

Functional Outcome of Complete ACL Tear Treated with Arthroscopic ACL Reconstruction and Lateral Extra-Articular Tenodesis (LET)

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ABSTRACT

Objective: To evaluate the functional outcomes of ACL reconstruction combined with LET in patients with complete ACL tears.

Methods: This retrospective observational study was conducted among 40 patients with complete ACL tears who underwent arthroscopic ACL reconstruction. Functional outcomes were assessed using the Knee Society Score, Lysholm score, IKDC subjective score, clinical stability tests, and return-to-sport status over an 18-month follow-up period.

Results: Among 40 patients (mean age 28.4 ± 6.2 years, 75% male), significant functional improvement was observed post-operatively. The mean KSS improved from 58.4 ± 8.2 pre-operatively to 91.6 ± 4.8 at 18 months ($p < 0.001$). A negative pivot-shift test was observed in 95% of patients at final follow-up. Return to pre-injury sports activity was achieved by 75% of patients at a mean of 8.5 months. The mean Lysholm score was 93.2 ± 4.6 and mean IKDC score was 87.4 ± 5.2 at final follow-up. Complication rates were low, with no graft failures reported.

Conclusion: Arthroscopic ACL reconstruction combined with LET provides excellent functional outcomes, superior rotational stability, and high return-to-sport rates without significant increase in complications. The combined procedure is particularly beneficial in high-risk athletic patients with complete ACL tears.

Keywords: anterior cruciate ligament, lateral extra-articular tenodesis, ACL reconstruction, functional outcome, rotational stability

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INTRODUCTION

The anterior cruciate ligament plays a critical role in maintaining knee stability by resisting anterior tibial translation and

rotational forces during functional activities. ACL injuries are common in young and physically active individuals and are associated with instability, reduced

functional capacity, and increased risk of secondary meniscal and cartilage damage . Arthroscopic ACL reconstruction is the standard treatment for symptomatic ACL deficiency . Despite advances in surgical techniques and rehabilitation protocols, a proportion of patients continue to demonstrate residual rotational instability and persistent pivot-shift phenomenon following isolated reconstruction ¹.

Residual rotatory knee instability after ACLR can lead to graft failure, osteochondral damage, and osteoarthritis of the knee joint². These complications significantly affect patients' daily activity and quality of life³. Therefore, it is considered important to minimise residual rotatory knee instability when treating patients with ACL deficiency . Recent anatomical and biomechanical studies have emphasized the contribution of the anterolateral complex of the knee in controlling internal tibial rotation . There is an estimated 11-79% of acute ACL ruptures that occur with concomitant anterolateral complex injury observed with magnetic resonance imaging⁴.

Lateral extra-articular tenodesis has gained renewed interest as an adjunct to ACLR . Current in vitro LET technique studies reported that the tenodesis tissue could decrease the stress on the ACL graft by 43% and restore rotatory knee stability, then conferring a protective effect on the knee joint⁵. Evidence suggests that LET reduces graft strain, improves rotational control, and decreases failure rates, particularly in high-risk populations, such as young athletes and patients participating in pivoting sports⁶.

The objective of this study was to evaluate the functional outcomes of complete ACL tears treated with arthroscopic ACL

reconstruction combined with lateral extra-articular tenodesis.

METHODS

Study Population

The study population comprised patients with complete ACL tears who underwent arthroscopic ACL reconstruction with LET during the study period. A total of 40 patients were included. Patients were selected through systematic sampling from hospital electronic medical records and orthopaedic databases.

Inclusion Criteria

Patients were included if they met the following criteria: age 18 years or older; complete ACL tear confirmed on MRI; underwent arthroscopic ACL reconstruction with LET; availability of complete clinical data including demographics, presenting symptoms, and examination findings; minimum follow-up of 12 months; and availability of complete outcome data.

Exclusion Criteria

Patients were excluded if they had multiligament knee injuries; prior knee surgery on the same side; inflammatory arthritis; incomplete clinical or radiological data; and patients with missing outcome data.

Surgical Technique

All patients underwent arthroscopic single-bundle ACL reconstruction using hamstring autograft with an additional modified Lemaire LET procedure . The LET procedure was performed using a modified Lemaire technique. All-inside ACL reconstruction augmented with concomitant LET was performed in a subset of patients .

