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Return to Sport and Graft Failure After ACL Reconstruction With Versus Without Lateral Extra-Articular Tenodesis in Athletes: A Systematic Review

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Background:

Anterior cruciate ligament (ACL) injuries are among the most prevalent knee injuries in elite and competitive sports, frequently requiring primary ACL reconstruction (ACLR) to facilitate a return to play. Despite refinements in surgical technique and rehabilitation, graft failure remains a career-threatening event, with reported rupture rates in high-risk populations—including elite athletes and young active individuals—ranging from 3% to 22%.

A primary driver of these failures is residual rotatory laxity, characterized by a persistent pivot shift following reconstruction. While isolated ACLR often provides subjective satisfaction, multiple studies demonstrate it may fail to fully restore native knee kinematics, particularly in cases with high-grade pre-operative instability. This persistent instability has been strongly correlated with inferior clinical outcomes, lower patient satisfaction, and an increased risk of revision surgery.

Recent anatomical and biomechanical research has highlighted the critical role of the anterolateral complex (ALC)—including the iliotibial band (ITB) and the anterolateral ligament (ALL)—in controlling internal tibial rotation. Evidence suggests that damage to these lateral structures occurs in up to 96% of acute ACL ruptures, contributing to high-grade rotatory instability that may be left unchecked by intra-articular reconstruction alone.

Consequently, there is renewed clinical interest in lateral extra-articular procedures (LEAP), such as the modified Lemaire lateral extra-articular tenodesis (LET), to augment primary ACLR. Biomechanically, these procedures serve to load-share with the ACL graft, significantly reducing the forces applied to the healing tissue and more reliably restoring rotatory stability.

While there is growing evidence for the use of LET in high-risk recreational cohorts, defining the precise indications—such as elite athletic status, young age (≤21 years), or the presence of an intraoperative residual pivot shift—remains a subject of active clinical investigation.

Methods

A systematic literature search was conducted across the PubMed, Cochrane Library, and Embase databases to identify studies comparing primary anterior cruciate ligament reconstruction (ACLR) alone versus ACLR combined with lateral extra-articular augmentation. The search employed a combination of Medical Subject Headings (MeSH) and keywords related to "Anterior Cruciate Ligament Reconstruction," "lateral extra-articular tenodesis" (LET), "anterolateral ligament reconstruction" (ALLR), and "return to sport" (RTS).

Studies were selected based on the following Inclusion and Exclusion criteria:

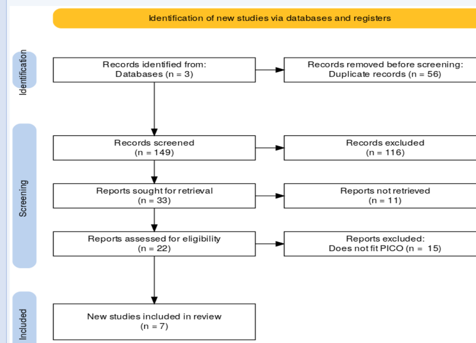
Inclusion Criteria:
- Population (P): Skeletally mature athletes aged ≥16 years undergoing primary ACL reconstruction for ACL rupture. Participants must be competitive or high-activity athletes involved in pivoting/cutting sports.
- Intervention (I): Primary ACLR combined with lateral extra-articular tenodesis (LET) or an anterolateral augmentation procedure (e.g., ALLR).
- Comparison (C): Primary isolated ACL reconstruction without LET/augmentation.
- Outcomes (O): Studies must report at least one primary outcome: return-to-sport rate, time to return to sport, or graft failure/re-rupture rate.

Exclusion Criteria:
- Revision ACL reconstructions.
- Multiligament knee injuries.
- Pediatric-only populations (skeletally immature).

Study Selection and Data Extraction:
Study selection followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Files encompassing studies found from data bases were uploaded to Rayyan.AI, where screening took place. Two independent reviewers (Z.K, S.J) screened through a total of 149 records after the removal of 56 duplicate records. Following the screening of titles and abstracts, 33 reports were sought for retrieval, and 22 reports were assessed for eligibility. 15 reports were excluded for not meeting the specific PICO criteria, resulting in 7 studies included in the final qualitative and quantitative synthesis. Any conflicts were resolved by a third reviewer (S.I).

The Primary Outcomes of interest were:
- Graft failure/re-rupture rates.
- Return-to-sport (RTS) rates.
- Time to return to sport.

Secondary Outcomes included:
- Rotational stability (measured via pivot-shift grading).
- Patient-reported outcomes, including IKDC, KOOS, and Tegner Activity Scale (TAS) scores.
- Reoperation and secondary surgery rates.



