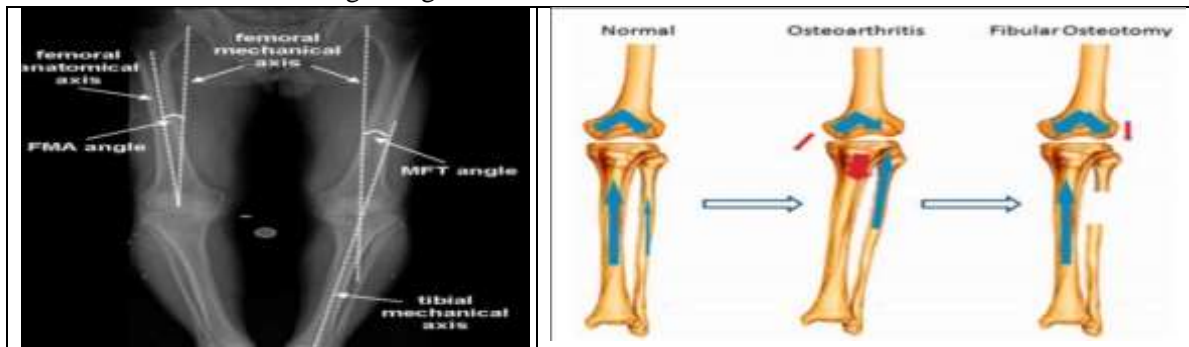
Results: The average preoperative FTA was 177.3° with a standard variation of 2.4° , which increased to $179.6^\circ \pm 3.1^\circ$ after the operation. This shift exhibited statistical significance, as shown by a p-value of less than 0.001. The average preoperative VAS score was 8.33 ± 1.32 , and it fell dramatically to 3.67 ± 1.11 after the operation. The decrease in discomfort was statistically significant, as shown by a p-value of less than 0.001. The average preoperative KSS score was 51.87 ± 4.28 , which increased to 83.08 ± 5.51 after the operation. The improvement in knee function demonstrated statistical significance, as shown by a p-value of less than 0.001. The research showed a substantial improvement in all assessed results after proximal fibular osteotomy. The femoro-tibial angle (FTA) demonstrated a significant correction, suggesting improved alignment of the knee. The postoperative assessment using the Visual Analog Scale (VAS) showed a considerable reduction in pain levels. Postoperatively, there was a significant rise in functional improvement, as shown by the KSS measurement.

Conclusion: Proximal fibular osteotomy is a very successful surgical procedure for those suffering with medial compartment knee osteoarthritis. It offers substantial benefits in terms of pain reduction, knee alignment, and functional results.

Keywords: Proximal Fibular Osteotomy, Pain, Osteoarthritis, Knee.

Introduction

Primary osteoarthritis (OA) is a very prevalent chronic degenerative condition that affects the knee joint, with a prevalence rate of 28.7% in the general population.¹ It is a long-lasting disorder that causes discomfort, stiffness, and limited mobility, making it difficult to perform everyday tasks.² The medial compartment of the knee, out of the three compartments, carries 60-80% of the stress when weight is placed on it by those who are healthy and have no medical conditions.^{3,4} This makes it the area most susceptible to osteoarthritis (OA). Another possible explanation, according to the prevailing idea, for the medial compartment's participation is that the load is distributed along the mechanical axis, which typically goes through the center of the knee on the inner side.⁴ The majority of patients with knee osteoarthritis in the medial compartment have a varus deformity, as shown by an FTA ^{greater} than 180° and narrowing of the MJS.⁵ Pain is a very disruptive condition that hinders an individual's physical and psychological functioning in their daily activities. This incapacitating illness may be remedied by a range of therapy strategies, including both conservative and surgical approaches. The conservative treatment for knee osteoarthritis includes the use of pain relievers, viscosupplementation, intra-articular injections of steroid or platelet-rich plasma, and physical therapy.⁶⁻⁷ Both Total Knee Arthroplasty (TKA) and High Tibial Osteotomy (HTO) are well-established surgical procedures for knee osteoarthritis (OA). However, they are costly and involve complex procedures that may lead to numerous problems.^{5,8} The PFO, or Patellofemoral Osteotomy, is a recently developed surgical technique that has been suggested as a viable alternative for individuals suffering from primary medial compartment knee osteoarthritis.^{4,8-10} The PFO technique is characterized by its simplicity, safety, technical ease, and cost-effectiveness. This procedure is appropriate for individuals of all age groups, including both young and elderly populations. It is characterized by low blood loss and a short duration of hospitalization.⁹ PFO greatly reduces discomfort and improves knee functioning in these individuals.¹⁰ Nevertheless, this surgery is not a conclusive solution and has great promise in delaying the need for total knee arthroplasty (TKA). In the future, Total Knee Arthroplasty (TKA) or High Tibial Osteotomy (HTO) may be performed effortlessly on a knee that has already had PFO without any obstacles.⁸ In this region, where total knee arthroplasty (TKA) and high tibial osteotomy (HTO) are challenging for patients with osteoarthritis (OA) due to the surgical procedures involved, PFO may provide a cost-effective treatment option. PFO provides substantial pain relief and functional improvement, with the added benefits of shorter hospital stays and early rehabilitation. Despite being a developing approach in the treatment of knee osteoarthritis (OA), there is a scarcity of research examining the outcomes of PFO. Previous studies have not considered the impact of BMI [11,12] and the correlation between K-L grading and the outcome of PFO.^{11,12}



