

FUNCTIONAL OUTCOME OF PROXIMAL FIBULAR OSTEOTOMY IN MEDIAL COMPARTMENT OSTEOARTHRITIS OF THE KNEE

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Received : 08/08/2026
 Received in revised form : 04/09/2026
 Accepted : 17/09/2026

Keywords:
 Osteoarthritis, osteotomy, visual analog scale, american knee society score.

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DOI: 10.47009/jamp.2026.8.5.67

Source of Support: Nil,
 Conflict of Interest: None declared

Int J Acad Med Pharm
 2026; 8 (5); 433-439



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ABSTRACT

Background: Objective: Osteoarthritis is a chronic progressive disease which is accompanied by joint pain, stiffness and often deformity. To evaluate the effectiveness of proximal fibular osteotomy as an upcoming surgery for improvement in pain and medial joint space in patients with medial compartment osteoarthritis of the knee. **Materials and Methods:** A total of 350 patients underwent proximal fibular osteotomy for medial compartment knee osteoarthritis from September 2018 to August 2020 at Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry and were regularly followed up. Both pre and postoperative full weight bearing radiographs were compared for the medial and lateral joint space along with the visual analogue scale (VAS) score and the American knee society score (KSS). **Results:** All of the 350 patients were followed up. Among them 128 were male and 222 were female. The mean age of participants was 56 years. 313 of the knees were grade 2 based on Kellgren Lawrence classification and 37 were grade 3. The average preoperative and postoperative VAS score were 76.5 and 2.7 points respectively and the average preoperative and postoperative KSS scores were 33.6 and 83.8 points respectively. The medial joint space also improved significantly from an average of 1.14mm to 3.02mm. **Conclusion:** In conclusion we would like to say that PFO is an excellent alternate surgery for management of medial compartment osteoarthritis of the knee. It is simple, inexpensive, effective procedure that is also associated with lesser complications and shorter recovery period as compared to HTO, UKA or TKA.

INTRODUCTION

Osteoarthritis is a chronic progressive disease which is accompanied by joint pain, stiffness and often deformity. Knee OA (KOA) is the commonest type of osteoarthritis seen among all the joints of the body and is the most common cause of disability in the geriatric population.^[1]

Among the three compartments in the knee the chances of developing primary medial KOA is 10 times higher than that of developing primary lateral KOA and every individual has a 44% lifetime risk of developing knee osteoarthritis.^[2]

Surgical treatment commonly includes different osteotomies, uni-compartmental knee arthroplasty (UKA) and total knee arthroplasty (TKA).^[3]

Arthroplasty (UKA or TKA) is a complex and expensive procedure with chances of dreaded post-operative complications. High tibial osteotomy

(HTO) is also not economical. They have an extremely painful post-operative and recovery period as well. Some patients may also need a second knee revision in their lifetime especially if they are young.^[4,5]

The non-uniform lateral and medial supports in varus knees is because of osteoporosis which leads to a three-cortex support laterally and a single cortical support medially. This results in non-uniform settlement which causes a medial shift of load from the normal distribution leading to even more varus thereby enhancing the progression of medial compartment KOA.^[6]

Proximal fibular osteotomy (PFO) is a simple and safe procedure, that addresses the biomechanical issue, that has a brief recovery period and can, if not treat, at least buy time till finally a total knee arthroplasty is needed. It may even negate the need for UKA altogether.^[3] Relief in pain is seen in almost all of the patients.

MATERIALS AND METHODS

This prospective study was conducted in Department of Orthopaedic Surgery, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry from September 2018 to 2020 with the sample size of 350 patients.

Study population: All the patients visiting the Ortho OPD of Sri Lakshmi Narayan Institute of Medical Sciences with medial compartment osteoarthritis of the knee willing to be a part of the study. All the patients were followed up at 1 month, 3 months, 6 months and 1 year after the surgery.

