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Case Series

Outcomes of proximal fibular osteotomy in osteoarthritis knee

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ABSTRACT

The need for management of mild to moderate osteoarthritis (OA) knee surgically with a new method that is relatively simple, less invasive, less expensive and suitable for Indian setting postulated to offer short to medium term relief and defers the need for a major surgery like total knee replacement was served by a novel surgical technique of proximal fibular osteotomy (PFO). The aim of this study is to evaluate the efficacy, functional outcomes and complications of PFO in OA of knee joint. Total 20 patients (33 knees) with OA knee operated by PFO were included in the study and were followed up at 1 month, 3 months and 6 months postoperatively. The outcomes of PFO were evaluated using VAS score, functional american knee society score and Kellgren Lawrence (KL) scale and the patients were evaluated post-operatively for development of any complication and it's improvement at each follow up. The results showed significant improvement in efficacy and functional outcomes with respect to VAS score and functional American knee society score however there was no significant change in KL scale grading postoperative. Few patients developed EHL weakness and hypoaesthesia post-operatively which gradually improved at further follow ups. This study concludes that PFO is a safe and efficacious method of management of OA knee showing significant pain relief and improving functional outcomes of patient significantly.

Keywords: PFO, OA knee, VAS score, Knee society score, EHL weakness

INTRODUCTION

One of the most common chronic progressive musculoskeletal disorders lowering the quality of life and burdening the healthcare system is OA knee. Pathophysiology of OA knee includes a complex interaction between mechanical, biochemical, and genetic factors causing degeneration of articular cartilage, decreased medial joint space and medial shift of weight bearing axis which leads to knee pain, varus deformity , restricted range of motion affecting the daily living of patients.[1] There is a wide range of risk factors associated with knee OA, including genetics, age, obesity, history of joint injuries, and occupational/lifestyle factors causing knee joint repetitive stress. A range of conservative and surgical interventions are used in knee OA management strategies with the goals of reducing pain, enhancing function, and maintaining joint integrity. Conservative management includes lifestyle modifications, weight loss, physiotherapy, NSAIDs and intraarticular injection of steroids and visco-supplementation. While medication, physical therapy, and lifestyle changes continue to be the mainstays of treatment, in cases of advanced disease or when conservative measures fail, surgical interventions may be necessary which includes high tibial osteotomy, unicondylar knee arthroplasty or total knee replacement. These operative interventions are major complicated surgeries, expensive and have difficulties in Indian setting like post operatively it is not advisable to do routine activities like squatting, sitting down cross-legged or working in field. Whereas PFO is relatively simple, less invasive, less expensive procedure, suitable for Indian setting and postulated to offer short to medium term relief

in OA knee. Present study analysed efficacy, functional outcomes and complications of PFO in OA knee.

CASE SERIES

A total of 20 patients (33 knees) having OA knee and operated for PFO were included in the study. Inclusion criteria were patients suffering from varus deformity due to OA of the knee and age more than 50 years. Exclusion criteria were patients with inflammatory arthritis like RA, AS, SLE, etc., patients with pre-existing neuropathy of lower limb, patients with previous fractures around knee joint and patients with preexisting vascular dysfunction in lower limb like DVT, PVD, etc. Patients enrolled in the study were examined clinically and evaluated radiologically with a scannogram (Standing). Patients were evaluated pre-operatively for VAS score, functional American knee society score functionally and radiologically for KL scale. Patients were operated for PFO in supine position under spinal anaesthesia where incision of 4-5 cm was taken 6-9 cm distal to fibular head and dissection done between posterior and lateral compartment of leg to expose and excise the fibular periosteum. Resection of 1.5-2 cm fibula segment is done under radiological guidance and adequate hemostasis is achieved (Drain was not put in all cases) (Figure 1). On the first post-operative day itself, patient was started on physiotherapy including full weight bear ambulation and knee range of motion along with lower limb strengthening exercises. Patient was evaluated in immediate post operative period for functional parameters including VAS score and Functional American knee society score, radiologically using KL scale and complications if any were evaluated. Patient was discharged on third postoperative day after wound check and followed up for suture removal at 2 weeks postoperative period. Patient was further followed up at 1 month, 3 months and 6 months postop and was evaluated clinically for VAS score, functional American knee society score and radiologically with standing scannogram for KL scale. Patient was also evaluated at each follow up for development and improvement of the complications if any.