F1: figure showing varus deformity of both knee with increased MFT angle and decreased joint space

F2: Figure showing progression of osteoarthritis to post fibulectomy

Aim and objectives: To evaluate the efficacy of Proximal Fibular Osteotomy as a viable alternative treatment method for alleviating pain and improving functionality in patients of osteoarthritis of knee.

Material and Methods

The purpose of this interventional cohort study was to assess the efficacy of proximal fibular osteotomy (PFO) as an alternative therapeutic method for alleviating pain and enhancing functional outcomes in individuals suffering with medial compartment knee osteoarthritis (OA). Initially, a cohort of 80 patients was chosen for the research. Among them, 60 patients agreed to participate and received PFO in a trauma hospital after providing written informed permission. The research includes a cohort of 60 participants of both genders and met the specified criteria for inclusion and exclusion. The study was conducted in the orthopaedic department at Anugrah Narayan Magadh Medical College and Hospital, Gaya, Patna, Bihar, India, after approval from the institutional ethical committee. All the study participants were briefed about the study, and written informed consent was obtained. This study was done between February 2023 and January 2023. The Institutional Ethics Committee gave the study its approval.

Demographic details such as age and gender were noted in all the cases. Keeping power (1-beta error) at 80% and confidence interval (1-alpha error) at 95%, the minimum sample size required was 60 patients; therefore, we included 80 (the minimum required number of cases) patients in present study.

Inclusion Criteria:

- Individuals experiencing significant symptoms and damage in the inside area of the knee joint, known as the medial compartment, ranging from mild to severe.
- Patients who required a surgical operation.
- Patient's age between 18-60 years.
- Available for follow up.
- Patients who possess the capacity to provide informed consent for the surgical procedure.

Exclusion Criteria:

- Patients not give written informed consent.
- Patients with immunocompromised status and patients on chemotherapy or steroid treatment.
- Those unable to attend follow-up.
- Individuals suffering from posttraumatic knee osteoarthritis, inflammatory joint disease. And knee valgus deformity.
- Patients who did not experience unsuccessful attempts at conservative management.
- Patients who do not show any major varus deformity on radiographic examination.

Surgical Procedure: Following the administration of spinal anaesthesia, patients were put in a supine posture with a sandbag positioned under the buttock on the side where the operation was to be performed. The skin marking was performed precisely, with the marking located just above the fibular head. A 5 cm long incision was performed longitudinally, positioned 8 to 9 cm below the fibular head, to expose the fibula located between the peroneus and soleus muscles.

The PFO procedure included the extraction of a 2- to 3-cm portion of the fibula, located 6 to 10 cm away from the fibular head, using an oscillating saw. Following the surgical removal, the extremities of the fibula were closed using bone wax. Following irrigation with a significant amount of normal saline, the muscles, fascia, and skin were individually sutured. Subsequently, a cohesive bandage including cotton and a compressive bandage were used. After surgery, patients were advised to start walking as soon as they could tolerate the discomfort. After the surgery, the patient was permitted to bear their full weight and move freely, while being cautious to prevent any harm to the common peroneal nerve during the bone cutting procedure.

Radiographic Assessment: Prior to surgery and after surgery, weight-bearing radiographs of the whole lower limb were taken for all patients to assess the alignment of the lower extremities and the knee joint space in the medial and lateral compartments. The main measure of interest was the change in the femoro-tibial angle (FTA) before and after the operation, as seen on weight-bearing radiographs.

