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Comparative outcomes of proximal fibular osteotomy versus high tibial osteotomy in patients with medial knee osteoarthritis: A retrospective analysis

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High tibial osteotomy (HTO) is a widely used procedure for delaying knee arthroplasty, correcting alignment, and relieving symptoms in patients with knee osteoarthritis. Recently, proximal fibular osteotomy (PFO) has emerged as a less invasive and more cost-effective alternative. This study compares the outcomes of HTO and PFO to evaluate whether PFO can deliver results comparable to HTO in similar patient populations. A total of 96 patients treated between 2018 and 2022 were analyzed, with 54 patients undergoing HTO and 42 undergoing PFO. Subgroups were also created based on body mass index (BMI): non-obese HTO, obese HTO, non-obese PFO, and obese PFO. For each patient, we recorded demographic data, preoperative and 1-year postoperative Oxford Knee Scores (OKS), visual analog scale (VAS) scores, medial joint space (MJS) measurements, mechanical axis deviations (MAD), Kellgren-Lawrence grade (KL), medial proximal tibial angle (MPTA), and any complications. Both HTO and PFO led to significant improvements in OKS, VAS, MJS width, and MAD. Age, KL grade distribution, BMI, and MPTA values were comparable across the groups. Overall, HTO showed superior clinical (OKS, VAS) and radiological (MJS, MAD) outcomes, particularly in non-obese patients. Among obese patients, HTO and PFO achieved similar clinical improvements, although HTO maintained a radiological advantage. Importantly, a lower preoperative MPTA was associated with poorer clinical outcomes in the PFO group. In conclusion, while PFO can produce meaningful clinical and radiological improvements, HTO remains the more effective option in terms of both clinical and radiological outcomes in patients with a BMI below 30. For patients with a BMI over 30, HTO preserves its radiological superiority, although its clinical benefits are comparable to those of PFO. Additionally, a low preoperative MPTA is significantly linked to worse OKS scores in patients undergoing PFO.

Keywords: Proximal fibular osteotomy, high tibial osteotomy, body mass index, medial joint space, oxford knee score.

INTRODUCTION

Knee osteoarthritis is a quite common condition and can be observed in three different compartments based on the affected region: medial (inner), lateral (outer), and patellofemoral (front). Due to the body's natural alignment, the medial compartment bears more weight during activities like walking and running, leading to increased stress on the medial cartilage and often causing osteoarthritis (OA) to start in this area, which subsequently results in progression towards varus, narrowing of the medial joint space, increased medial axis deviation, and a decreased medial proximal tibial angle[1-3]. The classification of osteoarthritis is crucial in determining an appropriate treatment approach. The Kellgren-Lawrence (KL) classification system widely assesses OA severity via radiographic evaluations, guiding treatment choices[4]. Primary approaches for Grade 1 OA include non-invasive strategies like weight management, physical therapy, and medications[5]. In Grades 2 and 3, conservative methods are preferred initially, with surgical options like arthroscopic debridement and osteotomy considered when these fail[6,7]. For Grade 4 OA, total knee arthroplasty (TKA) is the standard for addressing damage in multiple compartments, while partial knee arthroplasty (PKA) is viable for isolated medial OA[8,9].

High tibial osteotomy (HTO) is a popular surgical method, particularly for individuals with isolated medial compartment osteoarthritis in grade 2 mild and grade 3 moderate stages. HTO has two main goals; reducing knee pain by shifting weight-bearing pressure to the healthier lateral compartment in varus knees, and postponing the need for a total knee replacement by slowing or halting the degeneration of the medial joint compartment[10]. Proximal fibular osteotomy (PFO), also known as upper partial fibulectomy, is a relatively new surgical procedure gaining popularity among orthopedic surgeons. It aims to alleviate medial knee pain in patients with medial osteoarthritis (OA). During PFO, a portion of the fibula is removed. This increases the load on the lateral side of the knee joint, which in turn helps to relieve pressure on the painful medial joint space. This is thought to achieve a more balanced weight distribution across the knee joint[11,12]. This surgery procedure is also expected to delay the need for total knee replacement. Studies have shown that patients undergoing PFO experience improvements in knee function scores and pain reduction[13,14].

Our study aims to compare two surgical techniques (HTO and PFO) used for similar indications and to assess whether proximal fibular osteotomy, a less costly procedure, achieves results comparable to high tibial osteotomy. Additionally, we sought to observe the influence of BMI (Body Mass Index) within the obese class on the outcomes of these two surgical procedures.