A total of 20 patients with 33 knees (13 patients operated for bilateral PFO and 7 patients operated for unilateral PFO) were followed up upto 6 months. The average age of patients was 59.57 years (Range 41-75 years). Out of 33 knees, 31 knees of female patients and 2 knees of male patient were evaluated out which 81.8% had bilateral knee pain, 12.1% had right knee pain and 6.1% had left knee pain. The VAS scores for pain demonstrated a significant decrease from the preoperative mean of 8.06 (±0.70) to 4.73 (±0.45) immediately postoperatively. This reduction in pain levels was statistically significant. The pain scores continued to show improvement at subsequent time points: 1 month postoperatively (mean=4.48±0.51), 3 months postoperatively (mean=4.39±0.50), and 6 months postoperatively (mean=4.39±0.50), all with $p<0.001$. All postoperative time points for both the 41-60 and 61-80 age groups showed a decrease in VAS pain scores compared to preoperative levels. In comparison to the younger age group (41-60 years), the older age group (61-80 years) had somewhat larger mean differences. The VAS scores for pain showed a decrease from preoperative levels in both single and bilateral surgery groups at all postoperative time points. The group that underwent bilateral surgery had somewhat larger mean differences than the group that underwent a single operation. At any time point (preop vs. immediate, 1 month, 3 months, and 6 months), the p values showed no significant difference between the surgery types, indicating that the type of surgery did not really affect the pain reduction outcomes. The VAS scores for pain showed a decrease from preoperative levels in both female and male participants at all postoperative time points (Figure 2). The mean differences were slightly higher in females compared to males, with the immediate postoperative comparison showing the most notable difference ($p=0.1193$). However, the p values indicated no significant difference between genders at most time points, suggesting that gender did not significantly impact pain reduction outcomes, except for a potential trend immediately postoperatively.

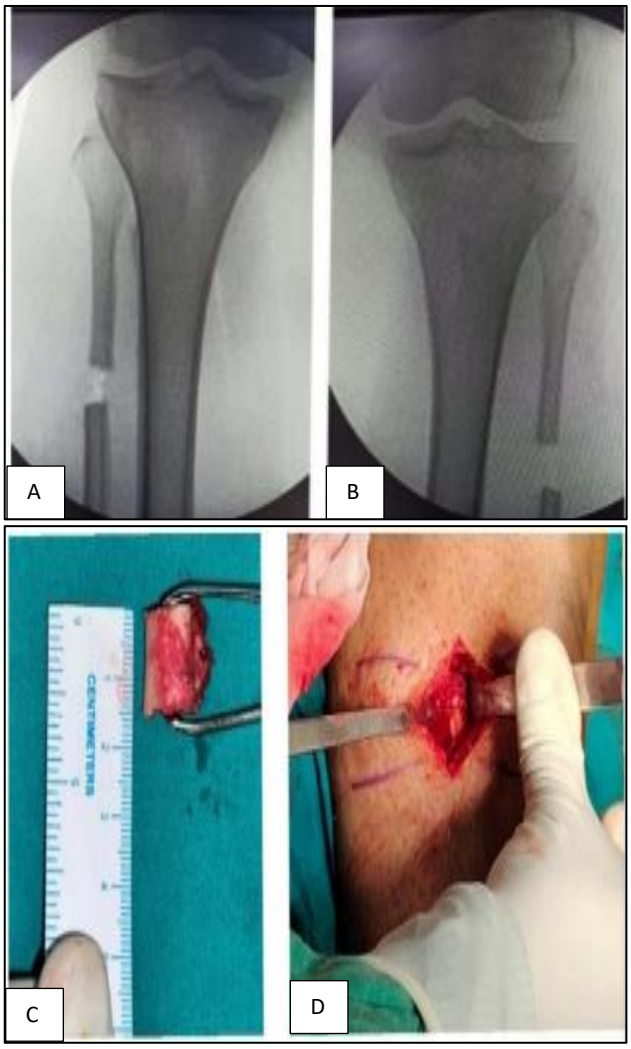

Figure 1 (A-D): Interoperative clinical and C-arm images of PFO.