Inclusion Criteria

1. Patients with medial compartment OA (KG Grade II or III) willing to give consent to be a part of the study
2. Predominance of self-reported pain over medial compartment of the knee
3. Knee pain unresponsive to conventional medical treatments for at least 3 months

Exclusion Criteria

1. Patients with involvement of lateral tibio-femoral joint or patellofemoral joint
2. Patients with valgus deformities of knee
3. Patients with post traumatic OA
4. Patients with history of previous infection in the knee
5. Patients with inflammatory arthritis
6. Patients with medical co-morbidities leading to osteoporosis (hepatic or renal)
7. History of prior knee replacement surgery or high tibial osteotomy
8. Patients with history of intra articular steroid injections within a period of 6 months

Preoperative assessment

All the patients were assessed preoperatively for the knee pain with the help of visual analogue scale (VAS), for the knee ambulation activities with the help of American Knee Severity Score (KSS) and the medial and lateral joint spaces were also measured on weight-bearing lower limb radiographs and their ratios calculated. The medial and lateral joint spaces can be measured by the vertical lines A and B between the horizontal lines C & D and E & F, respectively. Lines C & D are horizontal lines drawn from the lowest point of the medial condyle of femur and the medial plateau of the tibia, respectively whereas lines E & F are horizontal lines drawn from the lowest point of the lateral femoral condyle of the femur and the lateral tibial plateau, respectively. A/B gives the ratio of the medial joint space to the lateral joint space.

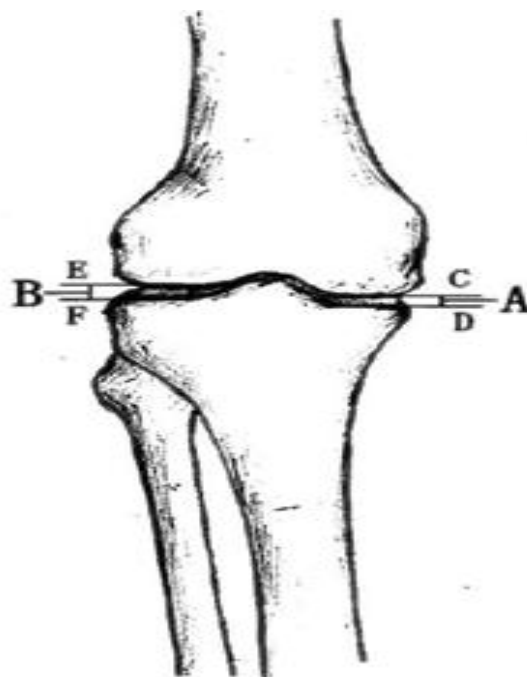


Figure 1: Ratio of Medial joint space to Lateral joint space

The hip-knee-ankle angle was also measured based on the whole lower limb radiographs. Line A is drawn from the centre of the head of femur to the centre of the knee joint and line B is drawn from the centre of the knee to the centre of the ankle joint. The intersection between lines A and B gives the hip-knee-ankle angle.

- Measure the patient's height
- Plan correct level of osteotomy —
- Height < 5 feet 6 inches - 8 cm below the fibular head
- Height > 5 feet 6 inches - 9 cm below the fibular head
- The ideal site to perform PFO described in the literature is 6 - 10 cms from the caput fibulae.^{3,7} Another study has described it as 7 – 8 cms from the head of the fibula.⁸ We chose the above-mentioned site as an average of these studies.
- The level at which the osteotomy is to be done is important because if done too low it will be ineffective and if done too high it carries the risk of injuring the common peroneal nerve.

Instrumentation

Routine bone and soft tissue instruments along with instruments needed for osteotomy. Ways to perform an osteotomy - multiple drill holes and breaking the bone with a chisel; using a power oscillating saw or with the help of a Gigli saw. Oscillating saw is preferred because it reduces the effort and increases the precision of the procedure. One must be careful while handling power tools so as to not injure the surrounding soft tissue structures.