MATERIAL METHOD

This is a retrospective study that has been approved by the ethics committee with decision number ESH/GOEK2023/53.

Patients and Study Design

Patients with Kellgren Lawrence stage 2 or 3 gonarthrosis in the isolated medial knee joint who did not respond to conservative treatment techniques such as intra-articular injections, physical therapy, and nonsteroidal anti-inflammatory drugs were evaluated as having HTO or PFO indication according to surgeon preference.

Surgeries of HTO and PFO were performed by 4 different surgeons in 3 different clinics, between January 2018 and December 2022 X-rays and patients' clinic scores were retrospectively reviewed through the data system of the hospitals and patients' follow-up forms completed by the surgeons. Pre-operative and postoperative 1-year Oxford Knee Score (OKS) and visual analog scale (VAS) scores of all patients were recorded in the follow-up form by the physician during the patient's clinic visit. Ortho roentgenogram and anteroposterior (AP) X-ray images of the knee were also obtained from the patients and pre-operative KL grade, medial proximal tibial angle (MPTA); pre-operative and postoperative 1-year medial joint spaces (MJS) and mechanic axis deviation (MAD) were recorded.

Inclusion criteria were patients who had isolated KL grade 2-3 medial knee arthrosis; Patients who had not received any intra-articular steroid, hyaluronic acid, or PRP injection treatment in the last 3 months in the preoperative period; Patients followed up at postoperative 3rd month, 6th month, and 12th month.

Exclusion criteria were patients who had KL grade 3-4 arthrosis of the lateral tibiofemoral joint or patellofemoral joint or KL grade 4 arthrosis medial tibiofemoral joint; Patients received any intra-articular injection therapy in the last 3 months preoperatively or during the postoperative follow-up period; patients had a rheumatologic disease; patients had septic arthritis; and inability to access data from outpatient clinic records.

Out of 123 patients screened (49 undergoing high fibular osteotomy and 74 undergoing high tibial osteotomy), 96 met the inclusion criteria (42 for high fibular osteotomy and 54 for high tibial osteotomy).

OKS, VAS scores, MJS width(mm), and MAD(mm) were compared between the groups at baseline (preoperative) and 12 months after surgery. Additionally, age, BMI, complications (implant failure, surgical site infection, and deep vein thrombosis (DVT) due to immobilization), Preoperative KL grade, and MPTA were recorded and compared between the groups. Additionally, the correlation between preoperative MPTA value and OKS result was evaluated within the groups.

Within each group, patients were categorized as non-obese (BMI < 30) and obese (BMI > 30) according to the World Health Organization (WHO) body mass index (BMI) classification. In this context, four subgroups were created: non-obese HTO, obese HTO, non-obese PFO, and obese PFO[15].

Operative preparation and surgical technique

Patients underwent routine preoperative preparation As antibiotic prophylaxis, 1000 mg cefazolin IV was given within 30 minutes before surgical incision. Spinal anesthesia was performed in all patients, the tourniquet was tied and the tourniquet was inflated to a systolic blood pressure of +200 mmHg before starting the surgery.

During the diagnostic arthroscopic examination, two portals were created on the anteromedial and anterolateral sides of the knee. If the arthroscopy revealed grade 3 or 4 degeneration in the lateral or patellofemoral joint, or diffuse grade 4 degeneration throughout the medial joint, surgical options were considered based on the patient's age and informed consent after a preoperative discussion. Potential surgeries included total knee arthroplasty or arthroscopic debridement.

For cases where only grade 2 or 3 degeneration was found in the medial joint, a proximal fibular osteotomy (PFO) or high tibial osteotomy (HTO) was performed. An example arthroscopic image is shown in Figure 1. No ligament or meniscus damage requiring repair was observed during any of the arthroscopic procedures, so no repairs were performed.

In 2 patients (1 in the PFO group, and1 in the HTO group), parrot-beak-type tears were extending to a depth of approximately 3 mm in the medial meniscus. These tears were cleaned and debrided using a punch, and these 2 patients were included in the study. However, 4 patients who underwent near-total meniscectomy due to complex degenerative tears and 3 patients who had microfracture surgery due to local cartilage defects were not included in the study, as their results would affect the outcomes and disrupt the homogeneity between the groups.

In PFO, approximately 2 cm of the fibula was excised as a block with a 3-4 cm incision made laterally about 8-10 cm distal to the fibular head. It is shown in Figure 2.