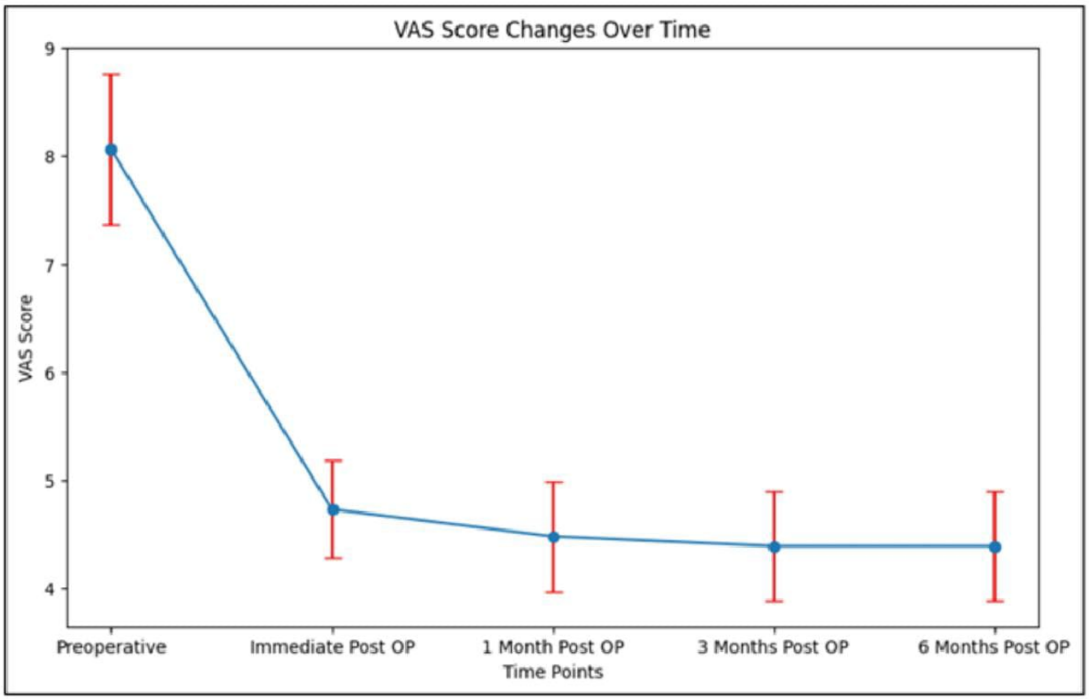

Figure 2: VAS score changes over time.

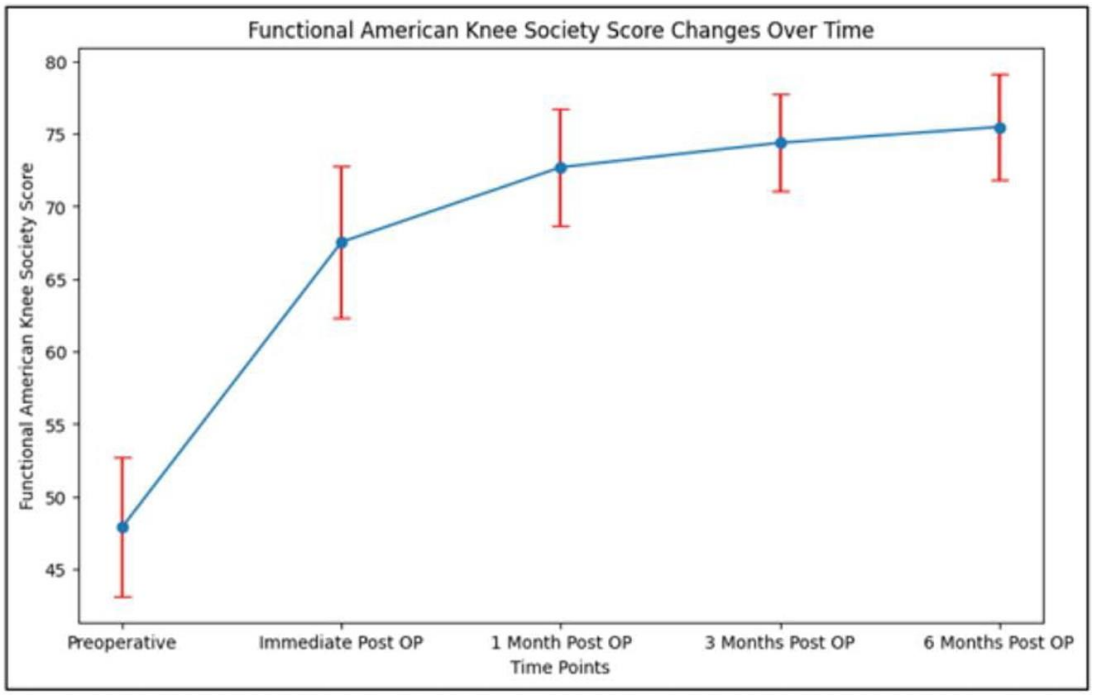

Figure 3: Functional American knee society score changes over time.

