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Does Adding Lateral Extra-Articular Tenodesis Improve Outcomes After Arthroscopic Anterior Cruciate Ligament Reconstruction? A Longitudinal Comparative Study

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Learning Point of the Article:

Lateral extra-articular tenodesis, when combined with ACL reconstruction, improves rotational stability and functional outcomes without increasing complications, especially in high-risk athletic patients.

Abstract

Introduction: Residual rotational instability may persist after isolated anterior cruciate ligament reconstruction (ACLR). Lateral extra-articular tenodesis (LET) has re-emerged as an adjunct procedure to improve rotational stability. We present a Longitudinal Comparative Study comparing functional outcomes of ACLR performed with and without LET.

Materials and Methods: Forty patients with ACL injury were treated surgically between 2022 and 2024. Twenty patients underwent isolated ACLR (Group B) and 20 underwent ACLR combined with LET (Group A). Functional outcomes were assessed using the Knee Society Score (KSS), clinical stability tests, return-to-sport status, and complication profiles over an 18-month follow-up period.

Results: Both groups demonstrated significant functional improvement. Group A achieved higher KSS at all follow-up intervals. A negative pivot-shift test was observed in 95% of Group A compared with 70% of Group B. Return to pre-injury sports was higher in Group A (75% vs. 50%). Complication rates and range of motion recovery were comparable.

Conclusion: The addition of LET to ACLR improves rotational stability and functional recovery without increasing complications. Combined reconstruction may be advantageous in patients at risk of persistent instability.

Keywords: Anterior cruciate ligament, lateral extra-articular tenodesis, pivot shift, knee instability, case series.

Introduction

The anterior cruciate ligament (ACL) 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 [1,2].

Arthroscopic ACL reconstruction (ACLR) 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 [3]. Such instability may compromise return to sports and increase the risk of graft failure.

Recent anatomical and biomechanical studies have emphasized the contribution of the anterolateral complex of the knee in controlling internal tibial rotation [4, 5]. Failure to address this structure may explain persistent rotational laxity after isolated

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ACLR. Consequently, lateral extra-articular tenodesis (LET) has gained renewed interest as an adjunct to ACLR.

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 sports [6, 7, 8]. This study aims to compare functional outcomes and knee stability between isolated ACLR and ACLR combined with LET.

Research question: In patients with anterior cruciate ligament injury, does arthroscopic ACLR combined with LET, compared with isolated ACLR, result in better functional outcomes, improved knee stability, and higher return-to-sport rates over an 18-month follow-up period?

Hypothesis: Patients undergoing arthroscopic ACLR combined with LET (ACLR + LET) will demonstrate significantly better functional outcomes, improved rotational knee stability, and higher return-to-sport rates compared with patients undergoing isolated ACLR over an 18-month follow-up period.

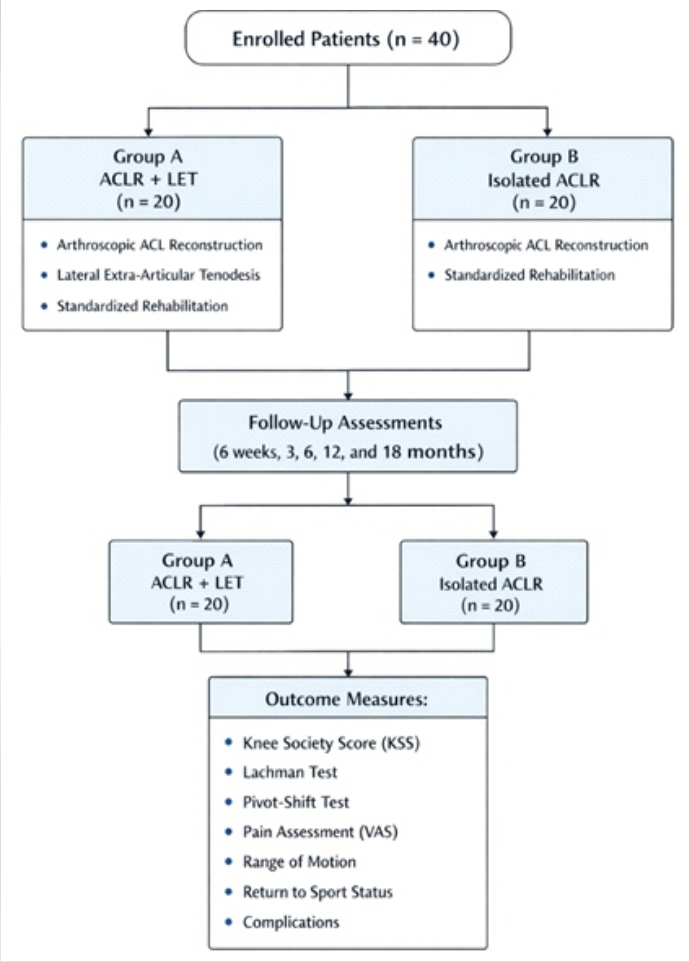

Figure 1: Study design.