In HTO, open wedge osteotomy and wedge plate fixation were performed by incision from the proximal anteromedial aspect of the tibia using the technique described in the literature. 16

PFO patients were up and walked on the same postoperative day and knee exercises were started with full range of motion. The patients were discharged on postoperative day 1. Antibiotic prophylaxis was given on the day of hospitalization DVT prophylaxis and antibiotics were not given at discharge because no implant was applied and the patients were mobilized immediately. The sutures were removed in the 2nd postoperative week, patients were called for follow-up visits every 3 months for 1 year, and radiologic and clinical evaluations were performed.

HTO patients were not weight-bearing on the operated extremity for 6 weeks and mobilized with crutches. The patients were discharged on

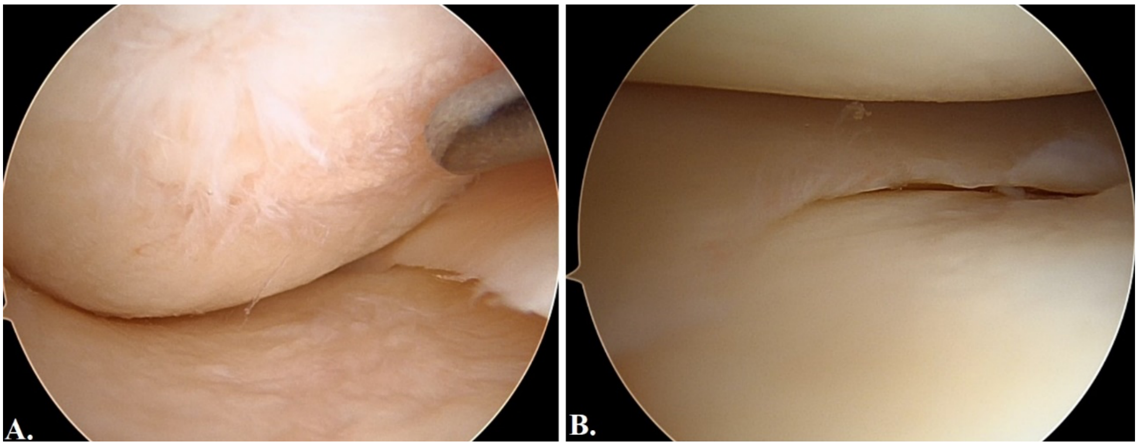

Fig. 1 — Arthroscopic view in a patient who decided to undergo high fibular osteotomy, A; arthroscopic view of the medial tibiofemoral joint space, B; arthroscopic view of the lateral tibiofemoral joint space.

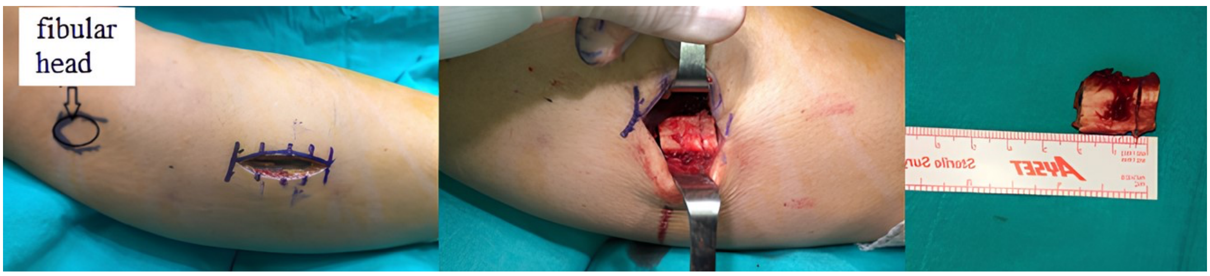

Fig. 2 — A 3-4 cm incision was made approximately 8-10 cm distal to the fibular head; Excision of a 2 cm fibular bone block.

postoperative day 1. Antibiotic prophylaxis was given on the day of hospitalization The patients received DVT prophylaxis for 2 weeks and oral antibiotics for 1 week at discharge. The sutures were removed in the 2nd postoperative week, patients were called for follow-up visits every 3 months for 1 year, and radiologic and clinical evaluations were performed.

Radiological measurement

The MPTA was measured and recorded on the ortho roentgenograms and calculated the angle between the joint line of the tibia (the top horizontal line) and the mechanical axis of the tibia[3] (Figure 3).

Fig. 3 — MPTA measurement.

