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Functional Outcomes Following Arthroscopic Anterior Cruciate Ligament Reconstruction using Semitendinosus Versus Peroneus Longus Tendon Autografts: A Prospective Comparative Study

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ABSTRACT

Background: Anterior cruciate ligament (ACL) rupture can lead to knee instability and functional limitation. Semitendinosus tendon autografts are widely used for ACL reconstruction, while the peroneus longus tendon is an alternative graft source. Aim: To compare the postoperative functional outcomes and knee stability following arthroscopic ACL reconstruction using semitendinosus tendon and peroneus longus tendon autografts. **Methods**: This prospective comparative study included 60 patients who underwent arthroscopic ACL reconstruction. The study was initiated after obtaining approval from the Institutional Ethics Committee (IEC), and written informed consent was obtained from all participants before enrolment. The patients were divided into two groups based on the graft used: Group A (n=30) received semitendinosus tendon autografts, while Group B (n=30) received peroneus longus tendon autografts. Postoperative functional outcomes and knee stability were assessed using Lysholm knee scores, International Knee Documentation Committee grading and Lachman test findings. The outcomes were compared between the two groups using the Pearson chi-square test. **Results**: A total of 60 patients were included in the study, with 30 patients in each group. In the Lysholm knee scoring assessment, excellent outcomes were observed in 20 (66.7%) patients in Group A (semitendinosus) and 23 (76.7%) patients in Group B (peroneus longus). Regarding IKDC grading, Grade A outcomes were recorded in 18 (60%) patients in Group A and 21 (70%) patients in Group B. Postoperative Lachman testing showed negative findings in 20 (66.7%) patients in Group A and 22 (73.3%) patients in Group B. This difference was also not statistically significant ($\chi^2 = 0.317$, $p = 0.573$). **Conclusion**: The peroneus longus group showed numerically higher proportions of excellent Lysholm scores, IKDC Grade A outcomes and negative Lachman test findings.

Keywords: ACL Reconstruction, Semitendinosus tendon autograft, Peroneus longus tendon autograft, Lysholm knee score, International Knee Documentation Committee (IKDC), Knee stability, Lachman test.

INTRODUCTION

The anterior cruciate ligament (ACL) plays an important role in maintaining anterior and rotational stability of the knee by restricting excessive anterior translation of the tibia relative to the femur.[1] ACL injuries commonly occur during pivoting movements, sudden changes in direction, awkward landings or direct trauma. Patients may present with pain, swelling, knee instability and difficulty returning to routine activities or sports.[2]

In patients with persistent symptomatic instability or high functional demands, surgical reconstruction may be considered to restore knee stability and facilitate functional recovery. Various autografts are used for ACL reconstruction, including

hamstring tendons, bone–patellar tendon–bone grafts and peroneus longus tendon grafts. The selection of an appropriate graft depends on graft characteristics, functional requirements and potential donor-site morbidity.[3]

The semitendinosus tendon is one of the commonly used autografts for ACL reconstruction. However, its harvesting may potentially affect hamstring strength and knee-flexion function.[4] The peroneus longus tendon has emerged as an alternative graft source because of its adequate length and diameter. Nevertheless, its harvesting may have potential implications for ankle function and eversion strength, which should be considered during graft selection.[5]

Both semitendinosus and peroneus longus tendon autografts have demonstrated clinical utility in ACL reconstruction. However, comparative evaluation of their postoperative functional outcomes and knee stability remains important.[6] Assessment of these outcomes can help understand the relative performance of the two graft options while also considering their potential donor-site complications.

Postoperative assessment following ACL reconstruction involves evaluating both knee function and ligament stability. The Lysholm Knee Scoring Scale is widely used to assess knee function based on eight parameters, including limp, support, locking, instability, pain, swelling, stair climbing and squatting. The total score ranges from 0 to 100, with higher scores indicating better knee function.[7,8] The International Knee Documentation Committee (IKDC) grading system is used to evaluate knee function and clinical status, with grades ranging from A (normal) to D (severely abnormal). Additionally, the Lachman test is a clinical examination used to assess anterior tibial translation and ACL stability. These assessment tools provide complementary information regarding functional recovery and postoperative knee stability.[9,10]

Therefore, the present study aims to compare the postoperative functional outcomes and knee stability following arthroscopic anterior cruciate ligament reconstruction using semitendinosus and peroneus longus tendon autografts. The findings may contribute to evidence-based graft selection and help guide clinical decision-making in patients undergoing ACL reconstruction.

