# Clinical and Functional Outcomes of Proximal Fibular Osteotomy in Patients with Knee Osteoarthritis and Diabetes Mellitus in Southern India

**Dr. Rohan Raj[1*], Dr. Balaji[2], Dr. Vankamaddi Vishnuvardhan[3]**

[1*]Junior Resident, Department of Orthopaedics, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, Tamil Nadu, India

**ORCID: 0009-0003-2169-8321**

Email: s.romanraj@gmail.com

[2]Senior Resident, Department of Orthopaedics, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, Tamil Nadu, India

**ORCID: 0000-0002-8018-1395**

[3]Senior Resident, Department of Orthopaedics, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, Tamil Nadu, India

**Orcid ID: 0009-0007-3465-5434**

**Abstract**

Background: Knee osteoarthritis (KOA) is a common degenerative joint disorder that causes pain, functional limitation, and reduced quality of life, particularly among older adults. Proximal fibular osteotomy (PFO) is a relatively simple, minimally invasive, joint-preserving procedure that has been proposed as an alternative treatment for selected patients with predominantly medial compartment KOA. However, evidence regarding its clinical and functional outcomes in patients with diabetes mellitus remains limited.

Aim: To evaluate the clinical and functional outcomes of proximal fibular osteotomy in patients with knee osteoarthritis and diabetes mellitus.

Materials and Methods: This prospective observational study was conducted in the Department of Orthopaedics, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, from February 2025 to March 2026. Patients aged ≥45 years with symptomatic knee osteoarthritis, functional limitations, and BMI ≥25 kg/m² were included. Patients with involvement of both medial and lateral compartments, BMI <25 kg/m², previous high tibial osteotomy, or a history of intra-articular injection were excluded. Patients underwent proximal fibular osteotomy under spinal anaesthesia. Clinical outcomes were assessed using the Visual Analogue Scale (VAS) for pain and the knee and function sub-scores of the American Knee Society Score (AKSS). Weight-bearing anteroposterior radiographs were obtained before and after surgery, and medial and lateral joint-space widths were compared. Continuous variables were expressed as mean ± standard deviation, and preoperative and postoperative parameters were compared using appropriate paired statistical tests. A p-value <0.05 was considered statistically significant.

Results: A total of 35 patients were included in the study. There was a marked female predominance, with 28 (80%) females and 7 (20%) males. The mean age of the study population was 58.9 years. The majority of patients, 22 (62.8%), belonged to the 56–65-year age group, followed by 7 (20%) patients aged >65 years and 6 (17.1%) patients aged 44–55 years. The right knee was involved in 71% of patients, while the left knee was involved in 29%. Postoperative clinical and functional outcomes were assessed using VAS and American Knee Society scores, while radiological outcomes were evaluated by comparing preoperative and postoperative joint-space measurements.

Conclusion: Patients undergoing proximal fibular osteotomy in this study were predominantly females and belonged to the 56–65-year age group, with right knee involvement being more frequent. PFO represents a relatively simple and minimally invasive joint-preserving procedure for appropriately selected patients with medial compartment knee osteoarthritis. Evaluation of postoperative pain, functional status, and radiological parameters may help determine its effectiveness, particularly in patients with coexisting diabetes mellitus. Larger studies with longer follow-up are warranted to establish its long-term clinical and functional benefits.

Keywords: Knee osteoarthritis; Proximal fibular osteotomy; Diabetes mellitus; Visual Analogue Scale; American Knee Society Score; Functional outcome; Joint-space width.

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**Introduction**

Osteoarthritis (OA) is the most common form of arthritis and represents a major cause of pain, disability, and loss of functional independence among adults worldwide. Knee osteoarthritis (KOA) is particularly important because it affects mobility and activities of daily living and is strongly associated with increasing age, female sex, obesity, previous joint injury, and mechanical loading. The global burden of KOA has increased substantially over recent decades, with the Global Burden of Disease Study 2019 estimating approximately 364.6 million prevalent cases worldwide in 2019. The burden is expected to increase further with population ageing and the increasing prevalence of metabolic risk factors such as obesity and diabetes mellitus.[1,2]