MJS was measured and recorded on the AP knee radiographs of the patients in standing positions, and the mid-point method was used as the measurement method. The midpoint method, which is defined as the measurement method in the literature, was used to measure the MJS. In this method, the most medial and lateral points of the tibial plateau and the highest medial and lateral points of the eminence are marked on the AP knee radiograph. The MJS measurement is made at the midpoint between these points in the medial and lateral directions[17] (Figure 4).

MAD was measured and recorded on the orthoroentgenogram. We calculated the MAD by measuring the perpendicular distance between the mechanical axis of the lower extremity (leg) and the center of the knee joint, as classically described[18] (Figure 5).

All knee AP and full-length extremity radiographs were digitized using Picture Archiving and Communication System (PACS) software (PiViewStar®; Infinit Technology, Seoul, Korea). For all measurements to be made, a digital goniometer and other measurement tools with a precision of 1/1000 provided by the software were used.With this standardization, all possible magnification and measurement errors were eliminated.

Statistical analysis

Statistical evaluations were conducted using the SPSS 25 program. Distribution analysis was performed through the Kolmogorow Smirnow test on all data. When comparing the groups among themselves, the Mann Whitney U test was applied. The effect of surgical

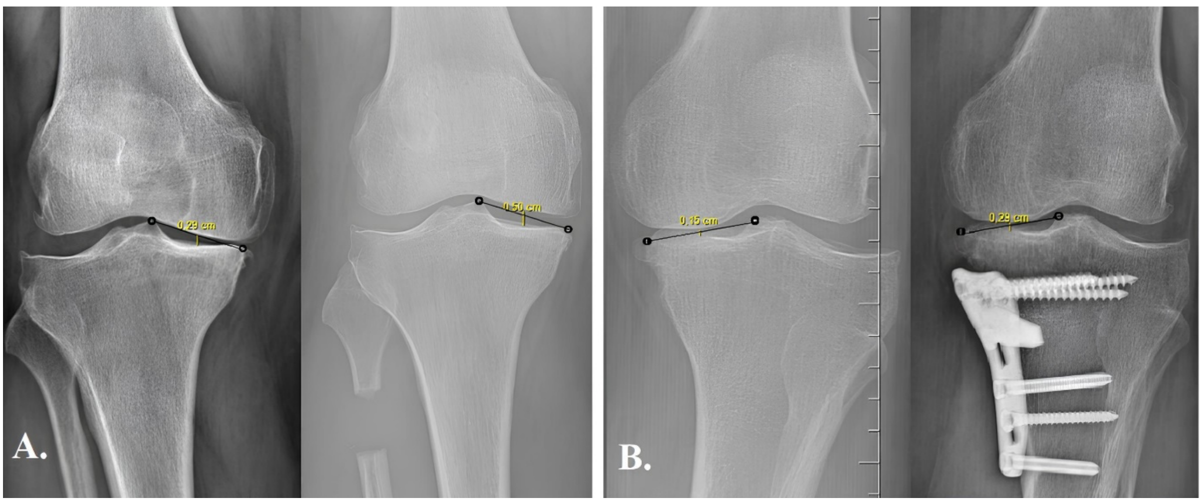

Fig. 4 — A. Proximal fibular osteotomy B. High tibial osteotomy preoperative and postoperative 1st-year medial joint opening measurements.

