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Research Article

Proximal Fibular Osteotomy Versus Hyaluronic Acid Injections for Medial Compartment Knee Osteoarthritis: An Innovative Descriptive Study with Five-Year Follow-Up

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Abstract

Background: Medial compartment knee Osteoarthritis (OA) presents a significant treatment challenge, particularly for patients unwilling to undergo Total Knee Arthroplasty (TKA). This study compared the clinical outcomes of Proximal Fibular Osteotomy (PFO) and Hyaluronic Acid (HA) injections in patients with grade III-IV medial compartment OA.

Methods: From 2018 to 2019, 47 patients with grade III-IV medial compartment knee OA and no flexion contracture were enrolled and followed for five years. All were deemed candidates for TKA but declined surgery. Group A (n=22) received intra-articular HA injections; Group B (n=25) underwent PFO. The Knee Society Score (KSS) and Visual Analog Scale (VAS) for pain were assessed at baseline and at 3, 6 and 12 months, then annually for 5 years. Patients with flexion contracture were excluded due to the limited efficacy of non-arthroplasty interventions in such cases.

Results: At one year, both groups showed improvement, but outcomes were significantly better in the PFO group (KSS 78.9 vs. 59.3; VAS 3.1 vs. 5.8). Over five years, 100% of HA-treated patients progressed to TKA, while only 5 of 25 in the PFO group required surgery. One transient peroneal nerve palsy was observed in the PFO group, with full recovery in four weeks.

Conclusion: Proximal Fibular Osteotomy offers a promising, low-cost alternative for managing medial compartment OA in select patients. Compared to HA injections, PFO provided superior long-term symptom relief and significantly reduced the need for knee arthroplasty.

Keywords: Proximal fibular osteotomy, hyaluronic acid, knee osteoarthritis, medial compartment, knee preservation, total knee replacement alternative

Introduction

Knee Osteoarthritis (OA) is one of the most prevalent causes of pain and disability among aging populations worldwide. The medial compartment is most commonly affected, often resulting in progressive varus deformity, cartilage loss and decreased quality of life. While Total Knee Arthroplasty (TKA) is widely accepted as the definitive treatment for advanced disease, many patients are reluctant to undergo surgery due to concerns about complications, cost and extended recovery [1-3]. Given this gap, there is growing interest in joint-preserving strategies that can provide symptom relief and improve function while deferring or avoiding prosthetic replacement. Proximal Fibular Osteotomy (PFO) is a biomechanically grounded, minimally invasive alternative that reduces loading of the medial compartment by altering lateral support from the fibula. This leads to realignment and improved tibiofemoral load distribution. Emerging evidence has highlighted PFO as a cost-effective procedure with promising mid- to long-term outcomes in appropriately selected patients [1-5]. Hyaluronic Acid (HA) injections remain a widely used conservative therapy. However, their efficacy is debated, with several meta-analyses demonstrating only modest short-term benefits and no evidence of disease modification [6-8]. This study was conducted to directly compare PFO and HA injections in patients with grade III-IV medial OA over a 5-year follow-up period.

Methodology

We conducted a retrospective comparative cohort study at a private orthopedic clinic in Guatemala City. Between January 2018 and December 2019, a total of 47 consecutive patients were evaluated for advanced medial compartment knee Osteoarthritis (OA) and enrolled in the study after declining Total Knee Arthroplasty (TKA), despite being appropriate surgical candidates.

Radiographic classification was performed using the Kellgren-Lawrence (KL) grading system. Only patients with KL grade III or IV medial compartment OA were considered. Weight-bearing anteroposterior and lateral radiographs were assessed independently by two orthopedic surgeons. To minimize confounding variables, patients with evidence of flexion contracture >5°, patellofemoral or lateral compartment OA, prior surgery on the affected knee or inflammatory joint disease were excluded. Patients were divided into two groups based on their selected treatment option:

- Group A (HA group): Received one intra-articular injections of cross-linked hyaluronic acid (6 mL per dose) using a superolateral approach under sterile conditions. The injections were performed by the same orthopedic specialist and patients were advised to avoid strenuous activity for 48 hours after each injection
- Group B (Proximal Fibular Osteotomy group): Underwent proximal fibular osteotomy following the technique described by Yang, et al., [1]. Under regional anesthesia and fluoroscopic guidance, a 2-3 cm incision was made over the proximal fibula (6-10 cm below the fibular head). After soft tissue dissection and protection of the common peroneal nerve, a 1-2 cm segment of the fibula was resected. Hemostasis was ensured and the wound was closed in layers. Postoperatively, full weight-bearing as tolerated was allowed from day 1. Patients were discharged the same day or the following morning (Table 1,Fig. 1,2)