KOA is a chronic, progressive disorder characterized by structural and functional changes involving the articular cartilage, subchondral bone, synovium, menisci, and surrounding periarticular tissues. Although traditionally considered a degenerative disease resulting primarily from mechanical wear, current evidence indicates that OA is a complex disease involving mechanical, inflammatory, metabolic, and biological mechanisms. Risk factors include increasing age, obesity, malalignment, previous trauma, genetic predisposition, and metabolic abnormalities.[3] Medial compartment involvement with varus alignment is one of the common patterns of KOA, in which altered lower-limb biomechanics increase the load transmitted through the medial compartment and contribute to progressive narrowing of the joint space and functional deterioration.

Diabetes mellitus (DM) is increasingly recognized as a potential metabolic contributor to OA. Hyperglycaemia, insulin resistance, oxidative stress, advanced glycation end products, and chronic low-grade inflammation may influence cartilage metabolism and joint homeostasis. Epidemiological studies have demonstrated an association between DM and OA, although the independent contribution of diabetes after accounting for obesity and other confounding factors remains debated.[4,5] Importantly, patients with concomitant DM and KOA represent a clinically relevant population because diabetes may influence tissue healing, functional recovery, and the overall response to surgical intervention. Therefore, evaluating treatment outcomes specifically in patients with diabetes may provide clinically useful information for patient selection and counselling.

Management of KOA ranges from conservative measures such as weight reduction, exercise, physiotherapy, analgesic medication, and intra-articular therapies to joint-preserving and joint-replacement procedures in advanced disease. For patients with predominantly medial compartment disease and varus malalignment, high tibial osteotomy (HTO) has traditionally been used to redistribute the mechanical load across the knee. However, HTO involves correction of the tibial alignment and generally requires greater surgical exposure, fixation implants, and a longer rehabilitation period.

Proximal fibular osteotomy (PFO) has emerged as a less invasive, joint-preserving alternative for selected patients with medial compartment KOA. The procedure involves resection of a segment of the proximal fibula, with the proposed biomechanical effect being redistribution of loading and reduction of excessive medial compartment stress.[6] Clinical studies have reported improvements in pain, knee function, joint-space parameters, and lower-limb alignment following PFO. A systematic review of Indian studies also demonstrated generally favourable improvements in pain, functional outcomes, and radiological parameters following PFO in patients with medial compartment KOA.[7] Recent systematic reviews and meta-analyses have further supported improvements in pain and functional scores after PFO, although heterogeneity between studies and limited long-term evidence remain important limitations.[8]

Despite increasing evidence supporting PFO, data specifically evaluating its clinical and functional effectiveness in patients with KOA and concomitant diabetes mellitus remain limited. Diabetes may potentially modify postoperative recovery and functional outcomes, making this an important subgroup for investigation. Therefore, the present study aims to evaluate the clinical and functional outcomes of proximal fibular osteotomy in patients with knee osteoarthritis and diabetes mellitus in India, with particular emphasis on improvement in pain, knee function, and postoperative recovery.

**Aim**

To evaluate the clinical and functional outcomes of proximal fibular osteotomy (PFO) in patients with knee osteoarthritis associated with diabetes mellitus in an Indian population.

**Objectives**

1. To assess the change in pain severity following proximal fibular osteotomy using a validated pain assessment scale.
2. To evaluate the functional outcome of the knee following proximal fibular osteotomy using a validated functional scoring system such as the Knee Society Score (KSS) or Oxford Knee Score.
3. To compare preoperative and postoperative clinical and functional parameters following proximal fibular osteotomy.

**Materials and Methods**

This prospective observational study was conducted in the Department of Orthopaedics, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, over a period from February 2025 to March 2026. The study included patients aged 45 years or older who presented with knee osteoarthritis associated with knee pain and functional limitations and were planned for proximal fibular osteotomy (PFO). Patients with a body mass index (BMI) ≥25 kg/m² were included. Patients aged less than 45 years, those with involvement of both the medial and lateral compartments of the knee, BMI <25 kg/m², previous high tibial osteotomy, or a history of intra-articular knee injection were excluded from the study. All eligible patients underwent a detailed clinical evaluation before surgery. Pain severity was assessed using the Visual Analogue Scale (VAS), while knee function and ambulation were evaluated using the knee and function sub-scores of the American Knee Society Score (AKSS). Preoperative and postoperative weight-bearing anteroposterior (AP) radiographs of the affected knee were obtained. The joint-space width of the medial and lateral compartments was measured and compared between the preoperative and postoperative radiographs to assess radiological changes following PFO.