MATERIALS & METHODS

Study Design and Setting

This prospective, comparative study was conducted over a period of two years at a tertiary-care hospital. The study was initiated after obtaining approval from the IEC. Written informed consent was obtained from all participants before enrolment**.**

Sample Size and Group Allocation

A total of 60 patients with MRI-confirmed ACL tears who underwent arthroscopic ACL reconstruction were included. Patients were allocated into two groups based on clinical and surgical preference:

Group A (ST group, n=30): Arthroscopic ACL reconstruction using an autologous semitendinosus tendon graft.

Group B (PLT group, n=30): Arthroscopic ACL reconstruction using an autologous peroneus longus tendon graft. Allocation was not randomized.

Follow-up and Outcome Assessment

Patients were followed up postoperatively, with the final outcome assessment performed at 6th month following surgery. Functional outcomes were evaluated using the Lysholm Knee Scoring Scale and IKDC grading system. Knee stability was assessed using the Lachman test. Pain, knee mobility, activities of daily living and postoperative complications were also recorded.[11-13]

Inclusion Criteria

1. Patients aged between 18 to 50 years with isolated ACL tears.
2. Patients willing to provide written informed consent.
3. Patients medically fit to undergo surgery under spinal anaesthesia.
4. Patients with MRI-confirmed ACL tears.

Exclusion Criteria

1. Patients with ACL tears associated with multi-ligamentous injuries .
2. Patients with intra-articular fractures.
3. Patients with collagen disorders.
4. Patients with infected knee joints.
5. Patients medically unfit to undergo surgery.

Surgical Procedure
All patients underwent arthroscopic ACL reconstruction under spinal anaesthesia using a pneumatic tourniquet. The surgical approach was similar in both groups, with the principal difference being the type of tendon autograft used. A standardised postoperative rehabilitation protocol was followed for both groups.

Preoperative Preparation
All patients underwent clinical and radiological evaluation to confirm ACL rupture and assess associated meniscal, chondral and other ligamentous injuries. Preoperative clinical assessment included knee range of motion, Lachman test, anterior drawer test and pivot-shift test. MRI was performed to confirm the ACL tear and evaluate associated intra-articular abnormalities. Written informed consent was obtained after explaining the surgical procedure, graft options, potential complications and donor-site morbidity.

Arthroscopic Evaluation
Standard arthroscopic portals were established, followed by diagnostic arthroscopy to assess the patellofemoral joint, menisci, articular cartilage and intercondylar notch. The ACL tear was identified, and the torn ligament remnants were debrided sufficiently to allow adequate visualisation and preparation of the femoral and tibial footprints. Remnant tissue was preserved wherever appropriate.[14]

Graft Harvesting Procedure
The graft harvesting procedure differed between the two groups, although both tendons were prepared as tripled grafts.

Group A – ST Tendon Harvesting
A small oblique skin incision of approximately 4 cm was made over the pes anserinus region on the anteromedial aspect of the proximal tibia, approximately 4 cm distal to the medial joint line and 3 cm medial to the tibial tuberosity. The sartorial fascia was exposed and incised to identify the semitendinosus tendon. The tendon was carefully mobilised, and its attachments and accessory bands were released. The tendon was then harvested using a tendon stripper, taking care to avoid premature tendon transection. The harvested tendon was cleaned of muscle tissue and residual attachments, and its length was measured. It was then folded to form a tripled graft, and the free ends were secured with sutures. The final graft length and diameter were measured to determine the appropriate tunnel size.[15]

Group B – PLT Tendon Harvesting
A small skin incision was made over the distal lateral aspect of the leg, approximately 3 cm proximal to the lateral malleolus. The peroneus longus tendon was identified and carefully exposed. The tendon was mobilised, and its proximal end was released and harvested using a tendon stripper, while preserving its distal attachment. Care was taken to protect the peroneus brevis tendon and surrounding neurovascular structures. The harvested tendon was cleaned of muscle tissue and residual attachments, and its length was measured. It was then folded to form a tripled graft, and the free ends were secured with sutures. The final graft length and diameter were measured to determine the appropriate tunnel size.[16]

Femoral and Tibial Tunnel Preparation
Following arthroscopic identification of the anatomical femoral and tibial ACL footprints, the tunnels were prepared as follows:

1. The femoral tunnel was created using a femoral guide, with its position corresponding to the anatomical ACL footprint on the medial aspect of the lateral femoral condyle.
2. The tibial tunnel was prepared using a tibial guide, ensuring appropriate alignment with the native tibial ACL footprint.
3. The diameter of both tunnels was determined according to the measured diameter of the prepared tripled graft.
4. Both tunnels were inspected arthroscopically, and residual bone debris was removed to facilitate smooth graft passage.[17]

Graft Passage and Fixation
The prepared tripled graft was passed through the tibial tunnel into the femoral tunnel using passing sutures. Femoral fixation was achieved using a cortical suspensory fixation device (Endobutton), while tibial fixation was performed using an interference screw with the knee maintained at 30° of flexion. The same fixation technique was used in both the ST and PLT groups. Following fixation, the knee was taken through a range of motion to assess graft tension, impingement and restriction of movement. Arthroscopic inspection and clinical stability testing were performed to confirm appropriate graft placement and fixation.