Inclusion Criteria	Exclusion Criteria
Radiographic grade III-IV medial knee OA	Flexion contracture >5°
Age between 45-75 years	Lateral or patellofemoral OA involvement
Symptoms >6 months	Inflammatory arthritis or autoimmune disease
Refusal of TKA	Previous surgery on the affected knee
Ability to attend regular follow-up visits	Neuromuscular disorders affecting gait

Table 1: Details of the inclusion and exclusion criteria.

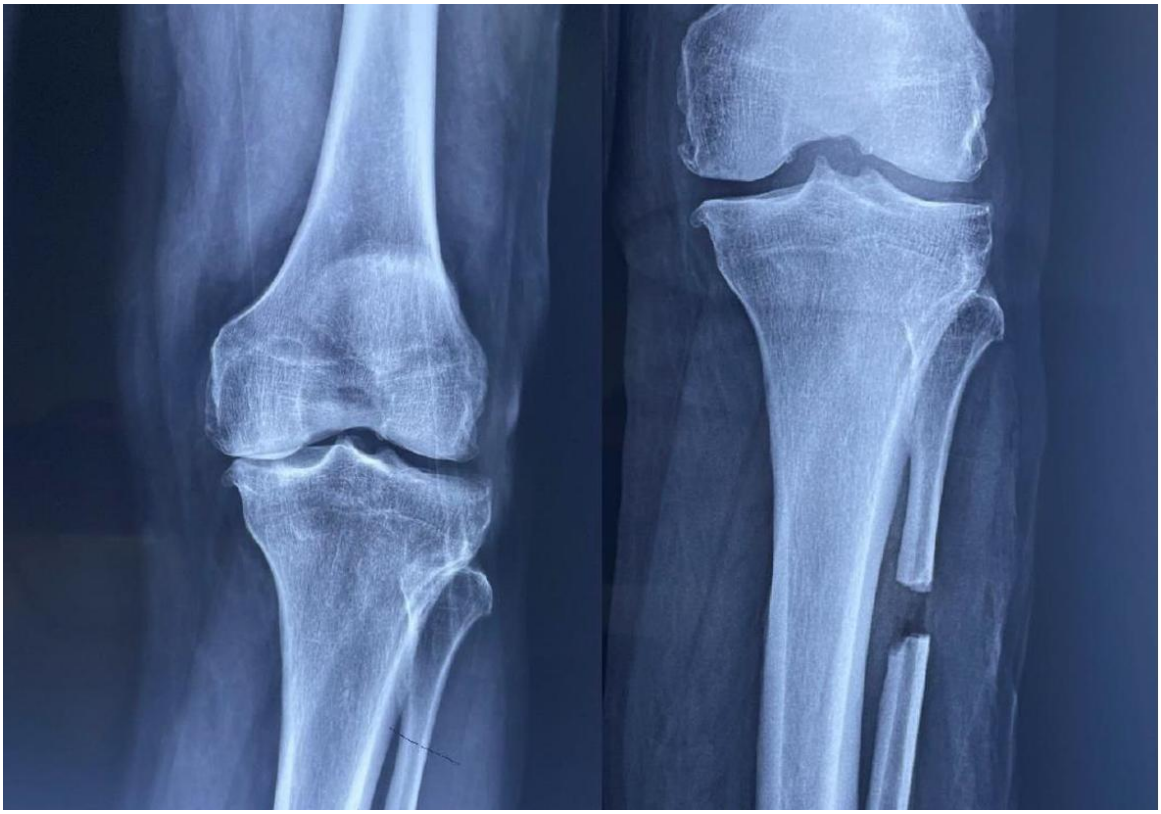

Figure 1: X-ray of a broken knee joint.

Figure 2: X-ray of a knee joint.

All participants underwent clinical assessments at baseline, 3 months, 6 months and 12 months post-treatment, followed by annual evaluations up to 5 years. Outcomes were measured using the Knee Society Score (KSS), which evaluates pain, range of motion and stability and the Visual Analog Scale (VAS) for pain. The primary outcome was functional improvement; secondary outcomes included progression to TKA and adverse events.

Statistical analysis was performed using SPSS v25. Repeated-measures ANOVA was used to compare intra-group and inter-group changes over time, with a significance level set at $p < 0.05$.