Proximal fibular osteotomy was performed by a skilled and experienced orthopaedic surgeon. Patients were placed in the supine position following administration of spinal anaesthesia. An approximately 5-cm longitudinal incision was made over the lateral aspect of the proximal fibula. The proximal fibula was exposed through the interval between the peroneus and soleus muscles, with careful protection of the surrounding neurovascular structures. A segmental proximal fibular osteotomy was then performed according to the established surgical technique. A negative-pressure suction drain was placed at the surgical site and was removed within 24 hours. Postoperatively, pneumatic compression was used to reduce the risk of lower-limb venous thrombosis, and appropriate lower-limb physiotherapy and mobilization exercises were initiated. Patients were followed up clinically and radiologically, and postoperative changes in VAS, American Knee Society knee and function scores, and joint-space width were documented.

Statistical Analysis

Data collected during the study were entered and analyzed using Microsoft Excel. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. Preoperative and postoperative clinical and radiological parameters, including VAS score, American Knee Society knee and function scores, and joint-space width, were compared using an appropriate statistical test for paired observations, such as the paired Student's t-test for normally distributed continuous variables. A p-value <0.05 was considered statistically significant. Where appropriate, the magnitude of change between preoperative and postoperative measurements was also calculated to determine the clinical and functional improvement following proximal fibular osteotomy.

**Result:**

A total of 35 diabetic mellitus patients were included in our study out of which 7 knees (L=3, R=4) were of males and 28 knees (L=7, R=21) were of females. Here was a female prevalence seen in present study along with the right knee being more frequently affected. Mean age of the patients was initiate to be 58.9 years. 62.8% of the patients belonged to the age group of 50 to 65 years. Right knee involvement occurred in 71% percent of the patients with OA, whereas left knee involvement occurred in 29 percent of the patients.

Table:1 Gender wise distribution patients

| **Gender of patients** | **Number of patients** | **Percentage** |
|---|---|---|
| Male | 7 | 20% |
| Female | 28 | 80% |
| Total | 35 | 100% |

Table: 2 Age-wise distributions of patients

| **Age group** | **Number of patients** | **percentage** |
|---|---|---|
| 44 to 55 | 6 | 17.1% |
| 56-65 | 22 | 62.8% |
| More than 65 | 7 | 20 |
| Total | 35 | 100% |

Figure: 1Surgical Exposure using Fibular Posterolateral approach.

Figure: 2 Fibular Osteotomy done approximately 6-10 cm (around four finger breadth) from fibular head.

Table: 3 Mean VAS score at different time intervals

| **Time intervals** | **Mean VAS score** | **p- value** |
|---|---|---|
| Pre-operative | 7.89 | 0.00 (Significant) |
| Post-operative | 4.74 | |
| Post operative6 weeks | 2.47 | |
| Post operative 9weeks | 1.52 | |

In present study reported as VAS score at pre-operative, postoperative, postoperative 6 weeks and postoperative 9 months were

found to be 7.89, 4.74, 2.47and 1.52correspondingly. Considerable results were obtained while comparing the mean VAS at different postoperative time intervals.

Table:4 Mean KSS score at different time intervals

| Time intervals | Mean KSS score | p- value |
|---|---|---|
| Pre-operative | 43.04 | 0.00 (Significant) |
| Post-operative | 53.50 | |
| Post operative6 weeks | 67.11 | |
| Post operative 9weeks | 68.14 | |

Our study results KSS score at pre-operative, postoperative, postoperative 6 weeks and postoperative 9 months were establish to be 43.04, 53.50, 67.11and 68.14 respectively. Significant results were obtained while comparing the mean KSS at different postoperative time intervals. (Table-4).

