



Original Article

Comparative Study of Functional Outcome Between Patients Treated with Proximal Fibular Osteotomy and Arthroscopic Debridement in Osteoarthritis Knee

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ABSTRACT

Introduction: Knee osteoarthritis (OA) is a common degenerative joint disorder causing pain, stiffness, and functional impairment. Surgical options like Proximal Fibular Osteotomy (PFO) and Arthroscopic Debridement (AD) are emerging minimally invasive treatments aimed at symptom relief. This study compares the functional outcomes of PFO versus AD in patients with knee OA.

Materials and Methods: A prospective, comparative study was conducted over 24 months involving 52 patients with radiographic Grade II and III knee OA unresponsive to conservative therapy. Patients were equally divided into two groups: Group A underwent PFO, and Group B received AD. Preoperative assessments included Visual Analogue Scale (VAS) for pain and Knee Society Score (KSS) for function. Follow-up evaluations were performed at 2 weeks, 6 weeks, 3 months, 6 months, and 12 months. Data analysis utilized paired and unpaired t-tests, chi-square tests, and repeated measures ANOVA to compare intra- and intergroup outcomes.

Results: Both groups demonstrated significant improvements in KSS and VAS scores at 6 and 12 months ($p < 0.001$). Intragroup analysis showed continuous functional and pain relief over time, with no significant difference between PFO and AD at any follow-up point ($p > 0.05$). Complication rates, including infection and nerve injury, were low and comparable in both groups.

Conclusion: Proximal Fibular Osteotomy and Arthroscopic Debridement are effective and safe surgical options for knee OA, yielding similar functional and pain outcomes over 12 months. Larger, long-term, multicenter studies are warranted to confirm these findings and optimize patient selection.

Keywords: Knee Osteoarthritis, Proximal Fibular Osteotomy, Arthroscopic Debridement, Functional Outcome, Pain Relief and Knee Society Score.

INTRODUCTION

Osteoarthritis (OA) of the knee is a prevalent degenerative joint disorder marked by cartilage loss, subchondral bone changes, osteophyte formation, and synovial inflammation [1][2]. It causes pain, stiffness, deformity, and impaired mobility, significantly reducing quality of life. The global prevalence is rising, especially among older adults with obesity and sedentary lifestyles [3][4]. OA is classified as primary (idiopathic) or secondary, with the medial compartment most commonly affected due to abnormal load distribution and varus alignment [5]. Repetitive mechanical stress leads to cartilage microdamage, subchondral sclerosis, and osteophyte development, progressing to joint space narrowing and joint dysfunction [2].

Biomechanical factors, such as uneven load distribution and varus deformity, play crucial roles in medial compartment OA development. The “uneven settlement theory” describes how repetitive weight bearing causes the sinking of the medial tibial plateau, shifting load medially and increasing cartilage degradation [6]. This process results in thinning cartilage, subchondral sclerosis, osteophyte formation, and joint space narrowing, culminating in pain and functional impairment. The imbalance creates a cycle of degeneration, leading to instability and disability. Understanding these mechanisms informs surgical approaches like high tibial osteotomy (HTO) and proximal fibular osteotomy (PFO), which aim to redistribute load and correct alignment, thereby alleviating symptoms [7][8].

Surgical intervention is typically reserved for cases unresponsive to conservative treatments. Traditional options include high tibial osteotomy (HTO), unicompartmental knee arthroplasty (UKA), and total knee arthroplasty (TKA), with TKA being the preferred choice for end-stage disease [9][10]. However, for younger, active patients, less invasive procedures like HTO or emerging techniques such as PFO and arthroscopic debridement (AD) are gaining popularity due to shorter recovery and fewer complications [11][12][13]. PFO involves removing a fibular segment to offload the medial compartment, effectively realigning the mechanical axis and reducing pain [7][8]. AD addresses intra-articular pathology by removing loose bodies and inflamed tissue, providing symptom relief without altering joint structure [14][18].

