



Original Article

An observational study of outcomes of proximal fibular osteotomy (PFO) in Medial Compartment osteoarthritis of knee joints

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Abstract

Objective: Main aim of this study was to observe the outcomes of proximal fibular osteotomy in unicompartmental (Medial) osteoarthritis of knee joint.

Patients & Method: A prospective clinical study was undertaken from May 2019 to October 2020 on total 32 patients. Preoperative and postoperative weight bearing and whole lower extremity Radiographs were obtained to analyze the alignment of the lower extremity and ratio of the knee joint space (Medial / lateral Compartment).

Both preoperative and postoperative knee pain was assessed by using a VAS (Visual Analogue scale) and knee Ambulation activities by American knee society score.

Results: After PFO

- i. Pain- Relief of Medial Compartment pain was observed in almost all patients.
- ii. Knee ambulation- In most of the patient's knee ambulation improved post-operatively.
- iii. Medial / Lateral compartment space ratio improved
- iv. Lower extremity radiographs- correction of alignment observed in 9 patients out of 30 patients.

Conclusion: This prospective study demonstrates that PFO effectively reliefs pain and improves joint functions in patients with medial compartment osteoarthritis of knee at a mean of 10.4 months post operatively.

Keywords: (i) Medial compartment osteoarthritis of knee
(ii) Proximal fibular osteotomy.

Introduction

Knee osteoarthritis (OA) is a chronic, progressive degenerative disease with accompanying joint pain, stiffness, and deformity¹. Knee OA is a common joint

disease, with an incidence of 30% of the population older than 50 years². Figure 1-1 Showing Osteoarthritis of Bilateral knee with Varus deformity of legs in a 50 years old

female. The initiation and progression of knee OA involves mechanical, structural, genetic, and environmental factors³. Knee varus deformities, characterized by a mechanical femorotibial axis of less than 180° on full-leg standing antero-posterior (AP) radiographs and narrowed medial joint space, are common in patients with knee OA and affect 74% of patients with idiopathic OA⁴. Although it has been reported that even in healthy knees the medial compartment bears 60% to 80% of the load,⁵ no one has precisely documented what contributes to this uneven load distribution. The current belief is that the load is distributed along the mechanical axis, which is generally medial to the centre of the knee. High tibial osteotomy and total knee arthroplasty are the 2 methods used for treating knee OA.

High tibial osteotomy can be a technically demanding procedure and may result in complications, including neurovascular injury, iatrogenic fracture, and nonunion^{6,7}. Total knee arthroplasty (TKA) is useful in elderly with severe degree of medial compartment osteoarthritis and knee varus deformity. TKA can correct lower extremity alignment, relieve pain, and improve function significantly. However, for younger, active patients or patients with moderate OA, it may not be the treatment of choice⁸. Based on previous image and clinical studies, its believe 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^{9,10}. 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. Using this logic, we have performed a proximal fibular osteotomy to relieve the increased loading force on the medial compartment for treatment of medial compartment OA of the knee joint.

Compared with high tibial osteotomy and total knee arthroplasty, the authors found that a simpler surgical procedure, proximal fibular osteotomy, could effectively relieve knee pain and also correct the varus deformity for patients with medial compartment knee osteoarthritis (OA).

A 2-cm-long section of fibula was resected 6 to 10 cm below the fibular head. Proximal fibular osteotomy can significantly improve both the radiographic appearance and function of the affected knee joint and also achieve long-term pain relief. This procedure may be an alternative treatment option for medial compartment OA.

Patients and Method

From May 2016 to October 2017 total 32 Patients in underwent **PFO** and followed prospectively (n=32, Mean Age = 56.238±7.88) age range(48 to 72) years including 18 females and 14 males.

Inclusion criteria for this study were clinical symptoms of osteoarthritis of knee i.e. pain and deformity. Patients in which conservative management failed and who have radiographic evidence of significant varus was good candidates for proximal fibular osteotomy.

The exclusion criteria for this study were post traumatic knee OA, Acute major trauma, inflammatory arthropathy, malignant tumours, significant peripheral vascular diseases, Genu-valgus deformity, significant senile dementia, unfit for anaesthesia or surgery, flexion contracture of more than 15 degree, knee flexion of less than 90 degree and when more than 20 degree of varus correction needed.

A written informed consent was obtained from every participant. Patients were placed on table in the supine position.