Special instruments required — power tools, saw blades, drill bits, Gigli wires, thin flat chisels and a stainless-steel scale.

Proximal fibular osteotomy - Surgical procedure:

All the procedures were done only after obtaining a written informed consent by the patient and ensuring that the patient is fit to undergo the surgery.

Anaesthesia of choice - Spinal. Position of the patient - Supine

Antibiotic coverage - Cefoperazone + Sulbactam A tourniquet was not used in our study.

Osteotomy site — 8 to 9 cm distal to the most prominent part of the fibular head.

A 5 - 8 cm long incision made over the lateral skin of the proximal fibula overlying the osteotomy site and the skin and soft tissue dissection was carried out. The fibula was exposed between the peroneus and soles muscles. The periosteum was incised, a 1.5 to 2 cm long piece of fibula was resected with the help of an oscillating saw. Care was taken not to stretch the soft tissue and avoid potential injury to the nerve. In some patients we encountered fibulae that bled quite profusely. In such cases bone wax was used to seal the cut ends of the bone. Once haemostasis was ensured a thorough wound wash was given followed by closure in layers and a sterile dressing with compression bandaging. Patients were made to stand and walk on the same evening of the surgery and were discharged on the third post-operative day after the first dressing.

INTRA-OPERATIVE PHOTOGRAPHS



Figure 2: Bilateral knees were operated in this patient



Figure 3: This patient is 5 feet 10 inches tall, so osteotomy was planned 9 cms distal to the head of fibula



Figure 4: Retract with Langenback's retractors alone. Avoid Hohmann's retractors at all cost



Figure 5: Periosteum was incised and elevated with the periosteum elevator



Figure 6: 2.5 mm drill holes made at the osteotomy level



Figure 7: A narrow saw is used to cut the fibula above and below the Steinmann's pin



Figure 8: Routine closure

RESULTS

Proximal fibular osteotomy was performed in 443 knees of 350 patients. The minimum age of a participant in our study was 47 years and the maximum was 68 years. The mean age of participants is 56 years.

At each follow up visit which happened at 1 month, 3 months, 6 months and 12 months post op, all the patients were analysed for complications and their functional outcome was compared with their previous status.

The patients were evaluated with the help of weight bearing X-rays of the knees. Knee ambulation activities were evaluated using the American Knee Society score (KSS) and pain was assessed with the help of visual analogue scale (VAS).

Table 1: Age distribution

Age	Frequency	Percent
45-50	58	16.7%
51-55	117	33.3%
56-60	105	30.0%
61-65	47	13.3%
66-70	23	6.7%
Total	350	100%

The maximum number of the patients were in the 51 - 60 years of age group with accounted for 63.3% of patients in our study. The youngest subject was of 47

years whereas the oldest was 68 years old. The mean age of the individuals was 56 years.

Table 2: Gender Distribution

Gender	Frequency	Percentage
Female	222	63.4%
Male	128	36.6%
Total	350	100%

A total of 222 patients out of the 350 were female which accounts for 63.4% indicating that a higher

female preponderance of female patients suffering from osteoarthritis.

Table 3: Side Distribution

Side	Frequency	Percent
Right	117	33.4%
Left	140	40.0%
Bilateral	93	26.6%
Total	350	100%

A total of 117 patients had Right OA knee and 140 had it in the Left whereas 93 patients had both the knees affected.

Table 4: Stage of OA (Kellgren - Lawrence Classification)

KL Grade	Frequency	Percent
Grade 0	0	0.0%
Grade 1	0	0.0%
Grade 2	313	89.4%
Grade 3	37	10.6%
Grade 4	0	0.0%
Total	350	100%

In this study most of the knees operated on (89.4%) had Grade 2 osteoarthritis and 10.6% had Grade 3 OA according to Kellgren and Lawrence classification.