Recent combined approaches—PFO with AD—target both biomechanical correction and intra-articular pathology, showing promising outcomes in pain reduction and function [16][17]. Outcome assessment tools like the Knee Society Score (KSS) objectively measure postoperative recovery, with moderate OA patients generally experiencing better results [23][24]. While both PFO and AD are effective, comparative data on long-term efficacy are limited. The present study is therefore designed to compare the postoperative functional outcomes of patients undergoing PFO versus AD using validated scoring systems such as KSCRS. The aim of the study was to evaluate the functional outcome of patients with osteoarthritis knee treated with proximal fibular osteotomy or arthroscopic debridement along with objectives to compare the functional outcome of proximal fibular osteotomy vs arthroscopic debridement in osteoarthritis knee and to study the complication in both the groups.

MATERIAL AND METHODS

This was a prospective comparative study conducted over 24 months at the Orthopaedics Department of Era’s Lucknow Medical College and Hospital, Lucknow. The study included 52 patients with radiographic Grade II and III knee osteoarthritis who had failed conservative treatment. Ethical approval was obtained from the Institutional Ethical Committee, and written informed consent was secured from all participants.

Patients were selected using convenience sampling based on specific inclusion criteria: age over 18, radiological confirmation of isolated medial knee osteoarthritis (Grade II or III), and failure of conservative management. Exclusion criteria included ligament injuries, skin infections, uncontrolled systemic illnesses, and advanced or early-stage OA (Grade I and IV). Participants were divided into two groups: those undergoing proximal fibular osteotomy (PFO) and those receiving arthroscopic debridement (AD).

Baseline data—including demographic details, clinical history, physical examination, and radiological assessment—were collected. Preoperative evaluations involved pain scoring via Visual Analogue Scale (VAS) and functional assessment using the Knee Society Score (KSS). Surgical procedures followed standard protocols, with postoperative care including analgesics and physiotherapy. Follow-up visits occurred at 2 weeks, 6 weeks, 12 weeks, 6 months, and 12 months, during which clinical and functional assessments were repeated.

Data were systematically recorded and analyzed using IBM SPSS v25. Descriptive statistics summarized categorical and continuous variables. Statistical tests included chi-square for categorical data, unpaired t-tests for comparing independent group means, paired t-tests for pre- and post-intervention comparisons within groups, and RM ANOVA for repeated measures over time. A p-value <0.05 was considered statistically significant, allowing comparison of pain relief and functional outcomes between the two surgical interventions.

RESULTS

The study included 52 knee osteoarthritis patients, evenly split into two groups: 26 received Proximal Fibular Osteotomy (Group A) and 26 underwent Arthroscopic Debridement (Group B). This balanced allocation ensured comparability for unbiased outcome assessment.

Table –1 Distribution of Osteoarthritis Knee Cases according to Gender

Variable		Group A		Group B		Significance	
		No.	%	No.	%	chi sq	p-value
Gender	Female	15	57.7%	17	65.4%	0.33	0.569
	Male	11	42.3%	9	34.6%		
Age	Over 18 years	53.96	9.31	53.69	10.33	0.10	0.922

Occupation	Pvt Job	7	26.9%	6	23.1%	3.04	0.693
	Driver	2	7.7%	1	3.8%		
	Labour	6	23.1%	7	26.9%		
	Farmer	2	7.7%	0	0.0%		
	Housewife	8	30.8%	10	38.5%		
	Other	1	3.8%	2	7.7%		

Gender distribution was similar: Group A had 57.7% females and 42.3% males; Group B had 65.4% females and 34.6% males ($p = 0.569$). The mean ages were comparable (Group A: 53.96 ± 9.31 years; Group B: 53.69 ± 10.33 years; $p = 0.922$). Occupational distribution was also similar, with no significant difference ($p = 0.693$), ensuring groups were well matched.

Table – 2 Distribution of Cases according to BMI

Variable		Group A		Group B		Significance	
		No.	%	No.	%	chi sq	p-value
BMI	< 18.5 kg/m ²	0	0.0%	0	0.0%	0.49	0.784
	18.5 - 24.9 kg/m ²	5	19.2%	7	26.9%		
	25.0 - 29.9 kg/m ²	14	53.8%	12	46.2%		
	>= 30.0 kg/m ²	7	26.9%	7	26.9%		

BMI distribution was similar: Group A had 19.2% normal, 53.8% overweight, 26.9% obese; Group B had 26.9% normal, 46.2% overweight, 26.9% obese. No significant difference was observed ($p = 0.784$).