Wound Closure
Following graft fixation, the joint was thoroughly irrigated with normal saline, and haemostasis was secured. The graft-harvesting incision and arthroscopic portal incisions were closed in layers using appropriate sutures. Sterile dressings were applied to all surgical wounds.[18]

Postoperative Rehabilitation
All patients in both groups underwent postoperative rehabilitation according to the MOON (Multicenter Orthopaedic Outcomes Network) Knee Rehabilitation Guidelines. The rehabilitation programme included progressive knee range-of-motion exercises, quadriceps and hamstring strengthening, gait training, and gradual functional rehabilitation. The progression of exercises was based on postoperative recovery and clinical assessment.[19,20]

Postoperative Protocol and Assessment
Functional outcomes were assessed using the Lysholm Knee Score and the IKDC system.

Statistical Analysis
The collected data were entered into Microsoft Excel and analysed using Statistical Package for the Social Sciences (SPSS), version 22.0. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation (SD). For comparisons between the semitendinosus and peroneus longus tendon groups, the independent-samples t-test was used for continuous variables, while the chi-square test was used for categorical variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1. Comparison of Demographic Characteristics Between the ST and PLT Groups

Parameter	Category	Group A ST (n=30)	Group B PLT (n=30)
Age group	≤30 years	14 (46.7%)	14 (46.7%)
	31–40 years	8 (26.7%)	10 (33.3%)
	>40 years	8 (26.7%)	6 (20.0%)
Sex	Male	22 (73.3%)	21 (70.0%)
	Female	8 (26.7%)	9 (30.0%)
Side of injury	Left	12 (40.0%)	13 (43.3%)
	Right	18 (60.0%)	17 (56.7%)

Demographic Characteristics
The study included 60 participants, with 30 patients each in the semitendinosus (ST) and peroneus longus tendon (PLT) groups. In Group A (ST), 22 participants (73.3%) were male and 8 (26.7%) were female. In Group B (PLT), 21 participants (70.0%) were male and 9 (30.0%) were female.

Regarding the side of injury, right-knee involvement was observed in 18 patients (60.0%) in Group A and 17 patients (56.7%) in Group B. Left-knee involvement was reported in 12 patients (40.0%) and 13 patients (43.3%), respectively.(Table 1)

Table 2. Postoperative Functional Outcome Comparison Between the ST and PLT Groups at 6 Months

Outcome measure	Category	Group A ST n = 30	Group B PLT n = 30
Lysholm score	Excellent	20 (66.7%)	23 (76.7%)
	Good	10 (33.3%)	7 (23.3%)
IKDC grading	Grade A	18 (60.0%)	21 (70.0%)
	Grade B	12 (40.0%)	9 (30.0%)
Lachman test	Negative	20 (66.7%)	22 (73.3%)
	Grade 1+ laxity	10 (33.3%)	8 (26.7%)

Comparison of Postoperative Functional Outcomes (Table 2)
Lysholm Knee Scoring Scale: Excellent outcomes were observed in 20 participants (66.7%) in Group A and 23 participants (76.7%) in Group B. Good outcomes were recorded in 10 participants (33.3%) and 7 participants (23.3%), respectively. chi-square test showed no statistically significant difference between the groups ($\chi^2 = 0.739$, $p = 0.390$).

IKDC Grading: Grade A was recorded in 18 participants (60.0%) in Group A and 21 participants (70.0%) in Group B, while Grade B was observed in 12 participants (40.0%) and 9 participants (30.0%), respectively. The difference was not statistically significant ($\chi^2 = 0.659$, $p = 0.417$).

Lachman Test: A positive Grade 1+ result was observed in 10 participants (33.3%) in Group A and 8 participants (26.7%) in Group B. A negative Lachman test was recorded in 20 participants (66.7%) and 22 participants (73.3%), respectively. There was no statistically significant difference between the groups ($\chi^2 = 0.317$, $p = 0.573$).

