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"Prospective Study of Functional and Radiological Outcome of Proximal Fibular Osteotomy for Medial Compartment Osteoarthritis in Elderly"

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ABSTRACT

Background: Osteoarthritis (OA) is the most common form of arthritis in Indian population. Proximal fibular osteotomy (PFO) is an alternative treatment to high tibial osteotomy (HTO) and Unicondylar arthroplasty or TKA.It is a surgical procedure for medial compartment knee osteoarthritis (KOA). The PFO helps in the correction of a varus deformity in KOA, which shift the loading force from the medial compartment more laterally. It, therefore, helps in decreasing the pain and satisfactory functional recovery

Objective: To evaluate the clinical and radiological outcome in medial compartment osteoarthritic knee treated with minimally invasive proximal fibular osteotomy as a new and alternative modality of treatment.

Materials & Methods: A total of 30 patients were selected (18 men and 12 women, age range between 50-72 years) from May 2019 to May 2020 who had undergone proximal fibular osteotomy for medial compartment osteoarthritis knee were followed in prospective manner.Pre-operative and post-operative weight bearing whole lower extremity scanogram obtained to analyse the alignment of lower limb (Femoro tibial angle) and ratio of joint space (medial/lateral joint space). Functional Outcome was assessed with American Knee Society Score (KSS) and Knee pain was assessed with Visual analogue scale.

Results: In our study, we had 30 patients who were managed by PFO and were followed up for a minimum period of 1 years. Following the surgery all patients reported dramatic relief in pain with the VAS dropping significantly form 6.39 in the preoperative period to 2.1 postoperatively ($P<0.005$). Weight bearing lower extremities radiographs showed significant increase in medial knee joint space in 20% patients. We also noted an increase in the medial joint space from 1.1±0.29mm preoperatively to 4.21±0.7 in the postoperative period. The femorotibial angle improved by around 7º, and the hip knee ankle angle improved by around 6º.

Conclusion: PFO is a new alternative method in the management of medial compartment arthritis of the knee which is minimally invasive, safe and effectively relieves the pain and improves the joint function. It helps in correctio of varus knee.

Keywords: Proximal fibular osteotomy, Osteo-arthiritis, KSS

I. INTRODUCTION

Osteoarthritis of the knee is a progressive disease of the joint associated with degeneration of the articular cartilage leading to pain, deformity, disability and decrease in the range of motion of the affected joint.[1] Primary osteoarthritis of knee is more common than that of the other joints.[2]The main triggering factors for development of osteoarthritis are biomechanical due to microfracture of subchondral bone or fatigue fracture of collagen fibres. However, medial compartment of the knee is the weight bearing component and it draws upon itself 60-80% of the load, none has accurately described the reason behind this non-uniformity of load sharing.[3]

The surgical management of Knee Osteoarthritis (KOA), so far, mainly revolved around arthroscopic procedures, Total and Unicompartmental arthroplasty (TKA and UKA) or high tibial osteotomy (HTO). Recently, another minimally invasive surgical treatment of proximal fibular osteotomy (PFO) is proposed for the management of KOA. This procedure is becoming much more popular in the Eastern world (China and India) than elsewhere. Its popularity is perhaps due to the fact this procedure is more straightforward, less expensive and requires lesser rehabilitation than the alternative procedures like HTO, UKA, and TKA. The PFO helps in the correction of a varus[4]deformity in KOA, which shift the loading force from the medial compartment more laterally. It therefore, helps in decreasing the pain and satisfactory functional recovery. Hence the present study was conducted to determine the efficacy of the procedure in terms of clinical, radiological and functional improvement.

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II. OBJECTVES OF STUDY

- To study the functional and radiological outcome of proximal fibular osteotomy for medial compartment osteoarthritis in elderly at Department of Orthopaedics, of Anil Neerukonda Hospital Under NRI Institue of Medical Sciences, Sangivalasa,Visakapatnam.
- Particular attention will be given in careful choosing of the patient. Subjective and objective study of clinical parameters like pain, comfort to the patients, early mobilization, operative techniques, radiological evaluation and any associated complications by using proximal fibular osteotomy.

