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Long-Term Clinical Outcomes Following Anterior Cruciate Ligament Reconstruction Using Peroneus Longus Allograft: A 10-Year Case Series

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ABSTRACT

Objective: The aim of this study was to assess the long-term stability, functional outcomes, and patient satisfaction following anterior cruciate ligament (ACL) reconstruction using peroneus longus tendon allograft over a 10-year period.

Materials and Methods: This retrospective case series included 20 patients who underwent arthroscopic ACL reconstruction with a peroneus longus tendon allograft between August 2012 and September 2014. Clinical and functional outcomes were evaluated using Lysholm and Modified Cincinnati scores, Lachman and Pivot-Shift tests, KT-1000 arthrometer, and Cybex II isokinetic dynamometry. In addition, complication rates, graft failure, and long-term knee function were assessed.

Results: The mean follow-up duration was 10.3±1.5 years. The Lysholm score at the final follow-up was 98.65±3.32, with 95% of patients classified as having an excellent outcome. The Modified Cincinnati score was 29.45±1.14. Knee stability assessments showed that 60% of patients had a negative Lachman test, while 35% had a Grade 1 positive result and 5% had a Grade 2 positive result. The Pivot-Shift test was negative in 75% of patients, while 25% had a Grade 1 positive result. KT-1000 arthrometer measurements demonstrated slight differences in anterior tibial translation between the operated and contralateral knee. Muscle strength loss between the operated and non-operated limbs remained clinically insignificant. One patient (5%) experienced mild flexion restriction (<10° loss), and transient knee hypoesthesia was observed in 9 patients (45%) but resolved without intervention. No graft failure, re-rupture, immune response, or infections occurred during the 10-year follow-up.

Conclusion: Peroneus longus tendon allograft demonstrated excellent long-term clinical and functional outcomes with a low complication rate. It appears to be a viable alternative to autografts, especially for patients seeking to avoid donor site morbidity. Larger comparative studies are required to confirm these findings and assess long-term graft durability.

Keywords: Allografts, Anterior cruciate ligament, Anterior cruciate ligament ınjuries, Graft survival, Knee joint, Treatment outcome

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INTRODUCTION

Anterior cruciate ligament (ACL) reconstruction is one of the most commonly performed procedures in orthopedic surgery, and its long-term success is influenced by multiple factors. Among these, graft selection stands out as a critical determinant of surgical success. The biomechanical properties of the graft directly impact the healing process, post-operative complication risk, and long-term knee stability. Therefore, optimal graft selection is recognized as one of the key components of surgical success.[1-3]

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Hamstring tendon autografts are widely preferred due to their strong biomechanical properties, low donor site morbidity, and broad availability.[4] However, peroneus longus tendon allografts offer advantages including shorter surgical time, absence of donor site morbidity, and reduced post-operative pain.[5-8] Despite these benefits, concerns remain regarding the potential for immunological response and the long-term stability of allografts, with limited data available on their durability and clinical efficacy.[6,7,9,10]

This study aims to the long-term functional and clinical outcomes of ACL reconstruction using peroneus longus tendon allografts over a minimum 10-year follow-up period. We hypothesized that peroneus longus allografts would provide sustained knee stability, functional improvement, and high patient satisfaction over the long term.

MATERIALS AND METHODS

Study Design

This retrospective case series was approved by the institutional ethics committee (Approval no: 731 Date: December 27, 2016) and adhered to the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants in accordance with ethical guidelines.

Study Group

Patients included in the study underwent ACL reconstruction at our orthopedic clinic between August 2012 and September 2014 using a peroneus longus tendon allograft. Inclusion criteria were primary ACL rupture, a minimum 10-year follow-up, and availability of complete clinical and radiological data. Exclusion criteria included prior knee surgeries, multi-ligament injuries, and severe joint diseases.

Surgical Technique and Rehabilitation

All surgeries were performed by the same experienced surgeon using standard arthroscopic techniques. The sterilized peroneus longus tendon allograft was fixed within the femoral and tibial tunnels using interference screws to ensure stability. The post-operative rehabilitation protocol included initial restricted knee motion (0°–30°) with a brace for the first 2 weeks, gradual weight-bearing starting at 6 weeks, and return to full sports activities between 9 and 12 months post-operatively.

Outcome Measures

Primary study outcomes included clinical and functional assessments, stability tests, and muscle strength measurements.

- Clinical evaluation: Functional outcomes were assessed using the Lysholm and Modified Cincinnati scores
- Stability tests: Knee stability was evaluated with the Lachman test, Pivot-Shift test, and KT-1000 arthrometer measurements
- Muscle strength analysis: Quadriceps and hamstring strength were measured using Cybex II isokinetic dynamometry at 60°/s and 240°/s
- Complications: Adverse events such as graft failure, flexion limitation, and knee hypoesthesia were documented.

All measurements were performed during follow-up evaluations using standardized and validated methods.

Statistical Analysis

Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) Version 27 (SPSS Inc., IBM, NY, USA). Descriptive statistics (numbers, percentages, means, and ranges) were used to analyze pre-operative radiographic findings and post-operative functional outcomes.

