To Assess the Functional Outcome of the Fibularis Longus Sinew Autograft Versus the Hamstring Sinew Autograft for ACL Reconstruction

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Abstract

Background: Anterior cruciate ligament (ACL) reconstruction is widely performed to restore knee stability following ligament rupture. The choice of autograft remains pivotal in determining long-term functional outcomes. While hamstring tendon (HT) autografts are commonly used, they are associated with donor site morbidity and variable graft diameter. Fibularis longus tendon (PLT) has emerged as a promising alternative due to its favourable biomechanical properties and potential to preserve hamstring function.

Objectives: To assess and compare the functional outcomes, knee stability, and donor site morbidity associated with PLT versus HT autografts in patients undergoing ACL reconstruction.

Methods: A prospective comparative clinical study was conducted between August 2023 and March 2025 at a tertiary care institute in Varanasi. Fifty patients with isolated ACL tears were randomly assigned to undergo reconstruction using either HT or PLT autografts (25 per group). All underwent standardized arthroscopic techniques and a uniform rehabilitation protocol. Functional outcomes were assessed using IKDC, Lysholm, and Cincinnati scores; donor site morbidity using AOFAS and FADI scores; and knee stability via Lachman, pivot shift, and anterior drawer tests.

Results: Both groups showed significant improvement in IKDC scores postoperatively. The PLT group had a slightly higher mean IKDC at 1 year (90.90 vs 89.52; p=0.068), greater graft diameter, and better preservation of thigh muscle mass. No significant differences in knee stability tests or major complications were observed.

Conclusion: PLT is a reliable and effective autograft, showing comparable if not slightly superior functional outcomes to HT in ACL reconstruction, with minimal donor site morbidity.

Keywords: Anterior Cruciate Ligament, Autografts, Fibularis Longus Tendon, Hamstring Tendon, Functional Outcome.

Introduction

The anterior cruciate ligament (ACL) is a primary stabilizer of the knee joint, preventing anterior translation and rotational instability of the tibia in relation to the femur. ACL injuries are among the most frequent ligamentous injuries in orthopaedic practice, especially among physically active individuals and athletes. Globally, the annual incidence of ACL tears is estimated at 68.6 per 100,000 person-years, with increasing prevalence in developing nations like India due to sports injuries and road traffic accidents (RTAs) [1, 2]. ACL injuries, if untreated, predispose individuals to functional impairment, joint instability, meniscal tears, and early-onset osteoarthritis [3].

Surgical reconstruction remains the treatment of choice for symptomatic ACL-deficient knees, with autograft selection being a critical determinant of long-term functional outcomes.

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Table 1: Demographic Profile

Age Range	Gender	Counts	% of Total
18–28	Male	16	32.00%
29–39	Male	16	32.00%
40–50	Male	18	36.00%

Table 2: Association between Graft Type, Mechanism of Injury, and Meniscal Involvement

Parameter	Subcategory	Hamstring	Fibularis Longus	Total
Mechanism of Injury	Road Traffic Accident	10	12	22
	Fall	6	2	8
	Sports	10	10	20
Medial Meniscus	Affected	8	10	18
	Unaffected	17	15	32
Lateral Meniscus	Affected	10	13	23
	Unaffected	15	12	27