III. MATERIALS AND METHODS

STUDY SETTING: Study conducted at NRI Institute of Medical Sciences, Anil Neerukonda Hospital, Sangivalasa, Visakhapatnam.
STUDY DESIGN: Prospective study
STUDY PERIOD: The study will be carried out over a period from May 2019 to May 2020
STUDY POPULATION: After getting ethical clearance, all patients of both sexes who are satisfying inclusion and exclusion criteria will be taken in to study.
SAMPLE SIZE: A sample size of 30 patients assigned into the study.

INCLUSION CRITERIA:

1. Patients with knee pain and difficulty in walking due to medial compartment osteoarthritis. (Kellgren and Lawrence grade 2 &3)[5]
2. Weight-bearing X-ray showing medial compartment OA knee.

EXCLUSION CRITERIA:

1. Genu valgus
2. Lateral compartment OA
3. kneeMore than one compartment involved
4. Early OA (Kellgren and Lawrence grade 0 & 1)
5. Bone to bone contact on weight-bearing X-ray
6. Acute major traumaInflammatory joint disease
7. Malignant tumors
8. Patient not fit for surgery (abnormal liver or renal functions)
9. Patient not willing for surgery.

SURGICAL TECHNIQUE: The surgery was performed with the patient in the supine position under spinal anaesthesia with antibiotic cover. Tourniquet was not used routinely in our series. The Fibular head palpated and marked and the osteotomy site was determined to be 7.5to 10cm from the head of fibula. An osteotomy at a higher level would be likely to cause an injury to the common peroneal nerve while if it was done any lower down that the effect of the osteotomy on the medial compartment arthritis would be lost. A 5 cm lateral incision was made overlying the chosen site of osteotomy and dissection was carried out through the skin and subcutaneous tissues. The peroneus and soleus muscles were then separated to expose the periosteum of the fibula which was then incised and a 1.5 to 2 cm of fibula was then resected with the help of an osscilating saw after placing a few drill holes at the osteotomy site. Curved homann retractors were placed behind the fibula prior to osteotomy and care was taken not to stretch the soft tissues too much in order to protect the nerve from potential damage. Occasionally after the osteotomy some of the fibulae tend to bleed quite profusely and in that situation bone wax was used to seal the cut ends of the bone. After ensuring heamostasis and giving wound wash, closure was done in layers and sterile dressing and compression bandage applied. All patients were encouraged to stand and walk on the same evening of surgery or on the first day of surgery and were discharged on the third postoperative day after the first wound inspection. Intravenous antibiotics for given for 3 days followed by oral antibiotics for a period of 5 days.

Follow-up: After discharge, patients were called for follow up on post op day 10-12 for sutural removal. Postoperative weight bearing X rays were then taken and the radiological parameters were evaluated and documented. The patients were reviewed at 1, 3, 6 months and at the end of the first year where the VAS[6] and the Oxford knee scores[7] were evaluated and documented.

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FIG1: PRE OPERATIVE CLINICAL VARUS

FIG 2:PRE-OP XRAY

FIG 4:SUPERFICIAL DISSECTION

FIG:5 BONE DRILLING

FIG:6 EXCISED FIBULAR PORTION

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FIG7:C-ARM IMAGE WITH INCREASED JOINT SPACE FIG8: POST OP XRAY

FIG:9 POST OP SCAR **FIG10: CORRECTION OF VARUS**

IV. RESULTS:

Proximal fibular osteotomy was performed in total of 30 patients with minimum age of 50 and maximum age of 72 and the average age is 56.5 years. The patients were reviewed at 1, 3, 6 months and at the end of the first year. Patients were analysed for any complications and their functional outcome was compared with their previous status. One patient in our study developed EHL weakness.