The functional American knee society scores showed a marked improvement following the PFO. The mean score increased from a preoperative value of 47.91 (±4.77) to 67.55 (±5.22) immediately postoperatively, with a highly significant $p<0.001$. This positive trend continued at subsequent followup periods: 1 month postoperatively (mean=72.70±4.01), 3 months postoperatively (mean=74.39±3.33), and 6 months postoperatively (mean=75.48±3.67), all showing significant improvements with $p<0.001$. The functional American knee society scores showed significant improvements from preoperative levels to various postoperative time points in both age groups. The mean differences were similar across the age groups, with slightly higher improvements observed in the older age group (61-80 years). The functional American knee society scores demonstrated significant improvements from preoperative

levels to various postoperative time points in both single and bilateral surgery groups. The p values indicated no significant difference between the surgery types at most time points, suggesting that the functional improvements were comparable between single and bilateral surgeries. The functional American knee society scores demonstrated significant improvements from preoperative levels to various postoperative time points in both female and male participants (Figure 3). The mean differences were slightly higher in males at all time points, with the preoperative vs. immediate postoperative comparison showing the most notable difference (p=0.3994). Despite this, the p values indicated no significant difference between genders at any time point, suggesting that gender did not significantly impact functional improvements following surgery.

The KL scale, used to assess the radiological severity of OA, showed minimal changes from the preoperative state to various postoperative time points. The mean preoperative score was 3.18 (±0.39), which slightly decreased to 3.15 (±0.36) immediately postoperatively, indicating no significant difference. At 1 month postoperative, the mean score further slightly decreased to 3.09 (±0.29). At 3 months postoperative, the score returned to 3.15 (±0.36), and at 6 months postoperative, it was 3.12 (±0.33), both with p=0.325. The KL scale showed minimal changes from preoperative levels across both age groups at all postoperative time points. Those between the ages of 41 and 60 had somewhat larger mean differences than those between the ages of 61 and 80. P values indicated no significant difference between the age groups, suggesting that age did not significantly impact the radiological outcomes of OA severity following surgery (Figure 4).

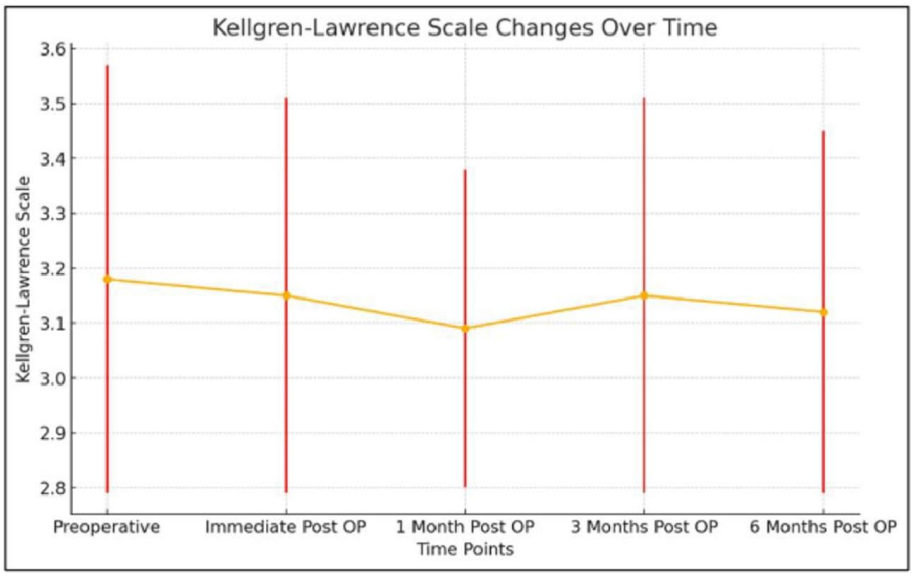

Figure 4: KL scale changes over time.