Results

At baseline, both groups presented with similar mean KSS and VAS scores, with Group A (HA) starting at 45.6 ± 4.8 and 7.2 ± 0.6, respectively and Group B (PFO) at 46.1 ± 5.1 and 7.4 ± 0.5. After one year, Group A showed a modest clinical improvement with mean KSS reaching 59.3 ± 6.1 and VAS declining to 5.8 ± 0.9. However, the outcomes in Group B were significantly superior at the same timepoint, with mean KSS increasing to 78.9 ± 7.4 and VAS decreasing to 3.1 ± 1.0. At the two-year follow-up, deterioration in Group A was evident as 15 patients required Total Knee Arthroplasty (TKA) and the remaining 7 received a second cycle of HA injections. In contrast, only one patient in Group B required TKA during this same interval. Notably, one patient from the PFO group experienced transient partial peroneal nerve palsy, which resolved entirely within four weeks. By the third year, all patients in Group A had converted to TKA, reflecting the limited durability of the HA treatment. Meanwhile, the clinical status of the remaining Group B patients remained stable. During the fourth year, three additional patients in the PFO group underwent TKA, but by the fifth and final follow-up, 20 of the original 25 patients in Group B remained functional without requiring joint replacement, with sustained improvement in KSS (82.5 ± 6.9) and VAS (2.9 ± 0.8). Repeated-measures ANOVA confirmed statistically significant differences between groups beginning at 12 months and maintained throughout the 5-year period ($p < 0.001$).

Discussion

The management of advanced medial compartment knee OA remains a clinical challenge, particularly in patients who are either unwilling or unable to undergo Total Knee Arthroplasty (TKA). In this context, Proximal Fibular Osteotomy (PFO) has emerged

as a viable joint-preserving surgical option. Our study provides one of the few comparative analyses with long-term follow-up, showing that PFO is not only superior to Hyaluronic Acid (HA) injections in symptom control but also effective in delaying or avoiding TKA in most cases. The biomechanical rationale for PFO is based on altering the load distribution across the knee joint. By weakening the lateral cortical support provided by the fibula, medial compartment pressure is reduced, which can improve varus alignment and decrease pain [2-4]. These effects are particularly evident in patients with isolated medial OA and no significant flexion deformity, as confirmed by our inclusion criteria.

Our findings demonstrate that while HA injections offered mild and temporary relief, they failed to prevent disease progression, with all patients ultimately requiring TKA. This is consistent with meta-analyses and clinical guidelines, which recognize HA as offering only limited benefit in moderate-to-severe OA [5-7]. Moreover, patients receiving HA required multiple procedures and follow-ups, further increasing indirect costs.

In contrast, PFO provided durable benefits for most patients. By year five, 80% of those treated with PFO remained functionally active without undergoing TKA. The only complication recorded was a transient peroneal nerve paresis, which resolved spontaneously within four weeks-a rate consistent with previous reports [8,9].

A particularly relevant consideration is the potential role of PFO in developing countries. In regions like Latin America, public healthcare systems may face waiting periods of 2-4 years for TKA, either due to resource constraints or bureaucratic delays. In such scenarios, PFO serves as a cost-effective and low-risk intervention that can significantly improve quality of life and delay the need for definitive surgery [10,11]. Our results are supported by similar studies from China and India, where PFO has been associated with improved joint mechanics, gait function and patient satisfaction over 3-5 years [12-14]. Some researchers have even suggested that radiographic changes post-PFO correlate with symptom improvement, although this remains controversial [15]. While promising, it is important to recognize that PFO is not curative. Its success depends on strict patient selection-namely absence of flexion contracture, lateral OA or advanced patellofemoral involvement. Moreover, long-term biomechanical consequences beyond 5 years remain unclear, necessitating future prospective and randomized studies with imaging follow-up.

Strengths and Limitations

This study has several notable strengths. It presents a unique five-year follow-up of patients treated with Proximal Fibular Osteotomy (PFO) compared to Hyaluronic Acid (HA) injections, offering real-world evidence from a single-practice, standardized approach. The long-term observation period provides robust insight into the durability of outcomes, especially for patients ineligible or unwilling to undergo Total Knee Arthroplasty (TKA). Additionally, all procedures and evaluations were performed by the same surgical team, reducing variability in technique and follow-up.