Complications reported in group A Semitendinosus graft included anterior knee pain in 8/30 (26.7%), quadriceps hypotrophy in 6/30 (20.0%), graft-site infection in 2/30 (6.7%) and paraesthesia in 2/30 (6.7%). One participant was also described as having restricted knee flexion. In group B Peroneal longus graft, quadriceps hypotrophy and anterior knee pain were each reported in 4/30 (13.3%), graft-site infection in 2/30 (6.7%), and no paraesthesia.

DISCUSSION

ACL rupture is an important cause of knee instability, particularly among physically active individuals. The present prospective comparative study evaluated the postoperative functional outcomes of arthroscopic ACL reconstruction using ST and PLT autografts in 60 participants, with 30 patients in each group.

Demographic characteristics

The mean age was 26.4 years in Group A (ST) and 26.3 years in Group B (PLT), with an overall mean age of 26.38 years. The age distribution indicated that younger individuals constituted a substantial proportion of the study population. Nair NMS et al. (2024), in a prospective study involving 120 patients undergoing ACL reconstruction using PLT autografts, reported that the majority of participants (36%) were aged 20–25 years. Their study reported a mean age of 27.1 ± 6.85 years, with male participants accounting for 88% of the study population. These findings demonstrate a similar age distribution to that observed in the present study.[21]

Regarding the mechanism of injury, Ambulgekar RK et al. (2023) identified road traffic accidents as the most common cause of ACL injuries in their study population.[22] Similarly, Nair NMS et al. (2024) reported that 55% of ACL injuries were attributable to road traffic accidents. These findings highlight the contribution of traumatic injuries to ACL tears.

Functional outcomes – Lysholm Knee Scoring Scale

Although the PLT group demonstrated a numerically higher proportion of excellent outcomes, the difference was not statistically significant ($\chi^2 = 0.739$, $p = 0.390$). Shair NA et al. (2023) and Nair NMS et al. (2024) also reported significant postoperative improvements in Lysholm and IKDC scores following ACL reconstruction using PLT autografts. Their findings support the potential of PLT as an alternative graft for ACL reconstruction. [23]

Functional outcomes – IKDC grading

In the present study, IKDC Grade A (normal knee) was observed in 60.0% of participants in the ST group and 70.0% in the PLT group, while Grade B (nearly normal knee) was observed in 40.0% and 30.0%, respectively. The slightly higher proportion of Grade A outcomes in the PLT group may be related to the favourable graft characteristics and reduced morbidity around the knee associated with harvesting the peroneus longus tendon. A systematic review and meta-analysis by Kumar et al. (2025), involving 949 patients, reported comparable functional outcomes and knee stability between PLT and hamstring tendon autografts.[24] Similarly, Ambulgekar et al. (2023) reported no significant difference in IKDC grading between the two graft groups. These findings are consistent with the results of the present study

Postoperative knee stability – Lachman test

Postoperative Lachman testing revealed negative findings in 66.7% of participants in the ST group and 73.3% in the PLT group. Grade 1+ laxity was observed in 33.3% and 26.7%, respectively. Although the PLT group demonstrated a slightly higher proportion of negative Lachman findings, the difference was not statistically significant ($\chi^2 = 0.317$, $p = 0.573$).

The Lachman test is an important clinical assessment of anterior tibial translation and is commonly used to evaluate postoperative knee stability following ACL reconstruction. A negative test suggests the absence of clinically detectable anterior laxity, whereas Grade 1+ indicates mild residual laxity.

The similarity in outcomes may be partly explained by the use of a standardised surgical technique in both groups, including tripled graft preparation, similar femoral and tibial fixation methods, and the same postoperative rehabilitation protocol. These factors may have contributed to comparable graft tension, fixation and functional recovery. Kumar et al. (2025) also reported no significant difference in objective knee stability, including Lachman test findings, between PLT and hamstring tendon autografts. Ambulgekar et al. (2023) reported similar postoperative Lachman findings, with 1+ laxity observed in both groups.

Limitations of the study

- Small sample size of 60 participants
- The non-randomised allocation of participants

CONCLUSION:

Both semitendinosus and peroneus longus tendon autografts demonstrated favourable functional outcomes and satisfactory knee stability following arthroscopic ACL reconstruction. The PLT group showed numerically better outcomes in terms of excellent Lysholm scores, IKDC Grade A grading and negative Lachman test findings. Although these differences were not statistically significant ($p > 0.05$), the results highlight the potential of both grafts as effective options for ACL reconstruction. The comparable outcomes observed suggest that the PLT may serve as a promising alternative to the conventional ST autograft. Further studies with larger sample sizes, comprehensive donor-site evaluation and longer follow-up are recommended to establish the long-term functional benefits of both grafts.

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