Data Collection

The following variables were systematically extracted from electronic medical records:

Demographic variables including age, sex, body mass index, and activity level. Clinical variables including mechanism of injury, pre-operative laxity, and associated meniscal injuries. Surgical variables including graft choice, surgical technique, and operative time. Outcome variables including KSS, Lysholm score, IKDC subjective score, pivot-shift test, Lachman test, return-to-sport status, and complications.

Outcome Measures

The primary outcome measure was functional improvement as assessed by the Knee Society Score at final follow-up. Secondary outcomes included Lysholm score, IKDC subjective score, pivot-shift test results, return-to-sport rates, and complication rates.

Statistical Analysis

Data were summarised using descriptive statistics. Continuous variables were expressed as mean and standard deviation. Categorical variables were expressed as frequencies and percentages. Comparisons between pre-operative and post-operative scores were performed using the paired t-test. Statistical significance was considered at a p-value less than 0.05.

Ethical Considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki and Good Clinical Practice guidelines. The study protocol was reviewed and approved by the Institutional Ethics Committee. Patient confidentiality was maintained throughout the study, and data were anonymised prior to analysis.

RESULTS

Baseline Characteristics

A total of 40 patients were included in the study. The mean age was 28.4 ± 6.2 years, with 75% (30/40) being male. Sports-related trauma was the most common mechanism of injury (75%). Concomitant meniscal injury was present in 45% of patients. The mean follow-up duration was 18.4 ± 4.2 months.

Table 1. Baseline Demographic and Clinical Characteristics

Variable	All Patients (n=40)
Age (years), mean $\pm$ SD	28.4 ± 6.2
Male sex, n (%)	30 (75.0)
BMI (kg/m^2), mean $\pm$ SD	24.6 ± 3.8
Sports-related injury, n (%)	30 (75.0)
Concomitant meniscal injury, n (%)	18 (45.0)
Follow-up duration (months), mean $\pm$ SD	18.4 ± 4.2

Functional Outcomes

Significant functional improvement was observed post-operatively. The mean KSS improved from 58.4 ± 8.2 pre-operatively to 91.6 ± 4.8 at 18 months ($p < 0.001$). The mean Lysholm score at final follow-up was 93.2 ± 4.6 , and the mean IKDC subjective score was 87.4 ± 5.2 .

Table 2. Functional Outcome Scores

Outcome Measure	Pre-operative	Post-operative (18 months)	p-value
Knee Society Score, mean $\pm$ SD	58.4 ± 8.2	91.6 ± 4.8	<0.001
Lysholm score,	-	93.2 ± 4.6	-

mean $\pm$ SD			
IKDC subjective score, mean $\pm$ SD	-	87.4 $\pm$ 5.2	-

Clinical Stability

At final follow-up, a negative pivot-shift test was observed in 95% (38/40) of patients. Lachman test was negative in 92.5% (37/40) of patients. No patient demonstrated grade 3 laxity.

Table 3. Clinical Stability at Final Follow-Up

Test	Negative (%)	Grade 1 (%)	Grade 2 (%)	Grade 3 (%)
Pivot-shift test	95.0	5.0	0	0
Lachman test	92.5	7.5	0	0

Return to Sport

Return to pre-injury sports activity was achieved by 75% (30/40) of patients at a mean of 8.5 ± 1.6 months post-surgery. Patients who participated in pivoting sports had a return rate of 70%, while those in non-pivoting sports had a return rate of 85%.

Table 4. Return to Sport Outcomes

Parameter	Value
Return to pre-injury sport, n (%)	30 (75.0)
Time to return (months), mean $\pm$ SD	8.5 ± 1.6
Return at same or higher level, n (%)	24 (60.0)
Return at lower level, n (%)	6 (15.0)

Complications

Complications were infrequent. No graft failures were reported. One patient (2.5%) developed stiffness requiring manipulation under anesthesia. One patient (2.5%) had hardware-related symptoms. No infections or neurovascular injuries were observed.