Table – 3 Distribution of Cases according to KL Grade

Variable		Group A		Group B		Significance	
		No.	%	No.	%	chi sq	p-value
KL_Grade	KL-1	0	0.0%	0	0.0%	0.32	0.575
	KL-2	10	38.5%	12	46.2%		
	KL-3	16	61.5%	14	53.8%		

The distribution of osteoarthritis severity was comparable between groups: KL-2 (38.5% in Group A, 46.2% in Group B) and KL-3 (61.5% in Group A, 53.8% in Group B). No KL-1 cases were present, and there was no significant difference in KL grades between groups ($p = 0.575$).

Table – 4 Distribution of Cases according to Duration of Osteoarthritis

Variable		Group A		Group B		unpaired t test	
		Mean	SD	Mean	SD	t-value	p-value
Duration of osteoarthritis (Months)		22.35	8.74	18.04	9.65	1.69	0.098

The mean duration of osteoarthritis was 22.35 ± 8.74 months in Group A and 18.04 ± 9.65 months in Group B. Although Group A showed a relatively longer duration of disease compared to Group B, the difference was not statistically significant. Unpaired t-test analysis revealed a t-value of 1.69 with a p-value of 0.098, indicating that the duration of osteoarthritis was comparable between the two groups at baseline.

Table – 5 Intragroup Comparison of KSS – Knee changes within Groups

KSS-Knee change from pre op	Group A				Group B			
	Mean change	SD	t-value	p-value	Mean change	SD	t-value	p-value
6 Month	20.35	3.69	28.14	<0.001	19.15	3.08	31.69	<0.001
12 Month	30.77	4.45	35.27	<0.001	33.42	5.00	34.10	<0.001

Both groups showed significant, sustained improvements in KSS knee scores at 6 and 12 months. At 6 months, Group A improved by 20.35 points and Group B by 19.15 points ($p < 0.001$). At 12 months, improvements were 30.77 points in Group A and 33.42 in Group B ($p < 0.001$). Both treatments led to substantial functional recovery, with Group B showing a slightly higher gain at 12 months.

Table – 6 Intragroup Changes in KSS – Function within Groups

KSS-Function change from pre op	Group A				Group B			
	Mean change	SD	t-value	p-value	Mean change	SD	t-value	p-value
6 Month	20.81	3.14	33.82	<0.001	20.62	3.09	34.06	<0.001
12 Month	32.81	3.90	42.91	<0.001	32.81	5.32	31.43	<0.001

Both groups showed highly significant and sustained improvements in KSS-function scores at 6 and 12 months. At 6 months, Group A improved by 20.81 points and Group B by 20.62 ($p < 0.001$). At 12 months, both groups improved by approximately 32.81 points ($p < 0.001$), indicating substantial functional recovery over time.

Table – 7 Intragroup Changes in KSS – Total within Groups

KSS-Total change from pre op	Group A				Group B			
	Mean change	SD	t-value	p-value	Mean change	SD	t-value	p-value
6 Month	41.15	4.50	46.67	<0.001	39.77	4.58	44.27	<0.001
12 Month	63.58	5.36	60.48	<0.001	66.23	6.78	49.78	<0.001

Both groups showed highly significant improvements in KSS total scores at all follow-ups. At 6 months, Group A improved by 41.15 points and Group B by 39.77 ($p < 0.001$). At 12 months, improvements increased to 63.58 points in Group A and 66.23 in Group B ($p < 0.001$), indicating sustained and progressive gains over time.