The patients were evaluated objectively by weight bearing radiographs and subjectively by visual analogue pain scale and knee society knee score

Pain was analyzed using Visual analogue scale both pre and post operatively. On the visual analogue scale for pain, majority of the patients had a score of 6.39. Following the surgery all patients reported dramatic relief in pain with the VAS dropping significantly form 6.39 in the preoperative period to 2.1 postoperatively ($P<0.005$)

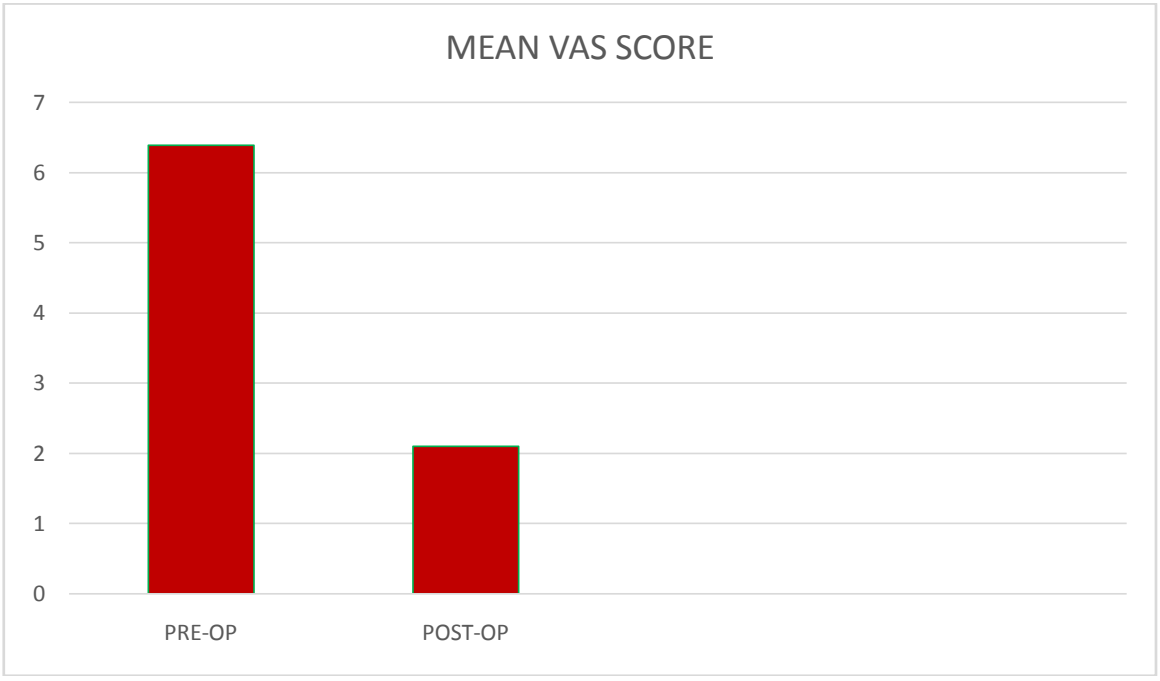

Fig 11: Post operatively Mean vas score of all patients were 2.1

Radiographic measurements were made on each of the operated Knee. The median hip knee angle or the mechanical axis were calculated in each Patient both pre and post operatively