RESULTS

Demographic Outcomes

This study included 20 patients, with 17 males (85%) and 3 females (15%). The mean age at surgery was 34.2±6.7 years (range: 21–46 years). The average time from trauma to surgery was 10.35±18.18 months (range: 1–84 months). The mean follow-up period was 10.3±1.5 years. Table 1 summarizes the demographic characteristics and trauma history of the patients.

Table 1. Demographic characteristics, trauma mechanisms, and clinical data of the patients

Characteristics	(n=20) (%)
Age	34.25±6.72
Gender (Female/Male)	(3/17)
Side (n)	
Left	5
Right	15
History of trauma (%)	
Football injury	50
Falling (after knee twisting)	20
Basketball injury	5
Skiing injury	5
Running injury	0
Kickboxing injury	5
Assault-related trauma	5
Motorcycle accident	10
Traffic accident	0
Time from trauma to surgery (months)	9.3±11.0
Follow-up duration (years)	9.8±0.4

Functional Outcomes

The mean Lysholm score was 98.65±3.32. Most patients (95%) had an "Excellent" outcome, while 5% were classified as "Good." The mean Modified Cincinnati score was 29.45±1.14, with all patients (100%) classified as "Excellent" (Table 2).

Based on the international knee documentation committee activity scale at the 10-year follow-up, 50% of patients resumed intensive activity (Level 1), 40% maintained moderate activity, and 10% were classified as having low activity. No patients were sedentary (Table 2 and Fig. 1).

Knee Stability Assessments

Knee stability was assessed using the Lachman test, Pivot-Shift test, and KT-1000 arthrometer to measure anterior tibial translation.

The Lachman test was negative in 60% of patients. A Grade 1 positive result was observed in 35%, while 5% had a Grade 2 positive outcome, indicating mild residual laxity in a small subset of cases.

The Pivot-Shift test was negative in 75% of patients, with 25% demonstrating a Grade 1 positive result (Table 3).

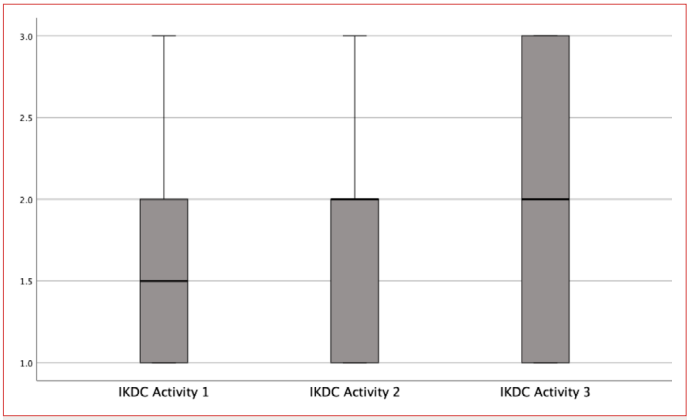

Figure 1. Distribution of international knee documentation committee activity levels (1, 2, and 3) of the study population.

KT-1000 arthrometer measurements, assessing anterior tibial translation under different force levels, are summarized in Table 4.

Isokinetic muscle strength was assessed at two different angular velocities, 60°/s and 240°/s, for both extension and flexion movements and the results are summarized in Table 5 and Figure 2.

Table 2. Functional outcomes, Lysholm and Modified Cincinnati Scores, and International Knee Documentation Committee Activity Levels of the study population

Variable	(n=20) (%)
Lysholm score	98.65±3.32
Good	1 (5)
Excellent	19 (95)
Modified cincinnati	29.45±1.14
Excellent	20 (100)
IKDC activity 1	
Intensive activity	10 (50)
Moderate activity	8 (40)
Low activity	2 (10)
Sedentary	0 (0)
IKDC activity 2	
Intensive activity	9 (45)
Moderate activity	8 (40)
Low activity	3 (15)
Sedentary	0 (0)
IKDC activity 3	
Intensive activity	7 (35)
Moderate activity	6 (30)
Low activity	7 (35)
Sedentary	0 (0)

IKDC: International Knee Documentation Committee.

Table 3. Knee stability test results in patients undergoing ACL reconstruction

Tests	(n=20)
Lachman test	
(–)	12 (60)
(+)	7 (35)
(++)	1 (5)
Pivot shift test	
Negative	15 (75)
Positive	5 (25)

ACL: Anterior cruciate ligament.

Table 4. KT-1000 arthrometer measurements in patients

KT-1000	(n=20)
15 pound	
Opere	7.21±2.48
Intact	6.67±2.6
20 pound	
Opere	9.21±2.93
Intact	8.53±3.02
30 pound	
Opere	11.16±3.12
Intact	10.32±3.21

Table 5. Isokinetic strength measurements using the Cybex II dynamometer in patients

Cybex II isokinetic dynamometer	(n=20)
Cybex opere extension 60°/s	158.45±39.31
Cybex opere flexion 60°/s	114.35±29.28
Cybex intact extension 60°/s	177.35±43.97
Cybex intact flexion 60°/s	118.10±29.23
Cybex opere extension 240°/s	74.55±20.24
Cybex opere flexion 240°/s	68.75±16.55
Cybex intact extension 240°/s	84.90±20.80
Cybex intact flexion 240°/s	71.60±17.40

