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A Comparative Study of Functional Outcomes Following Arthroscopic Anterior Cruciate Ligament Reconstruction Using Hamstring Tendon versus Peroneus Longus Tendon Autograft

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Learning Point of the Article:

The peroneus longus tendon is a better alternative for sacrificing a single tendon and also better in graft properties, providing the same functional outcome in comparison to a hamstring tendon graft.

Abstract

Introduction: Anterior cruciate ligament (ACL) injury is one of the most common ligamentous injuries of the knee, leading to instability, functional limitation, and early degenerative changes if untreated. Arthroscopic ACL reconstruction is the current gold standard. While hamstring tendon autograft is widely accepted, the peroneus longus tendon autograft has recently emerged as a promising alternative.

Aim & Objective: To compare the functional outcomes, graft characteristics, and donor site morbidity of arthroscopic ACL reconstruction using hamstring tendon autograft and peroneus longus tendon autograft.

Materials and Methods: A prospective randomized controlled study was conducted on 40 patients with confirmed ACL injuries. Patients were divided into two groups: Group A (Hamstring tendon autograft, n = 20) and Group B (Peroneus longus tendon autograft, n = 20). Functional outcomes were assessed using the international knee documentation committee (IKDC) score and Tegner Lysholm score. Donor site morbidity was evaluated using the foot and ankle disability index (FADI). Assessments were performed preoperatively and at post-operative day 10, 6 weeks, and 6 months.

Results: Both groups demonstrated significant improvement in functional scores at 6 months. There was no statistically significant difference between the two groups in IKDC and Lysholm scores at final follow-up ($P > 0.05$). Donor site morbidity in the peroneus longus group was minimal, with FADI scores returning to baseline by 6 months.

Conclusion: Peroneus longus tendon autograft provides functional outcomes comparable to hamstring tendon autograft with minimal donor site morbidity and can be considered a reliable alternative graft for arthroscopic ACL reconstruction.

Keywords: Anterior cruciate ligament reconstruction, hamstring tendon, peroneus longus tendon, autograft, arthroscopy.

Introduction

The knee joint is one of the most frequently injured joints in the human body, with the anterior cruciate ligament (ACL) being the most commonly injured ligament requiring surgical intervention [1]. The ACL plays a key role in maintaining knee stability by preventing anterior tibial translation and controlling rotational and valgus stresses [1,2,3].

ACL injuries are commonly associated with sports activities,

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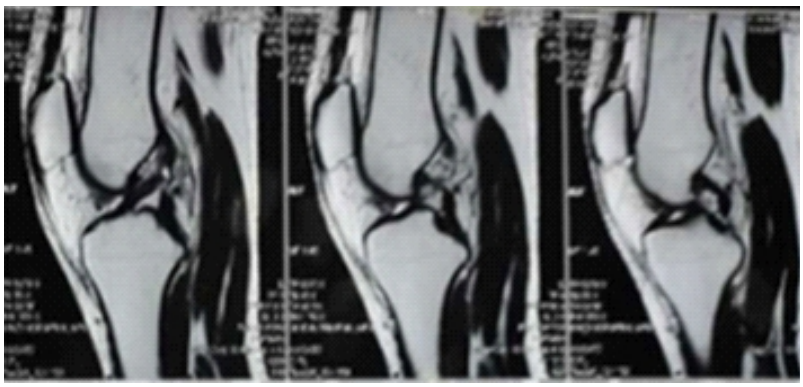


Figure 1: Case 1: Right knee ACL tear. Magnetic resonance imaging showing an ACL tear. ACL: Anterior cruciate ligament.

road traffic accidents, and non-contact twisting mechanisms. Untreated ACL deficiency results in recurrent instability, secondary meniscal injury, chondral damage, and early-onset osteoarthritis [4,5]. Arthroscopic ACL reconstruction has evolved as the gold standard treatment, offering anatomical restoration, minimal invasiveness, faster rehabilitation, and improved functional outcomes [6,7].

Various graft options have been described for ACL reconstruction, including bone–patellar tendon–bone, hamstring tendon, quadriceps tendon, and allografts [7]. Although bone–patellar tendon–bone graft was once considered the gold standard, complications such as anterior knee pain, patellar fracture, and extensor mechanism dysfunction have limited its use [8].

Hamstring tendon autografts have gained popularity due to reduced donor site morbidity and satisfactory functional outcomes [9]. Recently, the peroneus longus tendon has been explored as an alternative autograft owing to its adequate length, comparable tensile strength, and minimal functional deficit at the donor site [10,11,12]. Biomechanical studies have shown no significant difference in tensile strength between hamstring and peroneus longus tendons [13].