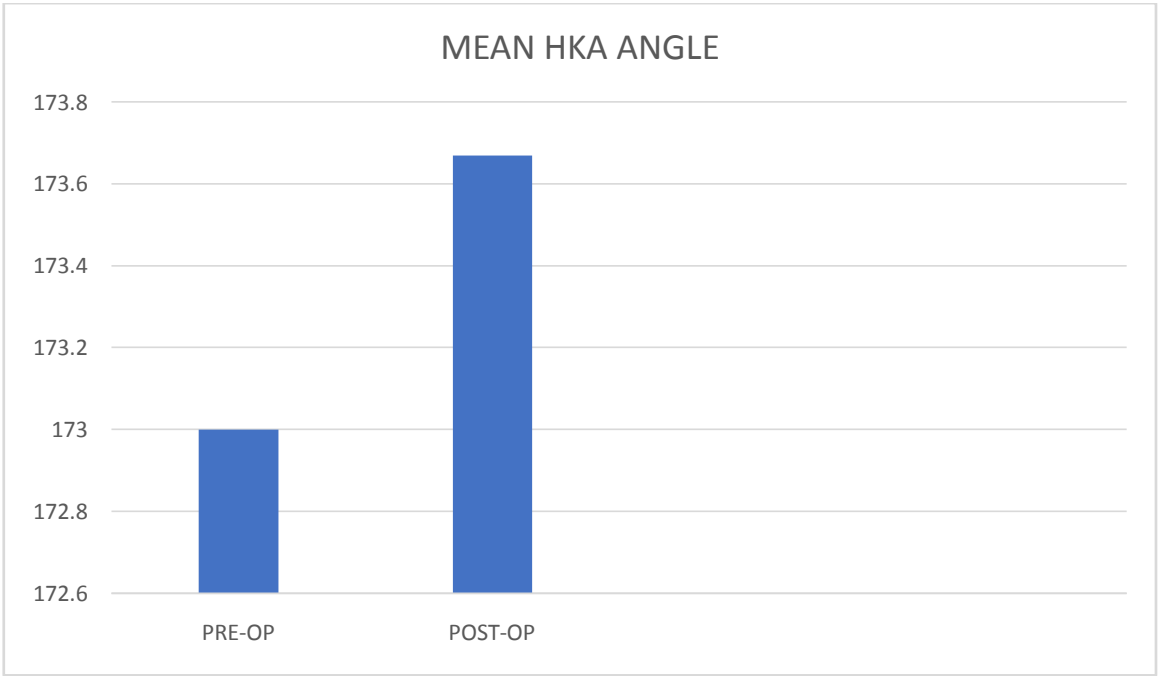

Fig 12: The mean mechanical axis in the pre-Operative and the post operative group were 173 and 173.67 respectively.

Medial joint space in the pre-operative period is 1.1±0.29mm and it is significantly increased to 4.21±0.7 in the postoperative period

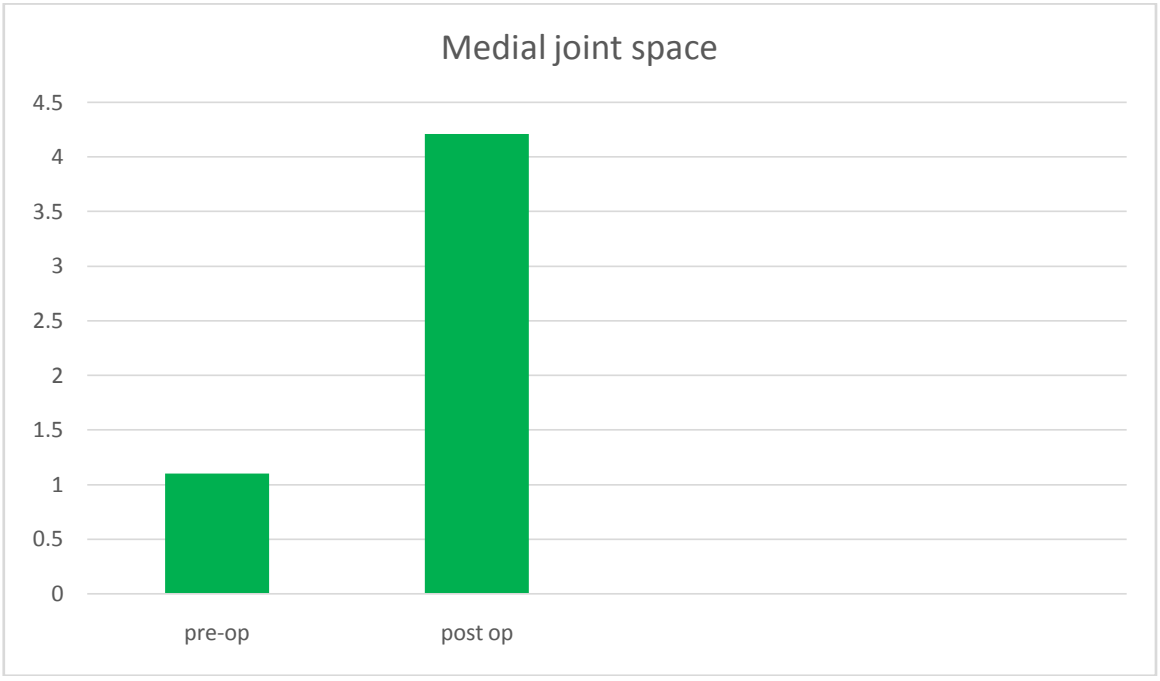

Fig 13: The mean medial joint space in the pre-Operative and the post operative group were 1.1 and 4.21 respectively.

The Functional results were evaluated according to the Knee Society Score. The Knee Society Score is divided into a knee score and a function score. The knee score evaluates pain, range of motion and stability. Maximum Number of points is 100.