Table 5: Body Mass Index (BMI)

BMI Category	Frequency	Percent
<18.5	0	0.0%
18.5 – 24.9	116	33.1%
25 – 29.9	210	60.0%
>30	24	6.9%
Total	350	100%

Most of the patients who were a part of the study were over weight (60%). 116 out of the 350 patients were of in the normal category.

American Knee Society Score

	Point
Pain	
None	50
Mild or occasional	45
Stairs only	40
Walking and stairs	30
Moderate	
Occasional	20
Continual	10
Sever	0
Range of motion	
5°=1 point	25
Stability	
Anteroposterior	
<5 mm	10
5–10 mm	5
10 mm	0
Mediolateral	
<5°	15
6–9°	10
10–14°	5
>15°	0
Subtotal	[–]
Deductions points (minus)	
Flexion contracture	
5–10°	2
10–15°	5
16–20°	10
>20°	15
Extension lag	
<10°	5
10–20°	10
>20°	15
Alignment	
5–10°	0
0–4°	3 points each degree
11–15°	3 points each degree
Other	20
Total deductions	[–]
Total knee score	[–]

A score of

< 60	—	Poor
60-69	—	Fair
70-79	—	Good
80-100	—	Excellent

Table 6: American Knee Society Score

Parameter	Frequency	Mean	Minimum	Maximum
Pre-op	350 (≈443 knees)	33.6	24	45
Post-op	350 (≈443 knees)	83.8	78	90

In my study it was found that the average pre-operative KSS was 33.6 which improved to 83.8 in the immediate post-operative period which indicates

towards significant improvement in the disability of the patient.

Table 7: VAS Score

Parameter	Frequency	Mean	Minimum	Maximum
Pre-op	350 (≈443 knees)	6.5	5	8
Post-op	350 (≈443 knees)	2.7	2	4

Patients reported significant improvement in pain as the VAS score reduced drastically from 6.5 to 2.7 in the immediate post-operative period indicating

towards the impact this procedure than have in reducing the symptoms of the patient.

Table 8: Mean Medial & Lateral joint spaces

	Frequency	Mean Medial Joint Space	Mean Lateral Joint Space
Pre-op	350 (443 Knees)	1.14 mm	5.69 mm
Post-op	350 (443 Knees)	3.02 mm	5.3 mm

It was found that due to the procedure the medial joint space had opened up on an average from 1.14 mm to

3.02 mm and the lateral joint space reduced from 5.77 mm to 5.43 mm.

Table 9: Ratio of Medial Joint Space (M) to lateral Joint Space (L)

	Frequency	Ratio (M/L)
Pre-op	350 (443 Knees)	0.20 mm
Post-op	350 (443 Knees)	0.56 mm

The ratio of the medial joint space to the lateral joint space had reduced from 0.20 mm to 0.56 mm which is found to be significant and indicates towards opening up of the medial joint space thereby relieving the patient off of his/her symptoms.

DISCUSSION

This study was done at Sri Lakshmi Narayana Institute of Medical Sciences for a two- year duration, from September 2018 to August 2020. In the study a total of 350 cases (443 knees as 93 cases were bilateral) of medial compartment osteoarthritis of knee were treated with proximal fibular osteotomy and were followed up. Other surgical options available for the management of medial compartment arthritis of the knee include and are limited to high tibial osteotomy (HTO) and unicondylar knee arthroplasty (UKA).

High tibial osteotomy is a well validated procedure to correct the varus deformity that is associated with medial compartment osteoarthritis of the knee, but it definitely has its disadvantages and complications. A longer recovery period due to an extended non-weight bearing period follows the surgery until there is union at the osteotomy site. There is a possibility of recurrence of the varus deformity or persistence of pain which eventually needs an arthroplasty.^[9,10]

Unicondylar knee arthroplasty on the other hand is not a well validated procedure and has produced inconsistent results in various studies. It has been found to have a higher revision rate than total knee arthroplasty in some studies.^[11,12]