Clinical Evaluation: Knee pain was evaluated on a visual analogue scale (VAS). The American Knee Society Score (KSS) was used to record knee ambulation activities before and after the operation. The efficacy of PFO in alleviating pain and enhancing functionality in individuals with medial compartment knee osteoarthritis (OA) was assessed by analysing changes in radiographic parameters (such as FTA), pain ratings (measured by VAS), and functional scores (evaluated using KSS).

Data Analysis

The data analysis was done with the help of Microsoft Windows Excel, and the statistical analysis was done using the Statistical Package for Social Sciences (SPSS) version 22.0. The data were reported as the mean value plus or minus the standard deviation (SD). The variations in outcome ratings between the preoperative and postoperative periods were compared using the Chi square test, paired and unpaired t-tests. Statistical significance was determined at a p-value of less than 0.05.

Results

Table 1: Basic demographic parameter of the participants

Parameter	Mean / Number	Percentage(%)
Mean Age (years)	63.11 ± 5.58	-
Gender		
Male	26	43.33
Female	34	56.67

Table 1 and Graph 1 presents the demographic information of the patients who took part in the trial. The mean age of the patients was 63.11 years, with a standard deviation of 5.58 years. The group included 26 men and 34 girls.

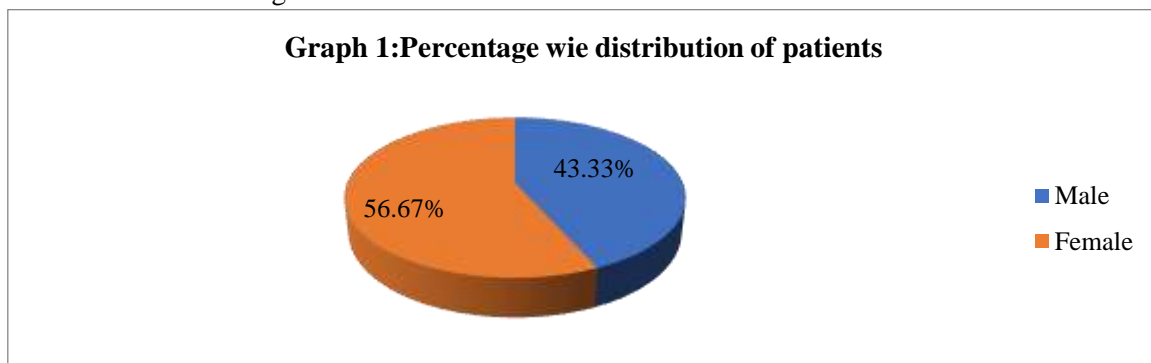


Table 2: Femoro-Tibial Angle (FTA)

Measurement	Preoperative Mean ± SD	Postoperative Mean ± SD	p-value
Femoro-Tibial Angle (FTA)	177.3° ± 2.4°	179.6° ± 3.1°	< 0.001

Table 2 displays the alterations in the femoro-tibial angle (FTA) before to and during the PFO operation. The average preoperative FTA was 177.3° with a standard variation of 2.4°, which increased to 179.6° ± 3.1° after the operation. The alterations in the femoro-tibial angle (FTA) was statistically significant, as shown by a p-value of less than 0.001.

Table 3: Visual Analogue Scale (VAS) for Pain




Time Point	Mean VAS Score ± SD	p-value
Preoperative	8.33 ± 1.32	< 0.001
Postoperative	3.67 ± 1.11	

Table 3 presents the changes in pain intensity as assessed by the Visual Analogue Scale (VAS). The average preoperative VAS score was 8.33 ± 1.32 , and it fell dramatically to 3.67 ± 1.11 after the operation. The decrease in discomfort was statistically significant, as shown by a p-value of less than 0.001.

Table 4: American Knee Society Score (KSS)

Time Point	Mean KSS ± SD	p-value
Preoperative	51.87 ± 4.28	< 0.001
Postoperative	83.08 ± 5.51	

Table 4 displays the alterations in knee function evaluated by the American Knee Society Score (KSS). The average preoperative KSS score was 51.87 ± 4.28 , which increased to 83.08 ± 5.51 after the operation. The improvement in knee function demonstrated statistical significance, as shown by a p-value of less than 0.001.