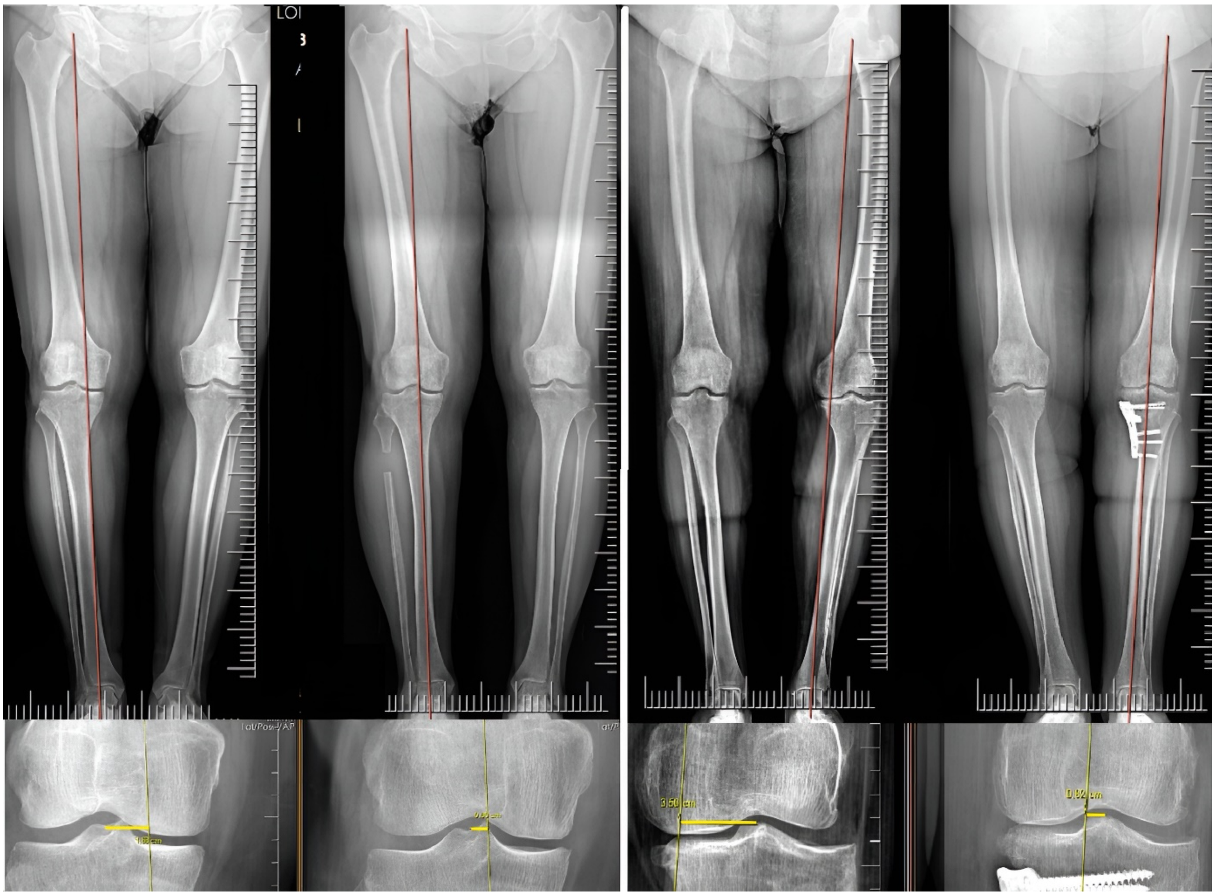

Fig. 5 — Left side proximal fibular osteotomy right side high tibial osteotomy preoperative and postoperative 1st-year mechanical axis deviations measurements.

treatments in each group and subgroup was compared by applying the Wilcoxon test. P < 0.05 was considered significant. The chi-square test and Fisher's exact test were used to compare nominal values; additionally, linear logistic regression analysis was conducted to evaluate the relationship between numerical values. Additionally, the effect size was calculated as 0.6 and the power of the study was calculated as 0.9 for the 96 data points included in the study.

RESULTS

A total of 96 patients were screened, with 54 undergoing HTO and 42 undergoing PFO. Importantly, the groups had no significant differences regarding age, BMI, MPTA, and KL scores (Table I) (Table II).

The HTO and PFO groups showed significant improvements in OKS, VAS score, MJS width, and MAD between the preoperative period and the first postoperative year, as shown in Table III.

When the difference between the groups in the OKS, VAS score, MJS width, and MAD between the preoperative period and postoperative first year were compared, as shown in Table IV, HTO was observed to provide significantly greater clinical improvement (increased OKS and decreased VAS scores) and radiological improvement (increased MJS width and decreased MAD) compared to PFO.

The relationship between the preoperative MPTA angle and the Oxford knee score at the 1-year postoperative mark was evaluated using linear logistic regression analysis. In the HTO group, the correlation between MPTA and the 1-year Oxford score was weak (R=0.11, P=0.415); whereas, in the PFO group, a moderately significant correlation was found between MPTA and the 1-year Oxford score (R=0.38, P=0.013).

Patients were divided into subgroups based on their BMI. As stated in Table V, there was a significant difference between the preoperative period and postoperative first year in the nonobese HTO, obese HTO, nonobese PFO, and obese PFO regarding OKS, VAS scores, MJS, and MAD. When BMI subgroups were analyzed, both clinical and radiological improvements (increased OKS, decreased VAS, and increased MJS width) were significantly lower in the

Table I. — Variables between HTO and PFO groups.