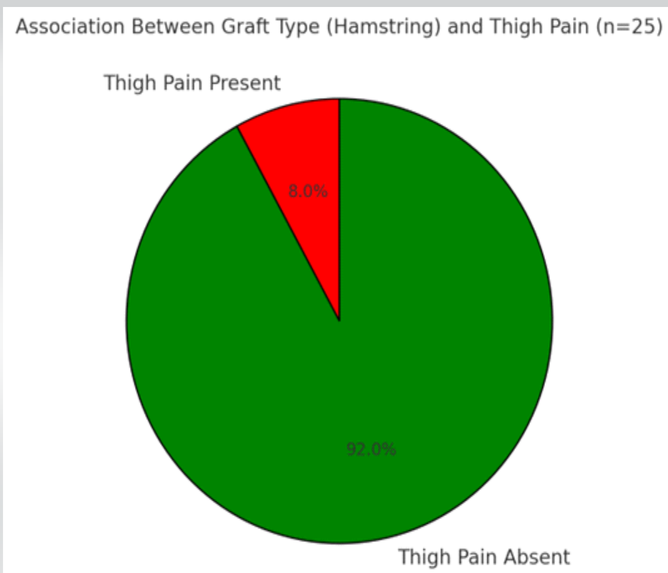

Figure 1: Association in the middle of Graft Type and Thigh Pain

Table 3: Comparison of IKDC Scores Between Graft Types Over Time (n = 50)

Time Point	Parameter	Fibularis Longus	Hamstring	t-value	p-value
Pre-operative	Mean ± SD	61.80 ± 9.32	58.20 ± 9.46	1.482	0.144
	Median (IQR)	63.2 (56.3–69)	57.85 (52.85–65.03)	—	—
	Range (Min–Max)	35.6 – 85.1	33.1 – 83.2	—	—
1 Year Post-op	Mean ± SD	90.90 ± 2.73	89.52 ± 3.00	1.857	0.068
	Median (IQR)	91.5 (88.28–93.1)	89.5 (87.28–92.02)	—	—
	Range (Min–Max)	86.5 – 95	84.6 – 94.9	—	—

Among the various autografts, the hamstring tendon (HT)—typically comprising the semitendinosus and gracilis tendons—has been widely accepted due to ease of harvest, favorable tensile strength, and lower incidence of anterior knee pain compared to bone-patellar tendon-bone (BPTB) grafts [4]. However, complications such as donor site morbidity, reduced hamstring strength, and variable graft diameter remain concerning, especially in young athletic populations [5].

In recent years, the fibularis longus tendon (PLT) has gained attention as a viable alternative. Anatomically located in the lateral compartment of the leg, it offers a graft of adequate diameter and uniform morphology. Several recent studies have reported that PLT autografts demonstrate comparable biomechanical strength and stiffness to HT grafts, with additional benefits such as preservation of hamstring function and reduced incidence of thigh muscle hypotrophy [6, 7].

Despite increasing interest, robust comparative data on functional outcomes between PLT and HT autografts remains scarce. The purpose of the study was to evaluated the functional recovery, knee stability, and donor site morbidity using validated scores such as IKDC, Lysholm, AOFAS, and EFAS. We aimed to inform graft selection and support personalized surgical planning in ACL reconstruction.

Materials and Methods

This prospective, comparative clinical study was conducted in the Department of Orthopaedics, Heritage Institute of Medical Sciences, Varanasi, between August 2023 and March 2025.

Study Setting and Ethical Approval

All procedures were carried out at a dedicated sports medicine unit. Ethical clearance was obtained from the Institutional Ethics Committee, and informed written consent was secured from all participants prior to inclusion.

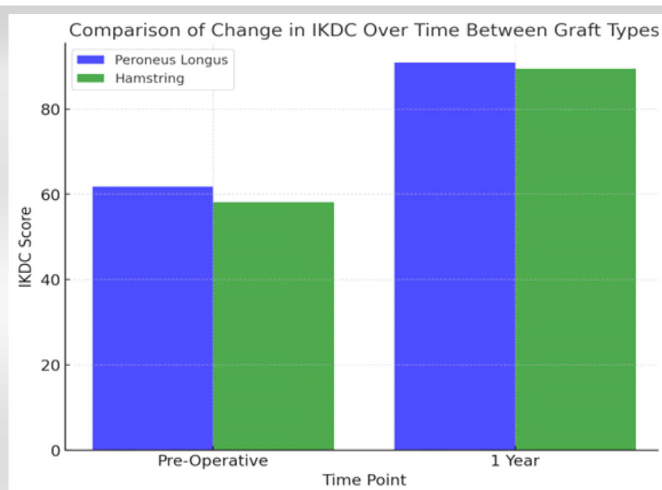

Figure 2: Comparison of the two Groups in Terms of change in IKDC over time

Table 4: Assessment of change in EFAS over time (n = 25)