Materials and Methods

Study design and setting

This prospective comparative longitudinal study was conducted at the Department of Orthopaedics, Pravara Rural Hospital, Loni, over an 18-month period after IEC approval (No. PIMS/DR/RMC/IEC-UG-PG/2025/313). Purposive sampling was used (Fig. 1).

Study population

Patients aged ≥18 years with clinically and MRI-confirmed ACL rupture were included. Inclusion criteria consisted of positive Lachman and anterior drawer tests and MRI evidence of ACL tear. Exclusion criteria included previous ACL surgery, associated realignment procedures, and two or more additional ipsilateral ligament injuries.

Sample size was calculated based on the primary outcome measure, the Knee Society Score (KSS). Based on previously published literature, a minimum clinically important difference of 8 points between the two groups was considered significant, with an estimated standard deviation of 10 points. To detect this difference with a power of 80% and a two-sided alpha error of 0.05, a minimum of 18 patients per group was required. To compensate for potential loss to follow-up and dropouts, the sample size was increased to 20 patients per group, giving a total sample size of 40 patients.

Pre-operative assessment

All patients underwent standardized clinical examination and radiological evaluation. Baseline functional status was assessed using the KSS. Demographic data, injury mechanism, and time from injury to surgery were recorded.

Surgical technique

All patients underwent arthroscopic ACLR using either hamstring tendon or peroneus longus tendon autograft. Standard anterolateral and anteromedial portals were established, the ACL remnants were debrided, and anatomic femoral and tibial tunnels were created under arthroscopic visualization. The prepared graft was passed through the tunnels and fixed using suspensory femoral fixation with appropriate tibial fixation after cycling and tensioning of the graft [2, 9].

Group A patients additionally underwent LET using a modified Lemaire technique. A longitudinal strip of the iliotibial band was harvested while maintaining its distal attachment at Gerdy's tubercle. The graft was passed deep to the lateral collateral ligament and routed proximally, then fixed to the femur at the

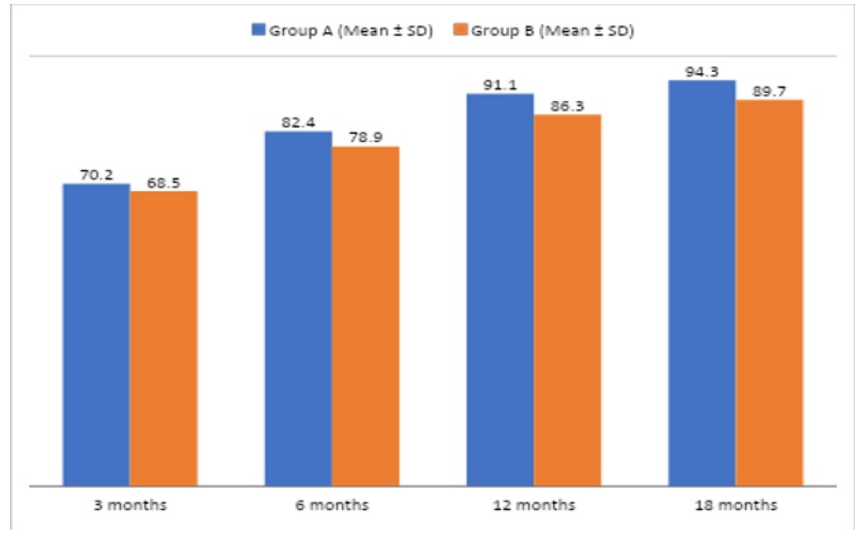

Figure 2: Mean knee society score over time.

isometric point with the knee held in approximately 30° of flexion and neutral rotation, ensuring appropriate tension without overconstraint.

Group B patients underwent isolated arthroscopic ACLR following the same intra-articular technique without any additional extra-articular stabilization procedure.

Rehabilitation protocol

Both groups followed an identical standardized rehabilitation protocol emphasizing early mobilization, quadriceps strengthening, progressive weight bearing, and gradual return to sports.

Outcome measures

Patients were evaluated at 6 weeks, 3 months, 6 months, 12 months, and 18 months. Outcomes included KSS, Lachman, and pivot-shift tests, pain assessment using the visual analog scale, return-to-sport status, range of motion, and postoperative complications.

Statistical analysis

Continuous variables were expressed as mean ± standard deviation and categorical variables as percentages. Intergroup comparisons were performed using independent t-tests or Mann–Whitney U tests and Chi-square or Fisher's exact tests as appropriate. A $P < 0.05$ was considered statistically significant.