N=96	HTO n=54	PFO n=42	P value
Age	51.1 ± 3.6	52.2 ± 5.5	0,244
BMI	30.1 ± 3.7	29.3 ± 3.3	0,283
MPTA	82,91 ± 2,08	83,84 ± 1,87	0,372
KL scores (grade 2/3 %)	18 %33 / 36 %66	17 %40,5 / 25 %59,5	0,305

Table II. — High tibial osteotomy and proximal fibular osteotomy groups; preoperative and first-year results.

T: 96 Male: 40 Female: 56	HTO N:54 Male: 24 Female: 30	PFO N:42 Male: 16 Female: 26
Preoperative Oxford score	16,8 ±3,3	16,9 ± 4,3
First Year Oxford score	29,1 ± 5,9	26,7 ±5,9
P value	P:0,001	P:0,001
Preoperative visual analog scale score	6,4 ± 0,9	6,3 ± 1,1
First-year visual analog scale score	4,3 ± 1,1	4,7 ±1,2
P value	P:0,001	P:0,001
Preoperative medial joint space	2,08 ± 0,7 mm	2,35 ± 0,8 mm
First-year medial joint space	3,1 ± 0,9 mm	2,9 ± 0,7 mm
P value	P:0,001	P:0,003
Preoperative mechanical axis deviation (mm)	23,7 ± 7,6 mm	21,6 ± 5,5 mm
First-year mechanical axis deviation (mm)	11,4 ± 3,6 mm	18,5 ± 6 mm
P value	P:0,001	P:0,006
Complication	Cellulitis in 1 patient In 1 patient, 1 screw of the implant loosened and was removed	1 patient with persistent pain at the osteotomy site

Table III. — High tibial osteotomy and proximal fibular osteotomy groups; difference between preoperative and postoperative first-year.

Difference between preoperative and postoperative first-year	HTO N:54	PFO N:42	P value
Oxford knee score	12.4 ± 5.5	9.4 ± 3.8	0,004
Visual analog scale	2.1 ± 0.9	1.5 ± 0.8	0,019
Medial joint space widening	1.02 ± 0.7mm	0.55 ± 0.68 mm	0,02
Mechanical axis deviation	12,5 ± 6mm	2,9 ± 3,6 mm	0,001

obese group compared to the non-obese group for both HTO and PFO patients. However, the reduction in MAD, another radiological parameter, was similar between obese and non-obese groups for both surgical interventions (Table V).

When examining the non-obese patient group, HTO provided significantly greater clinical improvement (increased OKS and decreased VAS scores) and radiological improvement (increased MJS width and decreased MAD) compared to PFO. However, when examining the obese group, HTO, and PFO provided similar clinical improvement, while HTO provided significantly greater radiological improvement. (Comparisons and p-values by subgroup are detailed in Table VI).

DISCUSSION

HTO is gaining popularity as a treatment for single medial compartment OA of the knee. Its ability to decrease medial compartment pressure contributes to pain relief[19].

MJS measurement is important to determine the stage of osteoarthritis. An increase in MJS may indicate cartilage regeneration and healing[20]. Additionally varus alignment increased MAD and

Table IV. — BMI subgroups; preoperative and first-year results.

T: 96 Male: 40 Female: 56	Nonobese HTO N:25 Male: 13 Female: 12	Obese HTO N:29 Male: 11 Female: 18	Nonobese PFO N:26 Male: 10 Female: 16	Obese PFO N:16 Male: 6 Female: 10
Preoperative Oxford	18,12 ± 3,1	15,82 ± 3	16 ± 4,1	18,43 ± 4
First Year Oxford	33,36 ± 3,2	25,55 ± 5,3	27,19 ± 4,2	25,93 ± 8
P value	0,001	0,001	0,001	0,001
Preoperative visual analog scale	6 ± 0,7	6,72 ± 0,9	6,46 ± 1,06	6,12 ± 1,2
First-year visual analog scale	3,52 ± 0,9	5 ± 0,9	4,61 ± 1,13	4,81 ± 1,3
P value	0,001	0,001	0,001	0,002
Preoperative mechanical axis deviation (mm)	22,36 ± 8,2	24,8 ± 7	19,7 ± 3	24,5 ± 6
First-year mechanical axis deviation (mm)	9,43 ± 2,4	13,2 ± 3,5	16,5 ± 4	21,9 ± 7
P value	0,001	0,001	0,002	0,043
Preoperative medial joint space (mm)	2,39 ± 0,7	1,81 ± 0,6	2,06 ± 0,7	1,74 ± 0,8
First-year medial joint space (mm)	3,66 ± 0,8	2,61 ± 0,8	2,83 ± 0,6	2,17 ± 0,7
P value	0,001	0,001	0,001	0,008

TableV. — BMI subgroups; difference between preoperative and postoperative first-year.