Timepoint	EFAS			Paired t-experiment	
	Mean (SD)	Median (IQR)	Range	T	P Value
Pre-Operative	40.00 (0.00)	40.00 (0.00)	40.00 - 40.00	8	0.003
1 Year	36.60 (2.31)	37.00 (3.75)	32.00 - 40.00		
Absolute Change	-3.40 (2.31)	-3.00 (3.75)	-8		

Inclusion criteria:
- Age between 18–50 years
- Isolated ACL tear confirmed by clinical examination and MRI
- Normal contralateral knee function
- Willingness to undergo ACL reconstruction with PLT or HT graft
- Pre-injury Tegner activity score ≥5
- Compliance with postoperative rehabilitation and follow-up

Exclusion criteria:
- Multiligamentous injuries
- Moderate/severe osteoarthritis (Kellgren-Lawrence grade >2)
- Prior knee surgery
- Systemic connective tissue disorders
- Lower limb neuropathy or significant ankle instability
- Anticipated loss to follow-up

Sample Size

Based on previous comparative studies and ensuring 80% power with 95% confidence, the final sample included 50 patients—25 in each group.

Surgical Technique

All ACL reconstructions were arthroscopically performed under spinal or general anaesthesia by experienced surgeons using standardized techniques.
- PLT Graft Harvesting: The fibularis longus tendon was harvested through a transverse incision ~2 cm above the lateral malleolus, then detached proximally and prepared using standard protocols. Tenodesis was performed using the fibularis brevis tendon.
- HT Graft Harvesting: The semitendinosus and gracilis tendons were harvested through a medial incision over the pes anserinus and prepared in a quadrupled fashion to achieve a ≥7 mm diameter.

Femoral and tibial tunnels were created using either anteromedial or transtibial approaches. Grafts were fixed using either bioabsorbable screws or suspensory fixation. Pre-tensioning to 20–25 N was performed consistently.

Postoperative Rehabilitation

A structured four-phase rehabilitation protocol was followed:

Table 5: Comparison of Graft Diameter and Length Between Hamstring and Fibularis Longus Autografts

Parameter	Measurement	Hamstring	Fibularis Longus
Graft Diameter	Mean (mm)	8.56 mm	9.55 mm
	Range (mm)	7.0 – 10.0	7.5 – 11.5
Graft Length	Mean (cm)	7.61 cm	7.76 cm
	Range (cm)	6.3 – 9.5	6.5 – 9.0

- Phase 1 (0–6 weeks): Pain control, swelling reduction, early mobilization
- Phase 2 (6–12 weeks): Strengthening, proprioception, and balance
- Phase 3 (12–24 weeks): Advanced neuromuscular training and agility
- Phase 4 (6–12 months): Sport-specific drills and return-to-play assessment

Outcome Measures

Patients were evaluated at baseline, 3, 6, and 12 months using:
- Objective scores: IKDC, Lysholm, and Modified Cincinnati scales
- Patient-reported measures: Visual Analog Scale (VAS), Tegner Activity Scale
- Stability tests: Lachman, Anterior Drawer, and Pivot Shift tests
- Donor site morbidity: AOFAS and FADI (for PLT); thigh circumference changes (for HT)

Statistical Analysis

Data were analyzed using SPSS v26.0. Continuous variables were compared using independent t-tests or Mann-Whitney U tests, and categorical data using chi-square or Fisher's exact tests. Repeated measures ANOVA evaluated functional score progression. Significance was set at $p < 0.05$.

Results

In our study, the demographic profile shows a balanced distribution across age groups, with the highest representation in the 40–50 years group (36%). All participants were male, ensuring age-based comparability across graft groups (Table 1). No significant association was found between graft type and mechanism of injury or meniscal involvement, indicating graft selection was independent of trauma type and meniscal status (Table 2) (Fig. 1).