In this scenario, there is a need for a procedure which is uncomplicated, simple to perform, straightforward, easily reproducible, awards good functional results and is associated with a short recovery period and improves the patient's quality of life. The patient is made to stand as soon as the effect of the spinal anesthesia wears off. The pathogenesis of medial compartment osteoarthritis of the knee indicates that the load transmitted by the tibial plateaus is asymmetrical. More stress is being borne by the medial side which causes "settlement" of the medial tibial plateau leading to a varus deformity and

development of arthritic changes and destruction of the articular cartilage. Proximal fibular osteotomy weakens the lateral support provided by the fibula onto the lateral tibial plateau thereby correcting the varus deformity. It causes a shift of the stress from the far medial point, that it was earlier at, to a more neutral point which results in relief from pain and increased functionality of the limb.

Various previous studies have been carried out to treat medial compartment osteoarthritis of knee with proximal fibular osteotomy. In a study done by Yang et al which included 150 patients with medial compartment arthritis were followed up for a period of more than 2 years. They found an increase in the American Knee Society Score of the knees from 45±21.3 to 92.3±31.7 after proximal fibular osteotomy. There was also a decrease in the pain experienced by the patients as the average visual analogue score was reported to have dropped from 7 to 2. They concluded by saying that proximal fibular osteotomy dramatically improves knee functionality and provides good pain relief.^[13]

A study conducted by Bo Liu et al, of 84 patients with 111 knees which were affected by medial compartment arthritis. They also reported a dramatic increase in the KSS and a remarkable relief from pain postoperatively. 77 knees out of the 111 showed significant improvement in limb functionality.^[14]

Our study included 350 patients (443 knees) which predominantly had osteoarthritis of the medial compartment of the knee, coming under grade 2 and grade 3 Kellgren and Lawrence classification. These individuals were managed by proximal fibular osteotomy and were followed up for a minimum period of 1 year. Majority of the patients in this study belonged to the age group of 51-60 years. There was an increased preponderance of female patients in our study which correlates with the usual incidence of the disease. 60% of the patients were over-weight which indicates that an increased weight increases the load transmitted through the medial joint and also cause varus at the knee. Following the surgery there was an immediate improvement in the American Knee Society Score (KSS) from 83.8 to 33.6. Patients reported a dramatic relief of pain which

was assessed with help of a visual analogue scale (VAS). VAS dropped from 6.5 to 2.7 postoperatively. An increase in the medial joint space was noted after the surgery from an average of 1.14mm to 3.02mm and the lateral joint space decreased on an average from 5.69mm to 5.3mm. This indicates a shift of the stress to a more neutral point. Two of the 30 patients developed a toe drop due to extensor hallucis longus weakness in the postoperative period after an uneventful surgery which eventually got recovered over a period of 3 to 6 months.

The advantage of PFO over the other procedures is that it is a simple and safe procedure which is cost effective and easy to perform. It gives dramatic pain relief postoperatively and is associated with a shorter recovery time. All patients can be mobilised with full weight bearing on the same day of surgery. If the procedure does not give good results in any situation then the field for performing a total knee arthroplasty at a later stage is not altered at all. The limitations of our study were the small sample of patients and relatively short follow up period. A longer period of follow up is necessary to evaluate whether the beneficial effects of PFO are sustained over a period of time.

CONCLUSION

It was concluded that proximal fibular osteotomy is an exciting procedure with promising results for the management of medial compartment knee osteoarthritis. The fact that it is easy to perform, is effective, is inexpensive and gives excellent pain relief postoperatively makes the future of this procedure even more exciting.

It is also associated with lesser complications and has a much shorter post-operative and recovery period when compared to high tibial osteotomy and unicondylar knee arthroplasty. A much longer period of follow up is needed to assess whether the benefits of proximal fibular osteotomy are actually sustainable over a period of time and if it can replace

unicondylar knee replacement or at the very least buy time comparable to high tibial osteotomy before a unicondylar or a total knee arthroplasty is needed.

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