Results

Forty patients were included, with comparable baseline demographic and injury characteristics between groups. Most patients were aged 26–35 years, with male predominance. Sports-related trauma was the most common mechanism of injury.

Mean operative time was longer in Group A (95 ± 12 min) than in Group B (75 ± 10 min). Post-operative complications were infrequent and comparable between groups.

Functional outcomes improved significantly in both groups. Group A demonstrated significantly higher KSS at 6, 12, and 18 months ($P < 0.05$) (Fig. 2, Table 1). At final follow-up, pivot-shift testing was negative in 95% of Group A compared with 70% of Group B ($P = 0.04$). Lachman test outcomes favored Group A but were not statistically significant (Table 2).

Return to pre-injury sports activity was achieved by 75% of Group A and 50% of Group B. Range of motion recovery, hospital stay, and early post-operative pain were comparable between groups.

Discussion

The present study demonstrates that arthroscopic ACLR

Table 1: Comparison of knee society score between groups

Follow-up duration	ACLR+LET (n=20) Mean±SD	ACLR only (n=20) Mean±SD	Test applied	P-value
3 months	70.2±4.8	68.5±5.0	t-test	0.32
6 months	82.4±5.2	78.9±4.6	t-test	0.04
12 months	91.1±3.8	86.3±4.2	t-test	0.01
18 months	94.3±3.2	89.7±3.9	t-test	0.002

ACLR: Anterior cruciate ligament reconstruction, LET: Lateral extra-articular tenodesis, SD: Standard deviation

Table 2: Comparison of knee stability at 18 months

Stability test	Result	ACLR+LET (n=20) (%)	ACLR only (n=20) (%)	Test applied	P-value
Lachman's test	Negative	18 (90)	15 (75)	Chi-square	0.18
	Positive	2 (10)	5 (25)		
Pivot-Shift test	Negative	19 (95)	14 (70)	Fisher's exact	0.04
	Positive	1 (5)	6 (30)		

ACLR: Anterior cruciate ligament reconstruction, LET: Lateral extra-articular tenodesis

combined with LET provides superior rotational stability and improved functional outcomes compared with isolated ACLR. While both groups showed significant improvement in anterior stability, residual rotational laxity was significantly lower in patients who underwent the combined procedure, as evidenced by a higher proportion of negative pivot-shift tests and superior functional scores. These findings directly address the primary objective of the study, confirming that the addition of LET enhances clinical stability and functional recovery following ACLR.

The improved control of pivot shift observed in the combined group supports the biomechanical role of LET in limiting excessive internal tibial rotation and reducing strain on the intra-articular graft, thereby improving overall knee kinematics and stability [7, 8]. This improved rotational control is clinically relevant, as persistent pivot shift has been associated with subjective instability, delayed return to sport, and increased risk of graft failure.

Higher return-to-sport rates in the ACLR + LET group further emphasize the functional benefits of addressing rotational instability, particularly in physically active individuals. Importantly, the addition of LET did not result in an increased incidence of complications, postoperative stiffness, or delayed rehabilitation, indicating that the combined procedure can be performed safely without compromising early recovery.

The results of this study are consistent with several national and international reports demonstrating improved rotational stability and lower graft failure rates with combined procedures [6, 7, 8]. Notably, the findings align closely with the STABILITY trial, which reported significantly reduced graft rupture rates and improved rotational control when LET was added to ACLR in high-risk patients [10]. Minor variations in outcome magnitude compared with other studies may be attributed to differences in patient selection, activity level, graft choice, surgical technique, rehabilitation protocols, and duration of follow-up.

Despite these encouraging findings, certain limitations must be acknowledged. The sample size was modest, which may limit the statistical power and generalizability of the results. In addition, the follow-up duration was relatively short and does not allow assessment of long-term graft survivorship, development of osteoarthritic changes, or late complications. The study was not blinded and relied partly on clinical examination scores, which may introduce observer bias.

Future studies with larger multicenter cohorts, longer follow-up periods, and objective biomechanical assessments are recommended to further validate these findings and to identify patient subgroups that may benefit most from the addition of LET. Randomized controlled trials comparing different LET techniques and fixation methods would also help optimize surgical strategies.

Conclusions

ACLR combined with LET provides superior rotational stability, improved functional outcomes, and higher return-to-sport rates compared with isolated ACLR, without increasing complications. This combined approach may be particularly beneficial in high-risk or athletic populations.

Clinical Message

Adding lateral extra-articular tenodesis to arthroscopic ACL reconstruction significantly improves rotational stability and functional outcomes without increasing complications in appropriately selected patients.

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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