		
F3: Preoperative x -ray	F4: Intraoperative picture	F5: 3 months follow up x-ray, significant increased joint space

Discussion

Knee osteoarthritis is the predominant kind of arthritis in the elderly population and is a significant contributor to disability.¹³ The surgical options for KOA include arthroscopic debridement, HTO, proximal fibular osteotomy, and either unicompartmental or complete knee arthroplasty using artificial components. Successful HTO relies on careful patient selection. HTO is most suitable for young patients who have osteoarthritis in the medial compartment of the knee and a varus deformity.¹⁴ Severe osteoporosis in senior patients increases the likelihood of tibial plateau fracture and proximal necrosis when undergoing high tibial osteotomy, making it an unfavourable surgical option for older individuals.¹⁵ 2PFO might serve as a viable option for individuals suffering from medial osteoarthritis (OA) of the knee in developing nations such as India, because to the constraints imposed by their financial and healthcare systems. Additionally, it might serve as a viable surgical option for individuals with osteoarthritis in the inner region of the knee, particularly for those who are unable to

undergo total knee arthroplasty (TKA) due to certain medical conditions. Moreover, these patients retain the option to have Total Knee Arthroplasty (TKA) in the future, should it become required.

The research revealed a significant enhancement in the femoro-tibial angle (FTA), with the average preoperative value of 177.3° increasing to 179.6° after the operation. This discovery is consistent with the research conducted by Yang et al., which revealed that the average correction of the frontal tibial angle (FTA) increased from 177.5° to 179.4° after performing proximal fibular osteotomy (PFO). This indicates that PFO is an efficient method for correcting varus deformity and enhancing knee alignment.⁴

The decrease in pain levels, as assessed using the Visual Analogue Scale (VAS), in our study (from 8.33 ± 1.32 before the operation to 3.67 ± 1.11 after the operation), is similar to the findings of Zhang et al., who reported a reduction in VAS scores from 8.0 to 3.5 after the operation in their group of patients undergoing PFO. The notable decrease in pain emphasizes the promise of PFO as a minimally invasive technique that offers considerable pain relief.¹⁶ In our research, the American Knee Society Score (KSS) showed a significant improvement in knee function, with a preoperative score of 51.87 ± 4.28 increasing to 83.08 ± 5.51 postoperatively. This finding aligns with the results published by Wang et al., who saw a similar rise in KSS from 50.2 to 82.3 after surgery. The findings highlight the efficacy of PFO in improving knee function and mobility.¹⁷

The precise method by which fibular osteotomy alleviates pain and corrects varus alignment remains uncertain. In weight-bearing joints such as the knee, there is a certain amount of bone mass reduction that occurs as a person gets older. In their study on knee non-uniform settlement, Zhang et al.¹⁵ highlighted the significance of the fibula in providing lateral support to the lateral condyle of the tibia. This support results in uneven settlement of the tibial condyles, with a greater impact on the medial side. Yang et al.⁴ hypothesized that the lateral support of the fibula to the tibial plateau is the main mechanism causing non-uniform settling of the tibial plateau and a medial displacement of the mechanical axis. After performing an osteotomy on the upper section of the fibula, the lateral support of the fibula weakens. This results in the correction of the varus deformity and causes the loading force to move towards the outer side. As a result, there is relief from discomfort and improvement in function.

The research findings indicate that PFO efficiently redistributes load throughout the knee joint by unloading the medial compartment, as seen by the considerable improvements in FTA, VAS, and KSS. Through the excision of a portion of the fibula, the mechanical alignment of the lower leg is changed towards the side, resulting in a decrease in pressure on the inner compartment and providing relief from discomfort. Moreover, the enhancement in knee alignment may lead to superior functional results and impede the advancement of osteoarthritis. An advantage of our research is the incorporation of a very substantial sample size of 60 patients, which yields strong and reliable data for analysis. Utilizing standardized outcome measures such as Visual Analog Scale (VAS) and Knee Society Score (KSS) facilitates straightforward comparison with other research projects. Nevertheless, our research is constrained by its brief duration of monitoring. Extended research is necessary to evaluate the long-lasting effectiveness of PFO results and the likelihood of osteoarthritis development in the lateral compartment.

Limitation of the study

The shortcoming of the study is small sample size and short duration of the study.

Conclusion

Proximal fibular osteotomy is a very successful surgical procedure for those suffering with medial compartment knee osteoarthritis. It offers substantial benefits in terms of pain reduction, knee alignment, and functional results.

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