NON OBESE PATİENTS N: 51 MALE: 23 FEMALE: 28			
Difference between preoperative and postoperative first-year	HTO	PFO	P value
Oxford knee score	15,25 ± 2,38	11,2 ± 2,4	0,001
Visual analog scale	2,48 ± 0.6	1.84 ± 0.6	0,001
Medial joint space widening	1.26 ± 0.65mm	0.73 ± 0.58 mm	0,007
Mechanical axis deviation	13,7 ± 6,8mm	3,2 ± 3,4 mm	0,001
OBESE PATİENTS N: 45 MALE: 17 FEMALE: 28			
Difference between preoperative and postoperative first-year	HTO	PFO	P value
Oxford knee score	9,7 ± 5.3	6,8 ± 4,7	0,072
Visual analog scale	1,7 ± 0.9	1.3 ± 0.7	0,176
Medial joint space widening	0,8 ± 0.7mm	0.35 ± 0.5 mm	0,036
Mechanical axis deviation	11,6 ± 2,58mm	2,5 ± 4,8 mm	0,001
HTO PATİENTS N:54 MALE: 24 FEMALE: 30			
Difference between preoperative and postoperative first-year	NON OBESE	OBESE	P value
Oxford knee score	15,25 ± 2,38	9,7 ± 5.3	0,001
Visual analog scale	2,48 ± 0.6	1,7 ± 0.9	0,002
Medial joint space widening	1.26 ± 0.65mm	0,8 ± 0.7mm	0,005
Mechanical axis deviation	13,7 ± 6,8mm	11,6 ± 2,58mm	0,245
PFO PATİENTS N:42 MALE: 16 FEMALE: 26			
Difference between preoperative and postoperative first-year	NON OBESE	OBESE	P value
Oxford knee score	11,2 ± 2,4	6,8 ± 4,7	0,001
Visual analog scale	1.84 ± 0.6	1.3 ± 0.7	0,048
Medial joint space widening	0.73 ± 0.58 mm	0.35 ± 0.5 mm	0,026
Mechanical axis deviation	3,2 ± 3,4 mm	2,5 ± 4,8 mm	0,482

decreased MPFA contribute to elevated stress on the medial knee cartilage, accelerating degeneration[3].

In a retrospective study of 81 patients, Tsai et al. suggested that the MJS width increased and the VAS score decreased after HTO[21]. In a retrospective study of 71 patients, Lee et al. suggested that MJS width increased and knee scores improved after HTO[22]. In their retrospective study, Myung Ku Kim and colleagues suggested that HTO effectively corrects MAD and improves clinical scores[23]. Additionally, numerous studies in the literature have demonstrated that the MPTA value significantly increases following high tibial osteotomy HTO. This increase in MPTA is associated with improved alignment of the knee joint, which can lead to enhanced clinical outcomes such as reduced pain and improved functional ability[24,25].

PFO a minimally invasive surgery for the treatment of isolated medial knee OA, has recently become popular. This popularity is perhaps because this procedure is simpler, less expensive, and requires less rehabilitation than HTO. Proximal fibular osteotomy shifts the loading force from the medial compartment to the lateral. Therefore, it helps reduce pain and achieve satisfactory functional recovery[26].

In a retrospective study of 60 patients, Ahmed et al suggested that after PFO, there was an increase in MJS width, a decrease in VAS scores, and an improvement in OKS[27]. In a prospective study of 21 patients, Kumar et al. suggested that after PFO, there was an increase in knee scores and a decrease in VAS scores[28]. In their study with 35 patients , H. Harshwardhan et al. found that after PFO, there was an increase in the VAS score and a decrease in MAD[29]. However, when we conducted a search on PubMed and Google Scholar, we were unable to find a study evaluating the relationship between PFO and MPTA.

In their meta-analysis, Wu et al. suggested that HTO and PFO have similar outcomes[30]. Mahadik et al. suggested that HTO and PFO have similar outcomes, but PFO is superior in terms of a lower complication rate and shorter surgical time[31].