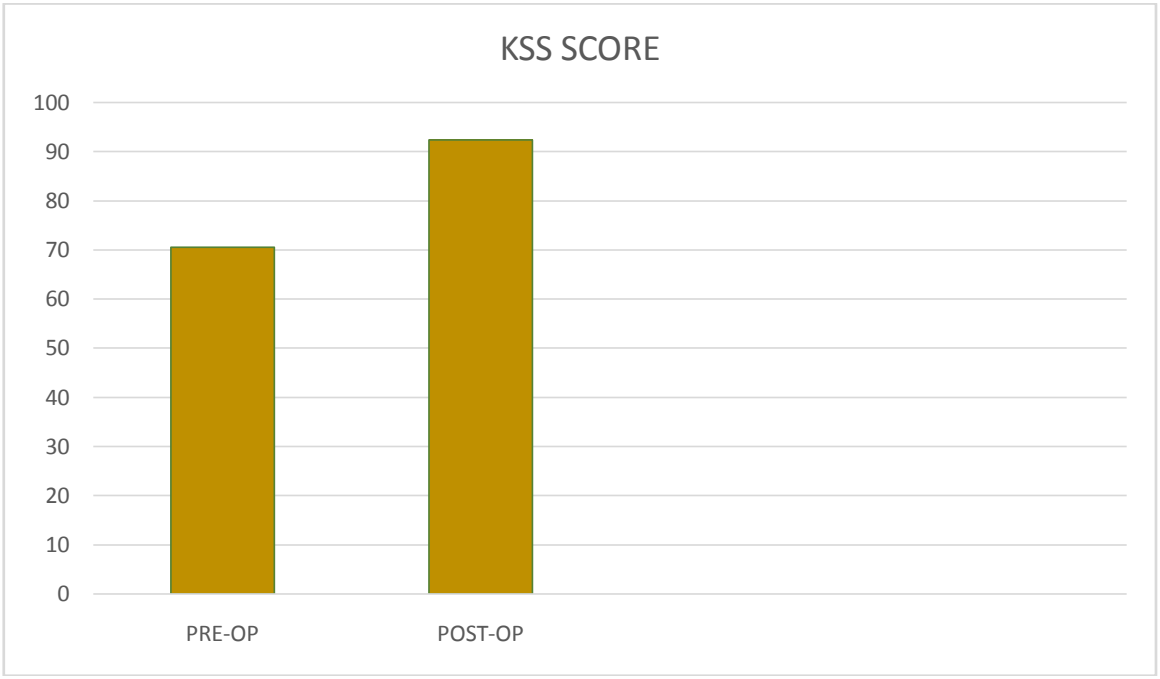

Fig.14 : An average of 92.38 points was attained after proximal fibular Osteotomy compared to an average 70.5 points preoperatively.

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V. DISCUSSION:

Conservative modalities advocated in early stages of osteoarthritis include intra-articular injection of steroids, PRP or hyaluronic acid. Many studies have shown that these modalities lead to an acceleration of disease pathology due to excessive joint loading after temporary pain relief is achieved, and thus the harms out-weight pain relief in long term[8]

The surgical options available for the management of medial compartment ostearthritis of the knee are limited to high tibial osteotomy and unicondylar knee replacement.

High tibial osteotomy correct the varus deformity associated with medial compartment osteoarthritis of the knee but it is associated with a longer recovery period and a prolonged period of non - weight bearing walking until union of the osteotomy site. HTO tends to relieve pain by diverting the weight-bearing axis to the lateral compartment and effectively relieves pain.However, this needs surgical expertise and is costly. Infection, non-union, common peroneal nerve injury are some of its disadvantages.[9]Another problem with HTO is while converting these patients to TKRs one needs to remove the plate and then go for TKR. Technically, converting HTO to TKR is more difficult because of the distortion of the proximal tibial metaphysis and due to ligamentous imbalance.