Table – 8 Intragroup Changes in VAS within Groups

VAS change from pre op	Group A				Group B			
	Mean change	SD	t-value	p-value	Mean change	SD	t-value	p-value
2 wks	-0.73	0.45	-8.24	<0.001	-0.73	0.45	-8.24	<0.001
6 wks	-1.46	0.51	-14.66	<0.001	-1.50	0.51	-15.00	<0.001
12 wks	-2.42	0.50	-24.52	<0.001	-2.58	0.50	-26.08	<0.001
6 month	-3.23	0.71	-23.19	<0.001	-3.31	0.68	-24.83	<0.001
12 month	-3.88	0.59	-33.67	<0.001	-3.65	0.69	-27.02	<0.001

Both groups showed significant, progressive pain reduction over time. At 2 weeks, VAS decreased by ~0.73, with continued improvement at 6 weeks, 12 weeks, 6 months, and 12 months. By 12 months, reductions were approximately -3.88 in Group A and -3.65 in Group B, all highly significant ($p < 0.001$). The intragroup analysis confirms sustained and substantial pain relief in both groups.

Table – 9 Intergroup Comparison of Infection

Variable		Group A		Group B		Significance	
		No.	%	No.	%	chi sq	p-value
Infection	Present	2	7.7%	1	3.8%	0.35	0.552
	Not Present	24	92.3%	25	96.2%		
Nerve injury	Present	1	3.8%	1	3.8%	0.00	1.000
	Not Present	25	96.2%	25	96.2%		
Delayed recovery	Yes	2	7.7%	1	3.8%	0.35	0.552
	No	24	92.3%	25	96.2%		

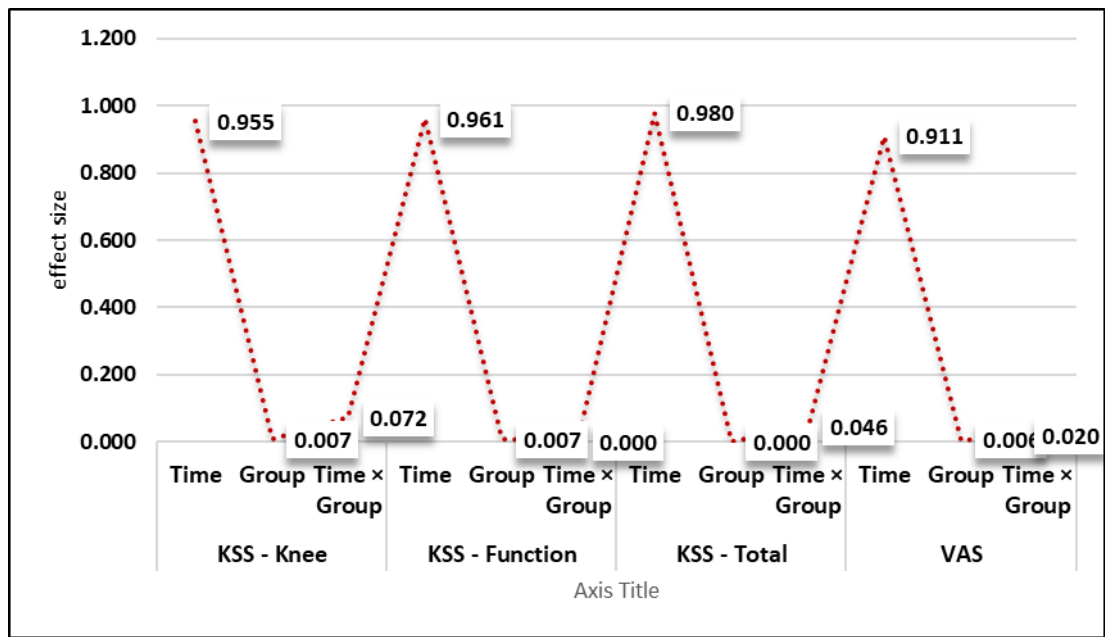
Postoperative infection rates were similar in both groups, with 7.7% in Group A and 3.8% in Group B; most patients remained infection-free, and the difference was not significant ($p = 0.552$). Nerve injury occurred in 3.8% of patients in both groups, with no significant difference ($p = 1.000$). Delayed recovery was observed in 7.7% of Group A and 3.8% of Group B, with no significant difference ($p = 0.552$). Overall, both groups had comparable and low complication rates.