This study aims to compare the functional outcomes and donor site morbidity of hamstring tendon and peroneus longus tendon autografts used in arthroscopic ACL reconstruction.

Materials and Methods

Study design and setting

This prospective randomized controlled study was conducted in the Department of Orthopaedics, SVMCH and RC, Puducherry, from February 2021 to August 2022, after obtaining Institutional Ethical Committee approval (No:15/SVMCH/IEC-Cert/Feb21).

Sample size

A total of 40 patients were included and randomly allocated into:

- Group A: Hamstring tendon autograft (n = 20)
- Group B: Peroneus longus tendon autograft (n = 20).

Inclusion criteria

- Age between 18 and 55 years
- Clinically and radiologically confirmed ACL tear
- Symptomatic knee instability
- Partial or complete ACL tears involving >30% fibers.

Exclusion criteria

- Bilateral ACL tears
- Revision ACL reconstruction
- Associated fractures around the knee.

Surgical technique

All patients underwent arthroscopic single-bundle ACL reconstruction under spinal anesthesia using standard portals. Femoral fixation was done using an endobutton and tibial fixation using an interference screw. A standardized rehabilitation protocol was followed for both groups.

Outcome measures

- Functional outcome: International Knee Documentation Committee (IKDC) score and Tegner Lysholm score

Table 1: Comparison of mode of injury between study group (*n*=40)

Mode of injury	Study group		Chi-square	*P*-value
	Hamstring tendon autograft (*n*=20) (%)	Peroneus longus tendon autograft (*n*=20) (%)		
Road traffic accidents	5 (25)	7 (35)	0.583	0.747
Slip and fall	9 (45)	7 (35)		
Sports	6 (30)	6 (30)		

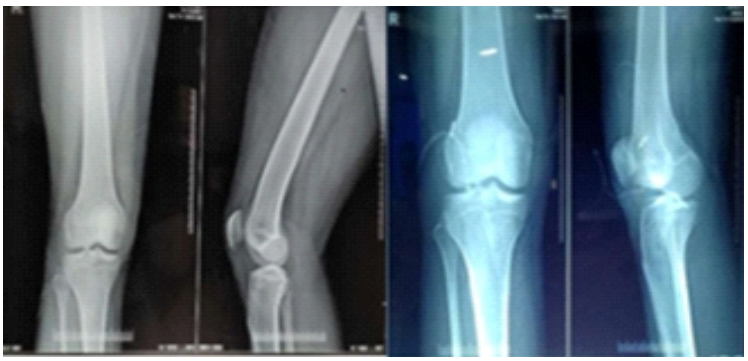


Figure 2: Case 1: Right knee ACL tear. Magnetic resonance imaging showing an ACL tear. ACL: Anterior cruciate ligament.

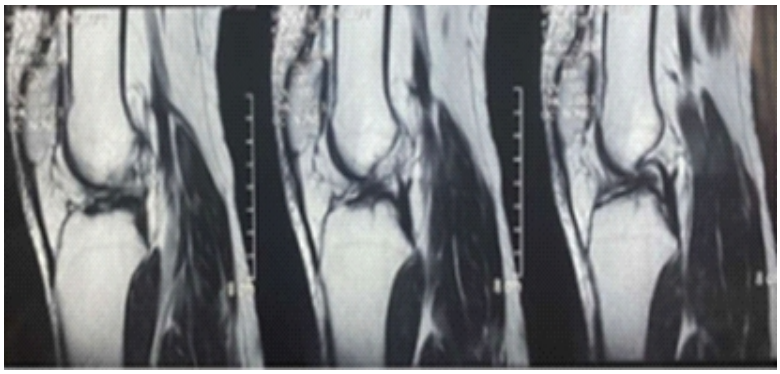


Figure 3: Case 2: Left knee ACL tear. Magnetic resonance imaging left knee with an ACL tear. ACL: Anterior cruciate ligament.

- Donor site morbidity: Foot and ankle disability index (FADI).

Statistical analysis

Data were analyzed using IBM Statistical Package for the Social Sciences version 22. Independent-samples t-test and Chi-square test were used. A $P < 0.05$ was considered statistically significant.

Results

A total of 40 patients who underwent arthroscopic ACL reconstruction were included in the study, with 20 patients in each group. Group A underwent reconstruction using hamstring tendon autograft, while Group B underwent reconstruction using peroneus longus tendon autograft.

Demographic profile

The mean age of patients in the hamstring tendon group was 31.65 ± 9.4 years, whereas in the peroneus longus tendon group it was 29.3 ± 6.62 years. The difference in mean age between the two groups was not statistically significant ($P = 0.366$), indicating comparable age distribution.