An approximately 5 centimeter longitudinal lincision was made over the posterolateral skin of the proximal part of the leg and fibula was exposed between the peroneus (longus and brevis) muscles and soleus muscle. PFO was performed by removing a approximately 2 cm length of fibula at a length of 6 cm below the fibular Head. Careful

about peroneal nerve injury .Steps of PFO as shown in figure 1-2,3,4&5. Preoperative and postoperative x rays are shown in the figure 1-6&7 respectively.

After 24 hrs of operation, full weight bearing and free mobilization were allowed to avoid anaesthetic complication like post spinal headache.

Both pre-operative and post-operative knee joint AP(standing) view and whole lower extremity X-ray were obtained in all patients and analyse the alignment of the lower extremity and medial to lateral compartment space .

By using VAS knee pain was assessed and by American Knee Society Score, knee ambulation activities were recorded.

Medial joint space was determined by a vertical line 'A' between two horizontal lines (C&D), that

were drawn from the lowest point of the medial condyle of the femur and medial plateau of the tibia respectively. Lateral joint space was determined by a vertical line 'B' between two horizontal line (E&F) that were drawn from the lowest point of the lateral condyle of the femur and lateral plateau of the tibia respectively . The ratio of the knee joint space was determined by ratio of A/B.As shown in figure 2-1.

The Hip –Knee –Ankle angle was measured by the whole lower extremity radiograph. Line X was drawn from the centre of the femur head to the centre of the knee and line Y was drawn from the centre of the knee to the centre of the ankle . The Hip –Knee –Ankle angle is the intersection angle alpha between lines X and Y .As shown in *figure 2-2 & 3.*



Figure 1

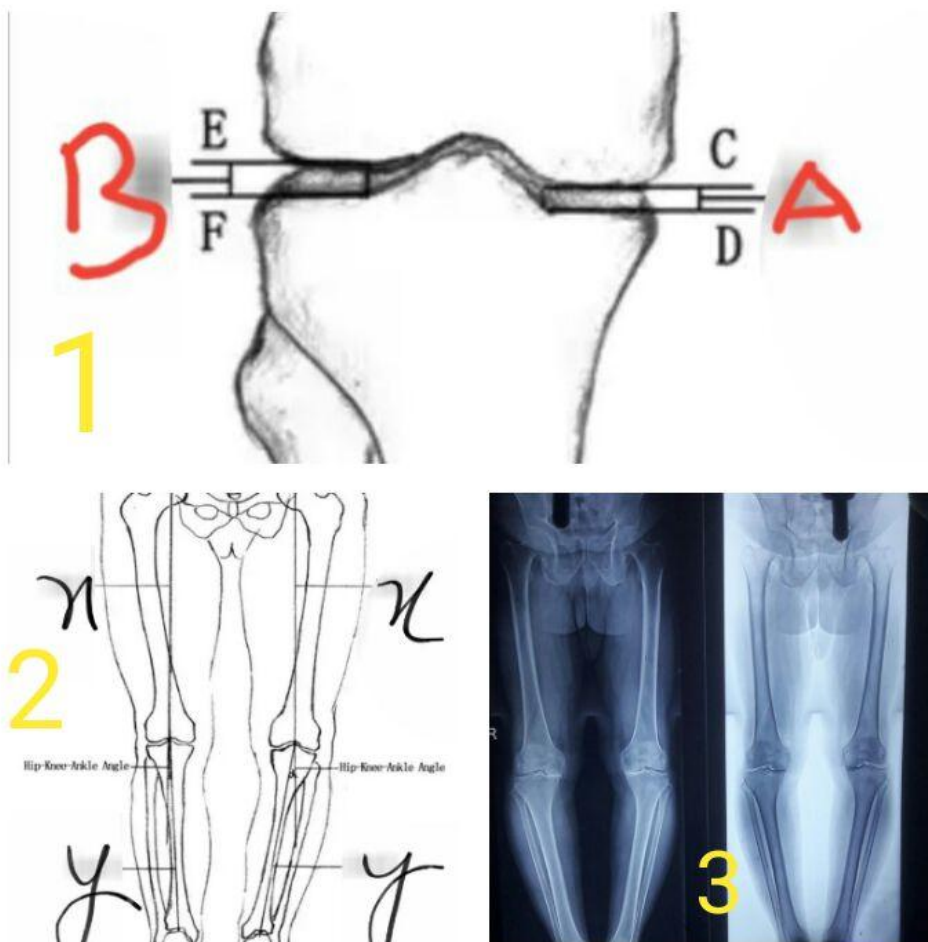


Figure 2

Results

Total 32 patients underwent PFO and out of 32, 4 patients lost to follow-up. (Mean age 56.33, Age range 48 -70 yrs) 28 patients who were followed for a minimum of 12 month . The mean duration of follow-up was 14.44 months (Range 12 - 17Months).