Unicondylar knee replacement surgery is effective but requires highly specialized surgical expertise and specialized instrumentation.The high cost of surgery and revision cost is a prohibitive factor for most of the Indian population because of low per capita income.[10] This procedure could be associated with problems such as progression of arthritis or loosening of components. Studies have demonstrated a high rate of revision for unicondylar knee replacement as compared to a total knee replacement

TKR is too radical surgery for a single compartment involvement and is cost-prohibitive. Also, this requires expertise and can only be done in tertiary centres. After TKR patients cannot squat as they cannot fully flex the knee, which is required for many of the day to day activities of common Indian population.

The mechanism[11]behind development of medial compartment knee osteoarthritis suggests that there is an asymmetric load transmitted across both tibial plateaus with more stress being borne on the medial side which eventually leading to the development of a varus deformity and arthritic changes with degeneration of the articular cartilage. Proximal fibular osteotomy acts by weakening the support laterally, corrects the varus deformity and shifts the stress from the medial to the lateral compartment resulting in alleviation of pain and gives a good functional outcome.

One of the recent study done by Harshwardhan[12] et al. suggest good functional outcome in varus deformity of the knee, reducing joint pain.

Cost[13] is also a prohibitive factor for TKR surgeries. The average cost of single knee total knee replacement is around 1,50,000 to 2,15,000. Whereas total cost for PFO in our setting vary from 8,000 to 15,000 for one knee. Thus PFO is an alternative approach suitable for low socio-economic groups .

In a study by Yang[14]et al, 150 patients with medial compartment arthritis were followed up for a period of more than 2 years. The preoperative KSS (Knee society score) was 45±21.3 while postoperatively it was 92.3±31.7. The mean VAS (Visual analogue score) preoperatively was 7 which significantly decreased to 2 in the postoperative period. They stated that proximal fibular osteotomy dramatically improves the function of the knee and gives good pain relief. In a study by Bo Liu et al,[15] they had 84 patients with 111 knees being affected by medial compartment arthritis. The average preoperative VAS score was 7.08±1.41. The average preoperative KSS and functional scores were 49.14±10.95 and 44.97±17.1 while postoperatively it was 67.77±11.08 and 64.66±13.12 respectively. 51 knees were associated with a satisfactory clinical outcome while 77 knees had a significant improvement.

In our study, we had 30 patients who were managed by PFO and were followed up for a minimum period of 1 years. Following the surgery all patients reported dramatic relief in pain with the VAS dropping significantly form 6.39 in the preoperative period to 2.1 postoperatively ($P<0.005$). Weight bearing lower extremities radiographs showed significant increase in medial knee joint space in 20% patients. We also noted an increase in the medial joint space from 1.1±0.29mm preoperatively to 4.21±0.7 in the postoperative period. The femorotibial angle improved by around 7^0, and the hip knee ankle angle improved by around 6^0

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Table 1: Comparing improvement in medial joint space with landmark studies

Series	Pre-Op	Post-Op	t	p-value
L Prakash[16]	1.2 ± 0.7	4.5 ± 2.7	40.3	< 0.001
Current Study	1.11 + 0.29	4.21 + 0.7	22.166	< 0.001

Table 2: Comparing improvement of VAS with similar studies

Series	Follow Up (Months)	Pre-Op	Final Follow-up
Zong-You Yang et al.	49.1	7.0	2.0
Xiaohu Wang et al.[17]	13.38	8.02	2.74
L Prakash [15]	12	6.7	2.2
Current	12	6.39	2.19

The advantage of proximal fibular osteotomy 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 mobilized with weight bearing on the next day of surgery. If the procedure does not give good results in any situation then the field for performing a Total knee arthroplasty (TKA) at a later stage is not altered at all. The limitations of our study were a 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 Proximal fibular osteotomy are sustained over period of time.

VI. CONCLUSION:

PFO is definitely an alternative procedure in the management of medial compartment osteoarthritis of the knee. It is a simple, effective, easy to perform procedure which is cost effective and gives excellent relief of pain postoperatively. It has few surgical complications and a shorter recovery period as compared to High tibial osteotomy and Unicondylar knee arthroplasty any how it is by no means a replacement for knee arthroplasty and high tibial osteotomy which remain gold standard procedures in advanced knee OA. After a review of the results of our study it was revealed that this procedure is reasonably good both clinic-radiologically, and can be recommended for medial compartment OA of the knee joint. A long termfollow up is necessary to evaluate the beneficial effects of PFO are sustained over a period of time.

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