**Discussion**

In the present study, a total of 35 patients with knee osteoarthritis undergoing proximal fibular osteotomy were evaluated. A marked female predominance was observed, with 28 patients (80%) being females and 7 patients (20%) being males. This finding is consistent with the epidemiological pattern of knee osteoarthritis reported in the Indian population. Pal et al. reported a prevalence of knee osteoarthritis of 28.7% in an Indian community-based study, with a significantly higher prevalence among females (31.6%) and increasing age identified as important associated factors.[9] The higher proportion of women in the present study may be related to the increased prevalence of knee osteoarthritis among women with advancing age, in addition to differences in body composition, hormonal factors, occupational activities, and biomechanical loading. The female predominance is also relevant because women frequently present with symptomatic and functionally limiting knee osteoarthritis at older ages.

The mean age of patients in the present study was 58.9 years, and the majority of patients belonged to the 56–65-year age group (22 patients, 62.8%), followed by those aged more than 65 years (7 patients, 20%) and 44–55 years (6 patients, 17.1%). Thus, approximately two-thirds of the study population were in the sixth and early seventh decades of life. The age distribution is consistent with the established relationship between advancing age and knee osteoarthritis. Degenerative changes in articular cartilage, subchondral bone, menisci, and other joint structures accumulate with increasing age, thereby increasing the likelihood of symptomatic disease.[10] Recent Indian systematic-review evidence has similarly identified advancing age and female sex among the important risk factors associated with knee osteoarthritis.[11]

In terms of laterality, the right knee was affected in 71% of patients, whereas the left knee was affected in 29%. Therefore, right-sided involvement was considerably more frequent in this cohort. Although this represents an observed pattern in the present study, it should not necessarily be interpreted as evidence of an intrinsic predisposition for right-sided osteoarthritis. Laterality may be influenced by occupational activity, limb dominance, previous injury, habitual loading patterns, and individual biomechanics. The relatively small sample size of 35 patients also limits the ability to establish whether this difference represents a true population-level association. Larger studies would be required to determine whether a consistent difference exists between right- and left-sided disease.

The demographic characteristics of the present cohort are important when interpreting the role of proximal fibular osteotomy (PFO) as a joint-preserving procedure. PFO has been increasingly investigated for patients with medial compartment knee osteoarthritis, particularly those with varus deformity. Its proposed mechanism involves alteration of load distribution across the knee following removal of a segment of the proximal fibula.[12] Previous systematic reviews have reported improvements in pain, knee function, and radiological parameters following PFO, although the available literature is characterized by relatively small sample sizes and heterogeneity in patient selection and follow-up.[13] A systematic review specifically evaluating Indian studies also reported generally favourable improvements in pain, functional outcomes, and radiological parameters after PFO.[14] The present study therefore provides useful demographic information regarding patients undergoing PFO, particularly the predominance of females and patients in the 56–65-year age group. However, demographic characteristics alone cannot establish treatment effectiveness. Assessment of postoperative changes in pain, functional scores, and radiological joint-space measurements is necessary to determine the clinical benefit of PFO in this population. The findings should also be interpreted in the context of the relatively small sample size and single-centre design. Future multicentre studies with larger cohorts and longer follow-up may help clarify the influence of age, sex, laterality, metabolic comorbidities, and other patient-related factors on outcomes following PFO.

**Conclusion**

In the present study, proximal fibular osteotomy was evaluated in patients with knee osteoarthritis, with a predominance of female patients and individuals in the

56–65-year age group. Right knee involvement was more frequent than left knee involvement. These findings highlight the demographic characteristics of patients presenting with symptomatic knee osteoarthritis who underwent PFO in the study population. PFO is a relatively simple, minimally invasive, joint-preserving procedure that may provide an alternative treatment option for appropriately selected patients with predominantly medial compartment knee osteoarthritis. Evaluation of postoperative pain, functional status, and radiological joint-space changes can help determine its clinical effectiveness. However, the relatively small sample size and single-centre design limit the generalizability of the findings. Larger prospective studies with longer follow-up are required to establish the long-term clinical, functional, and radiological outcomes of PFO, particularly among patients with associated metabolic comorbidities such as diabetes mellitus.

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