Gender distribution was also similar between groups. In the hamstring group, 55% were males and 45% were females, while in the peroneus longus group, 70% were males and 30% were females. The difference was not statistically significant ($P > 0.05$), suggesting homogeneity between the study groups.

Mode of injury

Slip and fall was the most common mode of injury in both groups, followed by sports-related injuries and road traffic accidents. No statistically significant difference was observed between the groups regarding the mode of injury ($P = 0.747$) (Table 1).

The mean pre-operative IKDC score was low in both groups, indicating poor knee function prior to surgery.

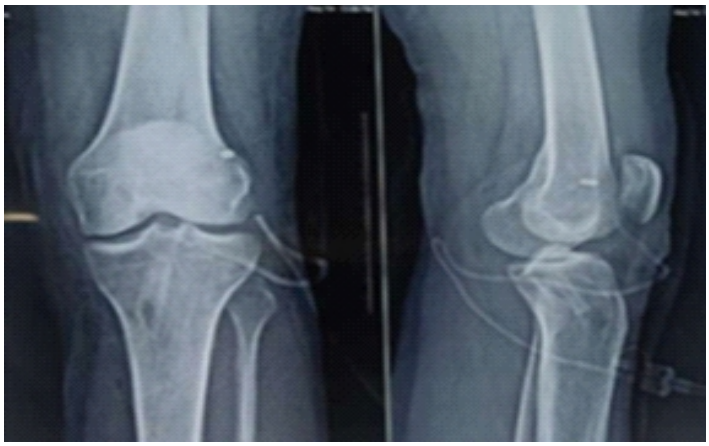


Figure 4: Case 2: Left knee anterior cruciate ligament tear. Post-operative X-ray.

Progressive improvement in IKDC scores was noted in both groups at post-operative day 10, 6 weeks, and 6 months.

At 6 months follow-up, the mean IKDC score in the hamstring tendon group was 0.80 ± 0.05, while in the peroneus longus tendon group it was 0.82 ± 0.05. The difference between the two groups at final follow-up was not statistically significant ($P > 0.05$), indicating comparable functional outcomes (Table 2).

A statistically significant difference in IKDC scores was observed at the 6-week follow-up, with slightly better scores in the peroneus longus group ($P < 0.05$). However, this difference was not sustained at the final follow-up.

Functional outcome – Tegner Lysholm score

Both groups showed significant improvement in Tegner Lysholm scores postoperatively. Early post-operative scores showed marginal differences between the groups; however, by 6 months, both groups achieved comparable scores, with no statistically significant

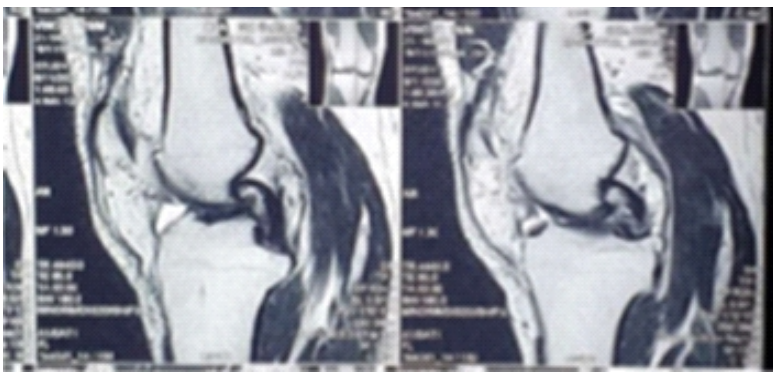


Figure 5: Case 3: Right knee anterior cruciate ligament tear. Magnetic resonance imaging right knee.



Figure 6: Case 3: Right knee anterior cruciate ligament tear. Post-operative X-ray.

difference (P > 0.05).

Donor site morbidity – FADI score

Donor site morbidity was assessed using the FADI in the peroneus longus tendon group. The mean FADI score was 1.0 ± 0.0 preoperatively, decreased to 0.57 ± 0.12 at post-operative day 10, improved to 0.95 ± 0.05 at 6 weeks, and returned to baseline (1.0 ± 0.0) by 6 months (Table 3).

This indicates that harvesting the peroneus longus tendon resulted in only temporary functional impairment of the ankle, with complete recovery by 6 months. No cases of infection or long-term donor site complications were noted in either group.

Case illustrations are shown in (Fig. 1-8).



Figure 8: Case 4: Left knee anterior cruciate ligament tear. Post-operative X-ray.

Discussion

ACL reconstruction aims to restore knee stability, prevent secondary intra-articular damage, and enable patients to return to pre-injury activity levels. The choice of graft plays a critical role in determining post-operative outcomes and donor site morbidity.