The average duration of bilateral PFO was 38 +- 10 minutes.

No any post operative complications observed.

Relief of pain in medial compartment was observed in almost all patients and mean Visual

Analogue Scale (VAS) score significantly decreased from 7.9+-1.45 preoperatively to 2.69+- 2.24 post operatively .

American Knee Society Score improved from 40.94+- 12.69 to 65.76+- 12.26 and knee function score from 42.41+- 8.5to 68.63+- 12.66 .

Obvious improvement in the joint space ratio (Medial /Lateral compartment) after PFO.

And obvious correction of alignment (Hip-Knee - Ankle) seen after PFO.

All the above results are explained by a graph as shown in figure 3-a&b

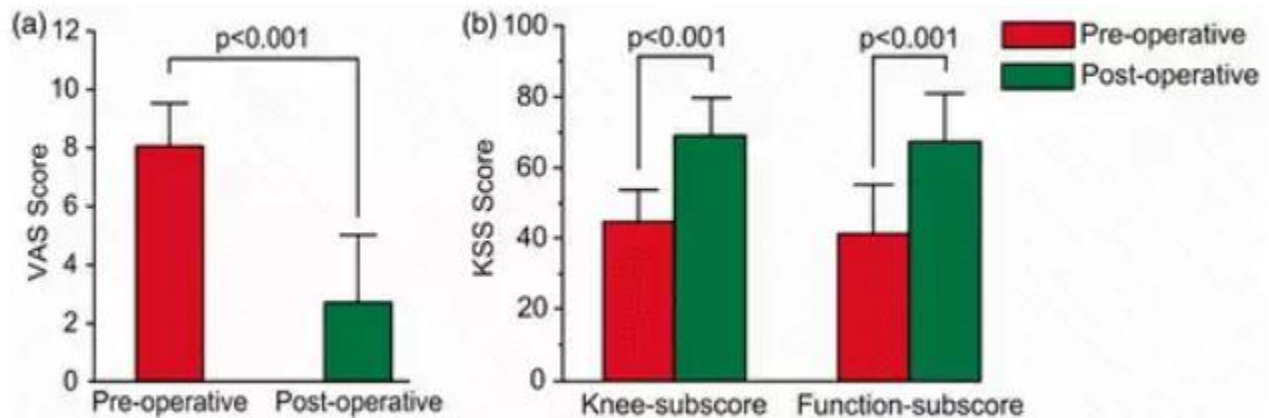


Figure 3

Discussion

Tibial osteotomy is a well-established procedure for the treatment of medial compartment osteoarthritis of the knee. Most reports have shown approximately 80% satisfactory results at 5 years and 60% at 10 years after high tibial osteotomy. These results also have been shown to deteriorate over time, however. The rate of proximal tibial osteotomies performed in North America has declined significantly in recent years, whereas the rate of total and unicompartmental knee arthroplasties has steadily increased. Nevertheless, high tibial osteotomy still is a useful procedure for properly selected patients.

Varus or valgus deformities are fairly common and cause an abnormal distribution of the weight-bearing stresses within the joint. The most common deformity in patients with osteoarthritis of the knee is a varus position, which causes stresses to be concentrated medially, accelerating degenerative changes in the medial part of the joint; if the deformity is one of valgus position, changes are accelerated in the lateral part. 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 joint¹¹. Osteotomies performed Proximal to the tibial tubercle may interfere with function

of the patellar tendon¹². This patellofemoral disturbance is common in patients who have previously undergone High tibial osteotomies. In the authors experience, a simple fibular osteotomy can relieve knee pain and correct varus deformity as effectively as high tibial osteotomy.

Bone mass decreases as part of the normal aging process¹³. Varying degrees of settlement of bone mass exist in the load-bearing joints, such as the knees, hips, ankles, and spine. In the proximal tibia, the lateral support of the fibula to the lateral tibial plateau routinely leads to nonuniform settlement, which is more severe in the medial plateau than in the lateral plateau. The slope of the tibial plateau arising from nonuniform settlement results in a transverse shearing force, with the femoral condyle shifting medially during walking and sports¹⁴. Furthermore, side-slip aggravates the nonuniform settlement of the tibial plateau, especially in the medial plateau. Accordingly, a cycle of increasing the load distribution in the medial compartment and nonuniform settlement occurs. There is also evidence that tibiofemoral articular stress distribution is related to the progression of knee OA¹⁵. Based on these assumptions, the current authors hypothesized that the lateral support of the fibula to the tibial plateau is a key factor that leads to the nonuniform settlement of the bilateral plateau and the medial shift of the mechanical axis, resulting in