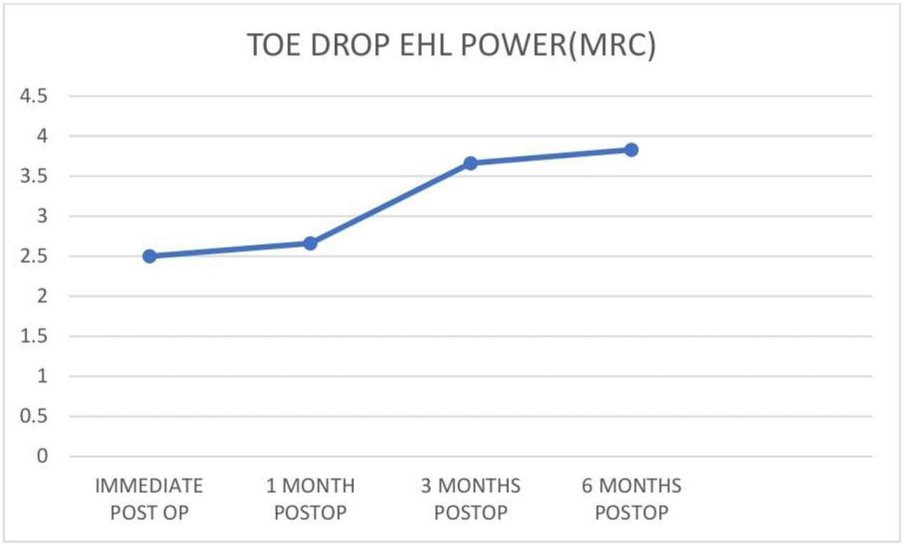

Figure 5: Improvement of power of EHL progressively at each follow up.

Toe drop, a complication characterized by difficulty in lifting the toe, was reported in 18.2% of participants at all postoperative time points (immediate, 1 month, 3 months, and 6 months). However, the power of EHL (MRC Grading) improved gradually with time. In 18.2% cases having toe drop, the mean MRC power improved from 2.5±0.438 to 2.66±0.413 in 1 month postoperative period to 3.66±0.54 in 3 months postoperative period to 3.83±0.327 in 6 months postoperative period. Out of the 18.2% cases having foot drop, the MRC power of EHL improved to 4/5 in 83.33% of the cases.

Hypoesthesia was reported in 15.2% of participants immediately after surgery and at 1 and 3 months postoperatively. By 6 months, the incidence had decreased to 6.1%, indicating an improvement in sensory outcomes over time. Foot drop, a more severe complication than toe drop, was not observed in any of the participants at any postoperative time point. None of the participants reported persistent or recurrent pain or infections at any of the postoperative assessments.

DISCUSSION

Knee OA has a significant negative influence on quality of life and is the primary cause of pain and disability in adults.[5] OA is a serious public health concern because of the aging of the world's population.[6] Structural and biomechanical alterations in OA knee result in pain, stiffness, and decreased mobility in the joints.[7] Knee OA can be managed with a variety of techniques, from conservative measures like physical therapy and medication to surgical options like total knee arthroplasty in more severe cases.[8] A surgical procedure called PFO modifies the mechanical axis and load distribution within the limb to relieve pressure on the knee joint (Figure 6). Patients with symptomatic OA who want better function and pain relief may be candidates for this procedure.[9,10] Research has demonstrated that PFO helps patients with knee OA experience markedly less pain and better joint function.[11,12]

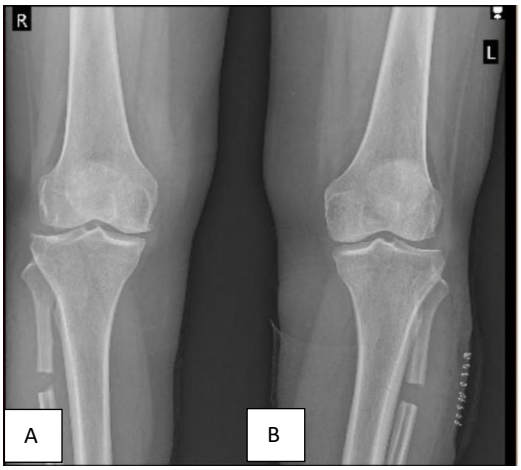

Figure 6 (A and B): Post-op X-rays of 55 years old lady of increase in medial joint space after PFO.