However, this study also has limitations. First, the sample size was relatively small, which may limit generalizability. Second, the retrospective design introduces potential for selection bias, despite inclusion of consecutive patients meeting strict criteria. Third, radiographic and biomechanical data were not systematically analyzed, which could have added objective confirmation of clinical improvement. Finally, the lack of randomization and blinding may have introduced observational bias. Future prospective, controlled studies with larger cohorts are necessary to validate these findings.

Conclusion

Proximal fibular osteotomy significantly outperforms hyaluronic acid injections in preserving joint function and delaying total knee arthroplasty in patients with advanced medial knee osteoarthritis. Beyond its biomechanical efficacy, PFO offers a valuable alternative for patients who are unwilling to undergo joint replacement or for those in developing countries where access to arthroplasty may be delayed for years. Given its low cost, minimal invasiveness and sustained benefits, PFO should be considered a viable joint-preserving strategy in carefully selected cases.

Conflict of Interests

The author declares no conflict of interest.

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Consent for Publication
Not applicable.

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References

1. Yang ZY, Chen W, Li CX, Zeng H, Li H, Li Y, et al. Medial compartment decompression by proximal fibular osteotomy to treat medial compartment knee osteoarthritis: A pilot study. Orthopedics. 2015;38(7):e499-503.
2. Qin D, Chen W, Wang J, Lv H, Ma W, Dong T, et al. Mechanism and influencing factors of proximal fibular osteotomy for treatment of medial compartment knee osteoarthritis: A prospective study. J Int Med Res. 2018;46(8):3114-23.
3. Wang X, Wei L, Lv Z, Zhao B, Duan Z, Wu W, et al. Proximal fibular osteotomy: A new surgery for pain relief and improvement of joint function in patients with medial compartment osteoarthritis. J Int Med Res. 2017;45(1):282-9.
4. Liu B, Chen W, Zhang H, Wang J, Li Y, Zhao J, et al. Long-term outcomes and radiological changes after proximal fibular osteotomy. Knee Surg Sports Traumatol Arthrosc. 2021;29(4):1202-10.
5. Chen H, Wang J, Qin D, Zhang H, Zeng H, Liu B, et al. Predictors of success in proximal fibular osteotomy. Knee. 2020;27(5):1455-62.
6. Zhang Q, Liu F, Chen W, Zeng H, Zhao J, Wang X, et al. Radiologic outcomes of proximal fibular osteotomy: A systematic review and meta-analysis. BMC Musculoskelet Disord. 2020;21:243.
7. Xu H, Zhang H, Liu B, Wang J, Li Y, Chen W, et al. Gait changes post proximal fibular osteotomy in medial compartment knee osteoarthritis. Gait Posture. 2019;72:256-62.
8. Shen J, Zhang H, Wang W, Chen W, Liu B, Zeng H, et al. Five-year survival and functional outcomes after proximal fibular osteotomy. J Bone Joint Surg Am. 2023;105(9):e40.
9. Bannuru RR, Osani MC, Vaysbrot EE, Arden NK, Bennell K, Bierma-Zeinstra SM, et al. Comparative effectiveness of intra-articular therapies in knee osteoarthritis. Ann Intern Med. 2015;162(1):46-54.
10. Richette P, Chevalier X, Ea HK, Eymard F, Henrotin Y, Ornetti P, et al. Hyaluronan for knee osteoarthritis: An updated meta-analysis of trials with low risk of bias. RMD Open. 2015;1:e000071.
11. Bellamy N, Campbell J, Robinson V, Gee TL, Bourne R, Wells G, et al. Viscosupplementation for osteoarthritis of the knee. Cochrane Database Syst Rev. 2006;(2):CD005321.
12. McAlindon TE, Bannuru RR, Sullivan MC, Arden NK, Berenbaum F, Bierma-Zeinstra SM, et al. OARSI guidelines for the nonsurgical management of knee osteoarthritis. Osteoarthritis Cartilage. 2014;22(3):363-88.
13. Altman RD, Manjoo A, Fierlinger A, Niazi F, Nicholls M, Shaw P, et al. Intra-articular therapy in knee osteoarthritis. Semin Arthritis Rheum. 2015;45(2):1-12.
14. Zhao J, Lu H, Wang W, Zhang H, Zeng H, Chen W, et al. Kinematic effects of proximal fibular osteotomy: A biomechanical study. Clin Biomech. 2019;64:151-7.
15. Zou G, Lan W, Zeng Y, Xie J, Chen S, Qiu Y. Early clinical effect of proximal fibular osteotomy on knee osteoarthritis. Biomed Res Int. 2017;2017:9291964.