Results

Primary Outcomes

Study	Study Design	Population Size (N)	Graft Failure Rate (Iso vs. Aug)	Return to Sports Rate (Iso vs. Aug)	Time to return to sports
Borque et al. (2022)	Retrospective cohort	455 (117 Aug / 338 Iso)	9.5% vs. 3.4%	88.0% vs. 88.0%	Mean 10.1 months (total cohort)
Getgood et al. (2020)	Randomized controlled trial	618 (306 Aug / 312 Iso)	11% vs. 4%	85.0% vs. 82.0%	Median 11 months both groups
Porter et al. (2020)	Randomized controlled trial	55 (28 Aug / 27 Iso)	14.8% vs. 0.0%	Higher activity (TAS) in augmented group	Protocol allowed at 9 months
Hopper et al. (2022)	Retrospective cohort	342 (232 Aug / 110 Iso)	15.5% vs. 6.0%	94.7% overall RTS rate	Protocol: 8–9 months
Guy et al. (2022)	Retrospective cohort	81 (31 Aug / 50 Iso)	34.0% vs. 6.5%	98.3% returned to competition	58.0% vs. 61.3% (Percentage of athletes returning in <10 months)
Porter et al. (2026)	Retrospective cohort	4755 (2497 Aug / 2258 Iso)	4.5% vs. 3.0%	Median TAS 8 vs. Median TAS 8 (Activity scores similar for both groups)	Protocol allowed at 9 months
Giuca et al. (2025)	Retrospective cohort (PSM)	92 (46 Aug / 46 Iso)	17.4% vs. 4.3%	83% vs. 54% at 8 months	5.3 mo (Aug) vs. 7.2 mo (Iso)

Secondary Outcomes

Study	Study Design	Population Size (N)	Rotational Stability (Residual Pivot Shift)	PROMs at 2 Years	Reoperation / Secondary Surgery Rates
Borque et al. (2022)	Retrospective cohort	455 (117 Aug / 338 Iso)	Reduces persistent pivot shift (review)	Similar clinical outcomes across groups	20% surgery before RTS
Getgood et al. (2020)	Randomized controlled trial	618 (306 Aug / 312 Iso)	40% vs. 25% (Clinical Failure)	No IKDC/KOOS difference at 24 months	3.4% required LET hardware removal
Porter et al. (2020)	Randomized controlled trial	55 (28 Aug / 27 Iso)	0% residual pivot in augmented group	Significant improvement in KOOS Sport/LKS	No complications recorded
Hopper et al. (2022)	Retrospective cohort	342 (232 Aug / 110 Iso)	Side-to-side laxity: 0.3 mm	6.7% retired due to cartilage issues	18.1% secondary ipsilateral surgery
Guy et al. (2022)	Retrospective cohort	81 (31 Aug / 50 Iso)	Not detailed	All but one achieved FIS rankings	23.5% secondary arthroscopy
Porter et al. (2026)	Retrospective cohort	4755 (2497 Aug / 2258 Iso)	12% vs. 0% (Residual Pivot)	No significant difference (IKDC ~90)	2.6% vs. 1.4% (Meniscal tears)
Giuca et al. (2025)	Retrospective cohort (PSM)	92 (46 Aug / 46 Iso)	37.0% vs. 13.0% (Grade ≥ 1)	Higher IKDC (86.4) and ACL-RSI (78.5)	1 superficial infection recorded

Conclusion/Discussion

The collective evidence from the sources demonstrates that adding a lateral extra-articular procedure (LEAP), specifically a lateral extra-articular tenodesis (LET), to primary ACL reconstruction significantly improves graft survivorship in high-risk populations. Across diverse athletic cohorts—ranging from elite professional players to high-level alpine skiers—the addition of a LEAP consistently resulted in a greater than two-fold reduction in graft failure risk. For instance, in young, active patients, clinical failure rates dropped from 40% to 25%, while graft ruptures specifically decreased from 11% to 4%. This protective effect is even more pronounced in extreme-demand environments like elite alpine skiing, where failure rates were reduced from 34.0% to 6.5%. Biomechanically, the sources suggest this occurs because the lateral augmentation load-shares with the intra-articular graft, reducing the forces it must withstand by approximately 40% to 43% during the critical healing and "ligamentization" phases.

A critical finding across the sources is the relationship between residual rotatory laxity and surgical success. Isolated ACL reconstruction often fails to fully restore native knee kinematics, particularly in patients with high-grade pre-operative instability. The sources highlight that an uncorrected residual pivot shift at the time of surgery is a primary driver of future graft rupture, with failure rates of 11% in knees with a residual shift compared to 3.5% in those without. Consequently, the intraoperative presence of a residual pivot shift serves as a potent indication for adding a LET, which has been shown to eliminate this instability in nearly 100% of cases.

Regarding functional recovery, the sources indicate that combined procedures may expedite the return-to-sport (RTS) timeline without increasing complications. In competitive athletes following accelerated rehabilitation protocols, the LET group achieved functional symmetry and resumed full competition nearly two months faster than the isolated ACLR group (5.3 vs. 7.2 months). While long-term patient-reported outcomes (PROMs) such as IKDC and KOOS scores often converge between groups by 24 months, the augmented group frequently demonstrates higher early functional symmetry and superior psychological readiness (ACL-RSI)

In conclusion, for athletes participating in pivoting and cutting sports, the transition from isolated ACL reconstruction to an augmented approach appears clinically justified for those at the highest risk. The sources identify young age (≤ 21–25 years), elite or professional athletic status, and a persistent intraoperative pivot shift as the primary indications for surgical augmentation. While lateral augmentation involves a small risk of hardware-related morbidity, such as staple irritation, the number needed to treat (NNT) to prevent one graft failure is notably low, ranging from 7 to 16.5 across different high-risk cohorts. Ultimately, combining ACL reconstruction with a lateral extra-articular procedure provides a robust mechanical safeguard that enhances graft longevity and supports a more confident and timely return to high-level competition.

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