Preoperative IKDC scores were comparable between groups ($p = 0.144$). Postoperative scores at 1 year improved significantly in both groups, with a non-significant trend favoring fibularis longus ($p = 0.068$), indicating similar functional recovery

CASE 1: Follow up at 1 year post of Fibularis Longus group patient 1

Figure 3: No evidence of foot drop in left foot compared with right foot at follow-up

Figure 4: Plantar flexion and eversion at 1 year post op

Figure 5: No difficulty in squatting at 1 year post op

Figure 6: 1 year post op

Figure 7: Post op follow up at 1 year

(Table 3) (Fig. 2).

EFAS scores showed a significant improvement postoperatively (p = 0.003), reflecting enhanced function and activity levels at one year after ACL reconstruction (Table 4).

Fibularis longus grafts had a larger mean diameter (9.55 mm vs. 8.56 mm) and similar length compared to hamstring grafts, suggesting superior structural adequacy without compromising procedural feasibility (Table 5).

Case I (Fig. 3-7)
Case II (Fig. 8-11)

Discussion

This prospective comparative study evaluated the functional outcomes of arthroscopic ACL reconstruction using fibularis longus versus hamstring autografts at a tertiary orthopaedic center. Functional outcomes were assessed using IKDC and Tegner-Lysholm scores, while donor site morbidity and graft characteristics were analyzed using EFAS and AOFAS scores.

Demographic analysis showed a balanced age distribution across groups, with most patients in the 40–50 age group (36%). Unlike prior studies, Rhatomy et al.[8], Liu et al.[9], our age-specific analysis adds clinical depth by assessing outcomes across age groups, offering insights into healing patterns and graft performance.

No significant association was found between graft type and mechanism of injury (p = 0.349), consistent with studies by Keyhani et al. [6] and Angthong et al.[10], who suggested that graft choice is primarily influenced by anatomical and technical factors. Similarly, no association was observed between graft type and meniscal injury (p-values > 0.5), echoing findings from Wiradiputra et al.[11] and Roe et al.[12], affirming that meniscal involvement does not dictate graft choice.

Donor site morbidity was minimal in both groups. Only 6.7% of hamstring patients reported thigh pain, aligning with Park et al.[13] and Feller et al.[14], who noted low donor site complications with hamstring grafts. Preoperative IKDC scores were comparable between groups (p = 0.144), ensuring baseline parity. At one year, both groups showed significant improvement, with mean IKDC scores of 90.90 (fibularis) vs.

CASE 2: Follow up at 1 yr post of Fibularis Longus group patient 2

Figure 8: No evidence of foot drop in right foot compared with left foot at follow up

Figure 9: No difficulty in squatting at 1 year of follow up

Figure 10: Follow up at 1 year

Figure 11: Follow up at 1 year

89.52 (hamstring), not statistically significant ($p = 0.068$), consistent with Rhatomy et al.[8] and He et al.[15], confirming clinical equivalence.

EFAS scores also improved significantly postoperatively (mean change = -3.40 ± 2.31; $p < 0.001$), indicating enhanced functional recovery. While EFAS is less commonly used in literature, its application here adds a unique, multidimensional assessment of recovery. Comparable improvement was noted in studies using AOFAS and FADI by Keyhani et al.[6] and Khalil et al. [16].

Importantly, the fibularis longus graft had a significantly larger diameter (mean 9.55 mm) than the hamstring graft (mean 8.56 mm), consistent with Keyhani et al.[6] and Liu et al.[9], suggesting a biomechanical advantage that may reduce re-rupture risk. However, graft lengths were similar (p = NS), reaffirming suitability for tunnel placement and fixation. This supports findings by Rhatomy et al.[8] and Kerimoglu et al.[17] on the procedural adequacy of fibularis longus grafts.

Conclusion

We concluded that both fibularis longus and hamstring tendon autografts are effective options for anterior cruciate ligament reconstruction. The fibularis longus tendon demonstrated slightly better outcomes in terms of graft diameter and postoperative comfort, without compromising knee function. No significant differences were observed in functional scores or complication rates. These results suggest that fibularis longus can be considered a safe and reliable alternative, especially in cases where hamstring grafts are unsuitable or insufficient in size.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflict of Interest: NIL; **Source of Support:** NIL

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