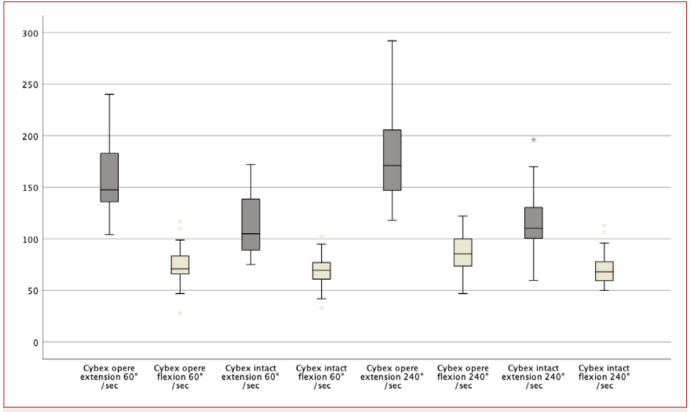

Figure 2. Isokinetic strength measurements using the Cybex II dynamometer in patients undergoing anterior cruciate ligament reconstruction.

Complications and Adverse Events

One patient (5%) experienced mild flexion restriction (<10° loss), but this did not significantly affect daily activities or overall functional outcomes. In addition, knee hypoesthesia was reported in 1 patient (5%), but it resolved over time without long-term neurological sequelae. No cases of graft failure, immune response, or infection were observed during the 10-year follow-up period.

DISCUSSION

The main finding of this study demonstrates that anterior cruciate ligament (ACL) reconstruction using peroneus longus tendon allograft provides favorable clinical and functional outcomes in the long-term follow-up. Based on the data obtained from our 10-year case series, we observed that the peroneus longus allograft maintains joint stability, supports functional improvement, and ensures patient satisfaction with minimal complications. Long-term results indicate that this graft choice is a reliable alternative for ACL reconstruction.

Our findings are consistent with the existing literature that highlights the advantages of peroneus longus allograft, particularly in terms of avoiding donor site morbidity and preserving muscle strength.[5-8] The absence of donor site morbidity may contribute to the high Lysholm scores observed in our study, aligning with previous reports that suggest allografts can enhance subjective outcomes by eliminating the negative effects associated with autograft harvesting.[11-14] Our findings showing stability over more than a decade are not inconsistent with these studies, but may not provide a clear judgment due to the limited sample size.

Stability assessments, including the Lachman test, Pivot-Shift test, and anterior tibial translation measurements with the KT-1000 arthrometer, revealed satisfactory results comparable to those reported in other long-term studies of allograft use.[15-17] Although some studies suggest that allografts may carry an increased risk of laxity over time,[18,19] our results did not indicate significant instability at the 10-year follow-up. This suggests that appropriate surgical techniques, graft preparation, and post-operative rehabilitation may mitigate the risks associated with allografts in ACL reconstruction.

Isokinetic muscle strength measurements demonstrated that the operated extremity retained strength comparable to the intact side, with muscle strength losses remaining within clinically acceptable limits. The long-term maintenance of muscle strength suggests that the peroneus longus allograft does not lead to significant deficits in lower extremity function, supporting its viability as a graft option.[20,21]

Complication rates were low in our case series. Minor issues such as flexion limitations and localized numbness were observed in some patients but did not significantly impact daily activities. While previous literature reports an increased risk of donor site morbidity with autografts,[8,22] the use of peroneus longus allograft eliminated this concern. In addition, although allografts have been associated with risks of infection and immune response,[23-25] no such complications were recorded in our cohort.

The main limitation of this study is the relatively small sample size, though all patients were selected as a homogeneous group and underwent surgery with a standardized technique. Another limitation is the lack of a control group; however, the primary objective was to evaluate the long-term outcomes of the peroneus longus allograft. Future comparative studies with larger cohorts and extended follow-up periods would further clarify the long-term durability and stability of this graft option.

CONCLUSION

Our study demonstrated that ACL reconstruction using peroneus longus tendon allograft provides favorable long-term clinical and functional outcomes. Considering its reliability, minimal donor site morbidity, and manageable risks of immunological response, this graft represents a viable alternative for ACL reconstruction. Our 10-year follow-up results support the sustained effectiveness of the peroneus longus allograft. However, further large-scale and comparative studies are necessary to validate these findings and assess long-term graft durability and stability in diverse patient populations.

DECLARATIONS

Ethics Committee Approval: The study was approved by Sisli Hamidiye Etfal Training and Research Hospital Ethics Committee (No: 731, Date: 27/12/2016).

Informed Consent: Informed consent was obtained from all individual participants included in the study.

Conflict of Interest: The authors declare that there is no conflict of interest.

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Footnote: This article is based on Rodi Ertoğrul's thesis entitled "Ön çapraz bağ lezyonlarının otojen hamstring tendon otogreft ve perenous longus allogreft ile rekonstrüksiyonu sonrası karşılaştırmalı erken dönem sonuçlarımız" completed in 2016 as part of the Medical Specialty Training Program.

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