degeneration and varus deformities of the knee joint. Some previous studies also confirm the safety and efficacy of partial/proximal fibular osteotomy in the treatment of medial compartment OA. Proximal osteotomy of the fibula weakens the lateral fibular support and leads to a correction of the varus deformity, which can subsequently shift the loading force from the medial compartment more laterally, leading to decreased pain and a satisfactory functional recovery. According to VAS scores, pain levels decreased significantly from severe to mild. Although proximal fibular osteotomy is a simple procedure, care should be taken to avoid potential peroneal nerve injury. Based on anatomical study and clinical experience, some authors recommend a posterolateral approach via the space between the peroneus longus and brevis muscle and soleus muscle to lessen the risk of iatrogenic nerve injury at a level of 6 cm below the fibular head. Care must be taken to avoid peroneal nerve injury. Limitations of this study are the bias which may be present because of the relatively small sample size. Proximal fibular osteotomy may reduce knee pain significantly in the varus osteoarthritic knee and improve the radiographic appearance and functional recovery of the knee joint. It may delay or even negate the need for total knee arthroplasty. It is a safe, simple, and effective procedure than high tibial osteotomy and that is an alternative to total knee arthroplasty for medial compartment OA of the knee joint.

Bibliography

1. Focht BC. Move to improve how knee osteoarthritis patients can use exercise to enhance quality of life. *ACSM's Health Fit J.* 2012; 16:24-28
2. Felson DT, Naimark A, Anderson J, Kazis L, Castelli W, Meenan RF. The prevalence of knee osteoarthritis in the elderly: The Framingham Osteoarthritis Study. *Arthritis Rheum.* 1987; 30(8):914-918.
3. Vincent KR, Conrad BP, Fregly BJ, Vincent HK. The pathophysiology of osteoarthritis: a mechanical perspective on the knee joint. *PM&R.* 2012; 4(5):S3-S9.
4. Shiozaki H, Koga Y, Omori G, Yamamoto G, Takahashi HE. Epidemiology of osteoarthritis of the knee in a rural Japanese population. *Knee.* 1999; 6(3):183-188.
5. Ahlbäck S. Osteoarthrosis of the knee: a radiographic investigation. *Acta Radiol.* 1968; DECEMBER 2015 | Volume 38 • Number 12 e
6. Wu LD, Hahne HJ, Hassenpflug T. A longterm follow-up study of high tibial osteotomy for medial compartment osteoarthrosis. *Chin J Traumatol.* 2004; 7:348-353.
7. Sprenger TR, Doerzbacher JF. Tibial osteotomy for the treatment of varus gonarthrosis: survival and failure analysis to twenty-two years. *J Bone Joint Surg Am.* 2003; 85:469-474.
8. Schnurr C, Jarrous M, Gudden I, Eysel P, König DP. Pre-operative arthritis severity as a predictor for total knee arthroplasty patients' satisfaction. *Int Orthop.* 2013; 37(7):1257-1261.
9. Zhang Y, Li C, Li J, et al. The pathogenesis research of non-uniform settlement of the tibial plateau in knee degeneration and varus. *J Hebei Med Univ.* 2014; 35(2):218-219.
10. Zheng Z, Sun Y, Zhang X, Chen W, Li S, Zhang Y. The pathogenesis and clinical imageology research of the knee osteoarthritis. *J Hebei Med Univ.* 2014; 35(5):599-600.
11. Campbell 's Operative Orthopaedics 12th Edition page 471.
12. Amendola A, Rorabec C, Bourne R, Apyan P. Total knee arthroplasty following high tibial osteotomy for

osteoarthritis. *J Arthroplasty*.1989;4:S11-S17.

13. Newton-John H, Morgan D. Osteoporosis: disease or senescence? *Lancet*. 1968; 291(7536):232–233. doi:10.1016/S0140-6736(68)90853-2 [CrossRef]
14. Zhang Y, Li C, Li J, et al. The pathogenesis research of non-uniform settlement of the tibial plateau in knee degeneration and varus. *J Hebei Med Univ*. 2014; 35(2):218–219.
15. Segal NA, Anderson DD, Iyer KS, et al. Baseline articular contact stress levels predict incident symptomatic knee osteoarthritis development in the MOST cohort. *J Orthop Res*. 2009; 27(12):1562–1568. doi:10.1002/jor.20936.