In our study, we observed that both HTO and PFO provided clinical improvement (increased OKS and decreased VAS scores) and radiological improvement (increased MJS width and decreased MAD). However, HTO provided significantly greater clinical improvement and radiological improvement compared to PFO.

In terms of the impact of MPTA on clinical outcomes, in our study, the MPTA value did not significantly affect clinical outcomes in the HTO group, whereas it had a significant impact on clinical outcomes in the PFO group. Patients with lower MPTA values had lower 1-year OKS scores. This result could be related to the nature of the surgeries; while HTO can directly correct the MPTA, PFO does not influence the MPTA.

The impact of BMI on clinical outcomes in patients after high tibial osteotomy is controversial. In a recent systematic review, studies on the influence of risk factors have revealed that old age, female sex, and being overweight, might result in worse outcomes in high tibial osteotomy patients[32].

In a study of 120 patients, Herbst et al. suggested that in terms of clinical outcome and health-related quality of life, overweight and normal-weight patients would benefit from open wedge HTO; however, clinical and functional outcomes would be inferior in overweight patients compared to normal weight patients[33].

Tuhanioğlu et al. suggested that positive clinical outcomes were obtained in parallel with weight loss in the postoperative period after HTO in a study of 18 patients with a BMI of 30 and above[34].

In a retrospective study of 123 patients, Chen Yi et al. suggested that being overweight or obese is not associated with inferior clinical outcomes[35].

When it comes to the association between BMI and PFO there are many publications in the literature stating that proximal fibular osteotomy reduces pain and improves knee scores[28,36-38]. However, we could not find a publication related to BMI and proximal fibular osteotomy.

Our study demonstrated no significant difference in MAD, a radiological parameter, between obese and non-obese patients. Conversely, both clinical (increased OKS, decreased VAS) and another radiological measure (increased MJS width) showed significantly lower improvements in the obese compared to the non-obese group for both HTO and PFO procedures.

While HTO proved significantly superior to PFO in both clinical and radiological outcomes for non-obese individuals, in the obese group this superiority was maintained only in radiological terms; however, clinically, HTO and PFO yielded similar results.

Additionally in our study, we state that, a low preoperative MPTA value did not adversely affect the clinical success of HTO but a low MPTA was significantly associated with poorer clinical outcomes in PFO patients.

Numerous complications associated with HTO have been documented in the literature. Wound site infection, implant-related infection, implant irritation, non-unıon of the osteotomy line, loss of correction, intraoperative lateral cortex fractures, postoperative lateral cortex fractures, deep venous thrombosis, and delayed unions, are known complications of HTO surgery[39-41]. According to the literature, the only complication reported in association with PFO is peroneal nerve palsy[26]. In our follow-up, 1 patient in the HTO group experienced cellulitis and 1 patient experienced screw loosening. In the PFO group, 1 patient experienced persistent pain at the osteotomy site.

From a cost perspective; proximal fibular osteotomy offers several economic advantages compared to high tibial osteotomy. First, it eliminates the need for intraoperative fluoroscopy, reducing costs associated with disposable equipment and radiation exposure. Second, as an implant-free procedure, it avoids expenses related to hardware and potential implant-related complications. Finally, earlier weight-bearing capacity following surgery leads to decreased work absenteeism and reduced economic burden. While all these factors make PFO a more economical and less complication-prone surgery, our study suggests that HTO generally provides greater clinical improvement.

Our study encountered several limitations. Firstly, the sample size was small, comprising only 96 patients, despite a large number presenting to our hospitals. Many patients opted for medical management over surgery, and accessing records for others was challenging.

Secondly, the study period was limited, preventing assessment of surgery's impact on ankle or hip biomechanics. A longer follow-up is necessary to gauge the surgery's long-term effect on knee osteoarthritis.

Lastly, although PFO requires less time than HTO, we cannot present this as scientific evidence. Our records only noted patient entry and exit times from the surgery room, without accounting for variables like anesthesia start times and postoperative dressing procedures.

CONCLUSION

While PFO offers clinical and radiological improvements with less economic burden, HTO is superior overall in both aspects. This study identifies MPTA as a predictor of clinical success in PFO. A BMI over 30 significantly reduces clinical and radiological success in both procedures, except for MAD, which showed no significant difference between obese and non-obese groups. When BMI is below 30, HTO achieves better clinical and radiological outcomes than PFO. However, in patients with a BMI over 30, HTO only demonstrates superior radiological improvement, making PFO a viable option due to similar clinical results.

Conflict-of-interest statement: The authors disclose that there is no conflict of interest.

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