In a study carried out in 2018 by Qin et al of 67 knee joints who underwent PFO with a mean age group of 62.5±6.7, it was observed that VAS score decreased from a preoperative mean score of 6.03±1.45 to 3.17±1.59 at 6 weeks postoperative period, 2.70±1.55 at 3 months postoperative period and 2.55±1.53 at 6 months postoperative period.[1] In a systematic review by Ashraf et al a total of 12 articles were included in the review.[2] The results obtained showed at least six studies reporting improvement in VAS score from the mean preoperative VAS score (6.32, 95% confidence interval=(4.05,8.59) to average postoperative VAS score (1.23, 95% CI:-1.20, 3.71). In a study by Sabir et al done prospective study was carried out on 47 knees at tertiary care centre which showed that VAS score improved from 7.33±0.72 to 7.13±1.64 at 3 months and remained the same at final follow up which was insignificant.[3] In our study , it was observed that the VAS (visual analog cale) scores for pain demonstrated a significant decrease from the preoperative mean of 8.06 (±0.70) to 4.73 (±0.45) immediately postoperatively. This reduction in pain levels was statistically significant, with a $p<0.001$. The pain scores continued to show improvement at subsequent time points: 1 month postoperatively (mean=4.48±0.51), 3 months postoperatively (mean=4.39±0.50), and 6 months postoperatively (mean=4.39±0.50), all with $p<0.001$. In a study carried out in 2018 by Qin et al of 67 knee joints who underwent PFO with a mean age group of 62.5±6.7, they assessed the functional outcomes with hospital for special surgery (HSS) knee score and they observed the HSS score improving from 52.27±11.27 preoperatively to 71.43±11.71 to 71.43±11.71 at 6 weeks postoperative period to 74.61±12.95 at 3 months postoperative period to 76.25±13.66 at 6 months postoperative period all showing significant improvement as compared to preoperative scores.[1] In a systematic review by Ashraf et al functional outcome was analysed with American Knee Society Score which improved from average score of 43.11 (95% CI: 37.83, 48.38) to postoperative score of 66.145 (95% CI: 61.94, 70.35) which was statistically significant.[2] In our study, functional improvement was analysed using functional knee society score where it was observed that the functional American knee society scores showed a marked improvement following the PFO. The mean score increased from a preoperative value of 47.91 (±4.77) to 67.55 (±5.22) immediately postoperatively, with a highly significant $p<0.001$. This positive trend continued at subsequent follow-up periods: 1 month postoperatively (mean=72.70±4.01), 3 months postoperatively (mean=74.39±3.33), and 6 months postoperatively (mean=75.48±3.67), all showing significant improvements with $p<0.001$. Following PFO (PFO), patients with knee OA may experience toe drop, foot drop, and hypoesthesia. The main cause of these disorders is dysfunction of the peroneal nerve, which can be impacted by PFO because of its close proximity to the surgical site in the fibula.[13-15] One of the noteworthy results of our investigation was the presence of toe drop in 18.2% of patients at all postoperative time points, indicating a potential risk for peroneal nerve injury, a known