In the present study, both hamstring tendon and peroneus longus tendon autografts demonstrated significant improvement in knee function following arthroscopic ACL reconstruction. At final follow-up, there was no statistically significant difference between the two groups in terms of IKDC and Tegner Lysholm scores, indicating that peroneus longus tendon autograft provides functional outcomes comparable to the traditionally used hamstring tendon autograft.

These findings are consistent with previous studies that reported satisfactory clinical outcomes with hamstring tendon autografts due to their adequate strength, ease of harvest, and reduced anterior knee pain when compared to bone–patellar tendon–bone grafts [9].

The increasing interest in peroneus longus tendon as an autograft is supported by biomechanical and clinical studies.

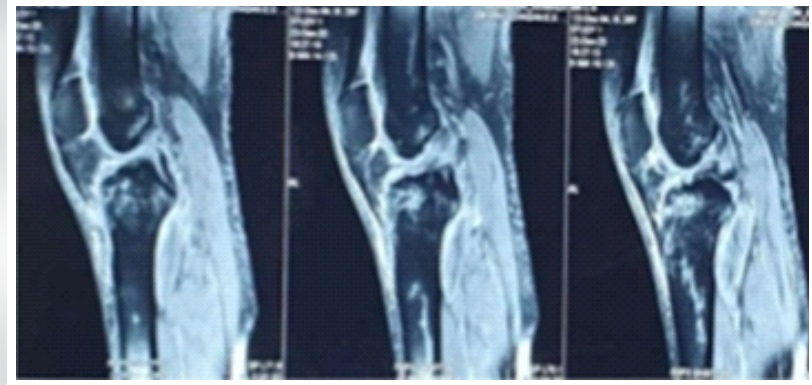


Figure 7: Case 4: Left knee anterior cruciate ligament tear. Magnetic resonance imaging left knee.

Table 2: Comparison of mean of international knee documentation committee score at different follow-up time between study group (*n*=40)

Parameter	Study group (Mean±standard deviation)		*P*-value
	Hamstring tendon autograft (*n*=20)	Peroneus longus tendon autograft (*n*=20)	
Pre-operative	0.24±0.07	0.33±0.19	0.055
POD 10	0.23±0.03	0.2±0.06	0.086
6 weeks	0.53±0.09	0.6±0.09	0.013
6 months	0.8±0.05	0.82±0.05	0.221

POD: Post-operative day

Table 3: Descriptive analysis of FADI score in pre-operative, 10 days, 6 weeks, and 6 months in peroneus longus group	
FADI score parameter	**Mean±standard deviation**
Pre-operative	1±0
10 days	0.57±0.12
6 weeks	0.95±0.05
6 months	1±0
FADI: Foot and ankle disability index	

Rudy et al. demonstrated that the tensile strength of the peroneus longus tendon is comparable to that of the hamstring tendon, making it a suitable graft choice for ACL reconstruction [13]. Similarly, Rhatomy et al. reported no significant difference in functional outcomes between peroneus longus and hamstring tendon grafts [11].

In the present study, early post-operative IKDC scores at 6 weeks were marginally better in the peroneus longus group. This may be attributed to preservation of hamstring muscle strength, which plays a crucial role in knee flexion and dynamic stabilization of the knee joint. Harvesting hamstring tendons has been associated with transient hamstring weakness, which can delay early rehabilitation [13,14].

Donor site morbidity is a major concern when introducing alternative graft options. In our study, donor site morbidity following peroneus longus tendon harvest was minimal and temporary, as evidenced by FADI scores returning to baseline by 6 months. This observation supports the findings of Angthong et al. and Xu et al., who reported preserved ankle function due to the compensatory action of the peroneus brevis muscle, which is the primary evertor of the ankle [12,15].

No long-term ankle instability, gait abnormalities, or functional limitations were observed in patients who underwent peroneus longus tendon harvest. This supports the anatomical and functional rationale that the peroneus brevis adequately compensates for the loss of the peroneus longus tendon.

The absence of significant differences in final functional outcomes between the two grafts suggests that peroneus longus tendon autograft can be considered a reliable alternative, particularly in cases where hamstring tendons are inadequate, previously harvested, or need to be preserved.

Conclusion

Peroneus longus tendon autograft is a safe, effective, and reliable alternative to hamstring tendon autograft for arthroscopic ACL reconstruction. It provides comparable functional outcomes with minimal donor site morbidity and can be considered especially in cases where hamstring tendons are inadequate or previously harvested.

Clinical Message

For patients requiring ACL reconstruction, the peroneus longus tendon represents a better alternative to the hamstring graft in terms of graft properties, harvesting time, donor site morbidities, and using a single tendon instead of two hamstring tendons.

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

Conflict of interest: Nil **Source of support:** None

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