Table – 10 RM ANOVA Showing Effect of Time, Group and Their Interaction over Osteoarthritis Parameters

Parameter	Factor	F-value	p-value	effect size
KSS - Knee	Time	1055.01	0.000	0.955
	Group	0.37	0.546	0.007
	Time × Group	3.90	0.054	0.072
KSS – Function	Time	1238.85	0.000	0.961
	Group	0.36	0.553	0.007
	Time × Group	0.01	0.907	0.000
KSS - Total	Time	2463.69	0.000	0.980
	Group	0.00	1.000	0.000
	Time × Group	2.41	0.127	0.046
VAS	Time	513.86	0.000	0.911
	Group	0.30	0.589	0.006
	Time × Group	0.99	0.323	0.020

Repeated measures ANOVA showed significant improvements over time in all osteoarthritis outcomes—KSS (knee, function, total), VAS pain scores—with large effect sizes ($\eta^2 > 0.9$). The effect of time was highly significant ($p < 0.001$), indicating marked clinical improvements during follow-up. However, there were no significant differences between groups ($p > 0.05$), and the time × group interactions were non-significant, suggesting similar patterns of improvement in both

treatments. Overall, time was the main factor influencing outcomes, with comparable effectiveness of both modalities throughout the study.



DISCUSSION

In this study, 52 patients with knee osteoarthritis were evenly divided into two groups: Proximal Fibular Osteotomy (Group A) and Arthroscopic Debridement (Group B), each with 26 participants. This balanced allocation minimized bias and enhanced comparability, consistent with similar designs in prior research [70][71]. Females comprised slightly more in both groups (Group A: 57.7%, Group B: 65.4%), but the difference was not significant ($p = 0.569$). This aligns with epidemiological data indicating higher osteoarthritis prevalence among women, especially post-menopause [72][73], and women reporting higher pain and functional limitations [74].

The mean age was comparable: Group A (53.96 ± 9.31 years) and Group B (53.69 ± 10.33 years), with no significant difference ($p = 0.922$). This reflects typical osteoarthritis demographics affecting middle-aged and older adults [75][76]. Occupational distribution was similar, with no significant difference ($p = 0.693$), and occupations involving repetitive knee stress, such as homemaking and manual labor, were prevalent, consistent with known risk factors [73][79].

BMI distribution was also comparable: most patients were overweight or obese, with no significant difference ($p = 0.784$), mirroring the established link between excess weight and osteoarthritis progression [72][73][74]. Radiographic severity (Kellgren-Lawrence grades) and disease duration were similar between groups ($p = 0.575$ and $p = 0.098$, respectively), reflecting typical clinical presentations [70][77][78].

Preoperative Knee Society Scores (KSS) were comparable ($p = 0.743$), and both groups showed significant improvements over time at 6 and 12 months ($p < 0.001$), with no significant differences between them. These findings align with previous studies demonstrating comparable efficacy of these procedures in improving pain and function [70][81][82]. The progressive increase in KSS scores indicates sustained functional recovery, attributed to biomechanical correction in Group A and intra-articular pathology removal in Group B [77][78][81].

VAS scores showed significant pain reduction in both groups over time ($p < 0.001$), with no intergroup difference, consistent with prior reports of similar pain relief following these interventions [71][84]. Infection and nerve injury rates were low and comparable ($p > 0.05$), indicating both procedures are safe with minimal complications [77][78][81]. Recovery patterns were also similar, with no significant differences in delayed recovery incidence ($p > 0.05$).

Repeated measures ANOVA confirmed significant improvements over time across all outcome parameters ($p < 0.001$), with large effect sizes, and no significant group effects or interactions, supporting the comparable efficacy of both treatments. These results corroborate previous findings that both surgical approaches effectively improve pain and function in knee osteoarthritis patients when properly indicated [70][71][82].

CONCLUSION

This study found that both Proximal Fibular Osteotomy and Arthroscopic Debridement significantly improved knee function and reduced pain over 12 months, with no significant differences in outcomes or complications between them.

Both procedures are safe and effective options for managing knee osteoarthritis. However, limitations such as small sample size, short follow-up, single-center design, and limited outcome measures suggest the need for larger, multicenter, randomized trials with longer follow-up and comprehensive assessments to better determine long-term efficacy and optimal patient selection.

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