complication of PFO.[16] This emphasizes the necessity of precise surgery and meticulous dissection to reduce this risk. The observed reduction in hypoesthesia between the 6-month follow-up and the immediate postoperative assessments points to a gradual restoration of nerve function, which may be related to the healing of minor nerve traumas sustained during surgery or the resolution of operative edema. The occurrence of toe drop in 18.2% of participants at all postoperative time points was one of our study's noteworthy findings, suggesting a risk of peroneal nerve injury. Similar complications were noted by Qin et al who found that 8 out of 67 limbs had symptoms of superficial peroneal nerve injury following surgery.[1] Nevertheless, these were transient symptoms in their study, going away within 18 months of surgery. Both studies point to the possibility of nerve damage with PFO but also point to the possibility of recovery, highlighting the need for cautious surgical technique and potentially better ways to reduce this risk. The review by Ashraf et al reports on the occurrence of nerve palsies, which is consistent with our findings about hypoesthesia and toe drop.[2] The risk of nerve injuries with PFO is highlighted by both sets of data, albeit they are typically temporary. Similar to the complication rates noted in our study, nerve palsy was reported as a complication in Vaish et al review (4.76% in their study).[4] Both sets of data highlight the temporary nature of these side effects and the generally positive recovery profile, underscoring the safety of PFO when carried out by qualified surgeons. In a study by Aamir Bin Sabir et al done in 2020, prospective study was carried out on 47 knees at tertiary care centre which showed that extensor Hallucis weakness was found in 10.6% of cases (5 knees) and paraesthesia was documented in 14.8% of cases (7 knees).[3] In a critical review of PFO in OA knee studied by Ashishek et al it was observed that nerve palsy was most frequent complication reported following PFO.[4] There were 14 cases from 204 operated knees (4.76%) out of which there were 12 superficial peroneal nerve palsies and 2 common peroneal nerve palsy. All of these nerve palsies were transient and were recovered in average time of 11.6 months (range 3 to 15 months.) In a study by Sabir et al prospective study was carried out on 47 knees at tertiary care centre which showed that extensor Hallucis weakness was found in 10.6% of cases (5 knees) and paraesthesia was documented in 14.8% of cases (7 knees).[3] In our study, toe drop was reported in 18.2% of participants at all postoperative time points (immediate, 1 month, 3 months, and 6 months). However, the power of EHL (MRC grading) improved gradually with time. In 18.2% cases having to drop, the mean MRC power improved from 2.5±0.438 to 2.66±0.413 in 1 month postoperative period to 3.66±0.54 in 3 months postoperative period to 3.83±0.327 in 6 months postoperative period. Out of the 18.2 % cases having footdrop, the MRC power of EHL improved to 4/5 in 83.33% of the cases. Hypoesthesia, or reduced sensation, was reported in 15.2% of participants immediately after surgery and at 1 and 3 months postoperatively. By 6 months, the incidence had decreased to 6.1%, indicating an improvement in sensory outcomes over time. The present study meticulously evaluated the efficacy, safety, and functional outcomes of PFO in patients with knee OA, with particular focus on functional outcomes, demographics, comorbidities, presenting complaints, operative sides, and specific postoperative complications. A female predominance was observed among the participants, aligning with the higher incidence of OA in females. The majority of the participants did not have comorbid conditions, which may have favourable implications for surgical outcomes and recovery. In terms of complications, toe drop was reported in a minority of cases across all postoperative periods, pointing to peroneal nerve involvement. However, there was gradual improvement in MRC power of EHL with majority of cases improving upto 4/5 power of EHL action by 6 months post-operative period. However, more severe complications like foot drop were not observed, suggesting a cautious surgical approach that avoids major nerve damage. Hypoesthesia was noted immediately post-surgery but showed significant recovery by the six-month follow-up, indicating temporary neuropraxia likely due to surgical manipulation. Remarkably, no persistent or recurrent pain was reported postoperatively, and no infections were noted, underscoring the success of the surgical technique and postoperative care in managing infection risks. Pain relief, as measured by VAS scores, was significant immediately after the surgery and sustained over six months, highlighting the immediate and lasting benefits of PFO. The functional American knee society scores showed significant improvements, affirming the enhancement in joint function and patient mobility post-PFO. There were minimal changes in the KL scale indicated that while symptomatic relief and functional improvements are achievable with PFO, the procedure does not alter the underlying radiographic progression of OA significant enough to change the grade of KL scale. The study highlights PFO as an effective treatment for knee OA, it effectively addresses symptoms irrespective of age, gender, surgery type, or OA severity, confirming its broad applicability and consistent benefits in managing knee OA. He presents study conclusively demonstrates the effectiveness of PFO in managing knee OA across diverse demographic groups and varying degrees of disease severity. It confirms that PFO significantly improves pain, functional mobility, and knee alignment without being influenced by factors such as age, gender, or severity of OA. The findings underscore PFO's adaptability and effectiveness, providing consistent benefits in reducing joint stress and enhancing the quality of life for patients with knee OA. This study supports the broader application of PFO as a reliable surgical option, promising substantial improvements in clinical outcomes and contributing positively to orthopaedic practice.

CONCLUSION

The present study conclusively demonstrates the effectiveness of PFO in managing knee OA across diverse demographic groups and varying degrees of disease severity. It confirms that PFO significantly improves pain,

functional mobility, and knee alignment without being influenced by factors such as age, gender, or initial severity of OA. The findings underscore PFO's adaptability and effectiveness, providing consistent benefits in reducing joint stress and enhancing the quality of life for patients with knee OA. This study supports the broader application of PFO as a reliable surgical option for OA patients, promising substantial improvements in clinical outcomes and contributing positively to orthopedic practice. However, a study with larger sample size is recommended and desirable for better understanding of outcomes of PFO in knee OA and to establish PFO as a standard of care for OA knee.

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