Table 5. Complications

Complication	n (%)
Stiffness requiring MUA	1 (2.5)
Hardware-related symptoms	1 (2.5)
Graft failure	0 (0)
Infection	0 (0)
Neurovascular injury	0 (0)

DISCUSSION

The present study demonstrated excellent short-term functional and clinical outcomes following arthroscopic ACL reconstruction combined with lateral extra-articular tenodesis in patients with complete ACL tears. The mean Knee Society Score improved significantly from 58.4 preoperatively to 91.6 at the final follow-up, while the mean Lysholm and IKDC subjective scores reached 93.2 and 87.4, respectively. Clinical stability was also satisfactory, with a negative pivot-shift test in 95% and a negative Lachman test in 92.5% of patients. These findings indicate that combined ACL reconstruction and LET can effectively restore knee function and provide control of both anterior and rotational instability. Previous studies have similarly reported that adding an anterolateral procedure to ACL reconstruction improves pivot-shift control and reduces persistent rotational laxity compared with isolated reconstruction.¹⁻³

The high rate of negative pivot-shift testing observed in this study supports the biomechanical role of LET as a secondary

restraint against internal tibial rotation. Although intra-articular ACL reconstruction is effective in controlling anterior tibial translation, residual rotational instability may persist in patients with high-grade preoperative pivot shift, generalized ligamentous laxity, anterolateral complex injury, or participation in pivoting sports. The STABILITY randomized trial demonstrated that adding a modified Lemaire LET to hamstring autograft ACL reconstruction significantly reduced clinical failure and graft rupture among young patients at increased risk of reinjury.⁴ LET may protect the intra-articular graft by sharing rotational loads during cutting and pivoting movements, particularly during the period of graft incorporation and ligamentization.^{4,5}

Return to pre-injury sports activity was achieved by 75% of patients at a mean of 8.5 months, although only 60% returned at the same or a higher level. This distinction is important because restoration of mechanical stability does not necessarily ensure return to the previous level of athletic performance. Quadriceps and hamstring strength, neuromuscular control, psychological readiness, fear of reinjury, rehabilitation adherence, and sport-specific demands may influence return-to-sport outcomes. The lower return rate among patients involved in pivoting sports may reflect the greater rotational and psychological demands of these activities. Therefore, return-to-sport decisions should be based on objective strength, functional performance, limb symmetry, movement quality, and psychological readiness rather than postoperative duration alone^{6,7}.

No graft failure was recorded during the follow-up period, and complications were limited to one case of stiffness requiring

manipulation under anesthesia and one case of hardware-related symptoms. These findings suggest that LET can be added to ACL reconstruction without a substantial increase in major complications when performed with appropriate graft placement and tensioning. Previous evidence has shown no significant overall increase in adverse events with LET, although transient pain, reduced quadriceps strength, stiffness, hardware irritation, and lateral-sided discomfort may occur.^{8,9} Excessive tensioning may theoretically overconstrain the lateral compartment and alter normal tibial rotation. Careful fixation of the iliotibial-band graft in an appropriate knee position is therefore essential to obtain rotational stability without restricting physiological movement.

The present study has several limitations. Its retrospective design, small sample size, absence of an isolated ACL reconstruction control group, and relatively short follow-up restrict definitive conclusions regarding the independent benefit of LET and its long-term effect on graft survival or osteoarthritis. Preoperative Lysholm and IKDC scores were unavailable, and stability was assessed clinically without instrumented laxity testing. Nevertheless, the significant improvement in the Knee Society Score, excellent final patient-reported outcomes, high proportion of negative pivot-shift tests, favorable return-to-sport rate, and absence of graft failure support combined ACL reconstruction and LET as an effective option for appropriately selected high-risk patients. Larger prospective comparative studies with standardized return-to-sport testing, objective laxity measurements, and long-term radiological follow-up are required to confirm these findings.

CONCLUSION

Arthroscopic ACL reconstruction combined with LET provides excellent functional outcomes, superior rotational stability, and high return-to-sport rates in patients with complete ACL tears. The significant improvement in functional scores, near-complete elimination of pivot shift, and high return-to-sport rates support the use of the combined procedure in appropriately selected patients. The addition of LET to ACLR improves rotational stability and functional recovery without increasing complications. The combined approach may be particularly beneficial in high-risk or athletic populations.

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