

Influence of Lateral Meniscus Posterior Root and Kaplan Fiber Tears in the ACL-Injured Knee and of a Combined Lateral Meniscus Posterior Root Repair with Lateral Extra-Articular Tenodesis in the ACL Reconstructed Knee

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Disclosures

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- Consulting: Smith and Nephew, Ossur, Responsive Arthroscopy
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Introduction

- Persistent knee anterolateral rotatory instability (ALRI) can remain after isolated Anterior Cruciate Ligament (ACL)-reconstruction
- Additional pathologies need to be diagnosed and treated
- When left undiagnosed or untreated they could lead to ACL graft overload and failure



Lateral meniscus posterior root (LMPR) tears

> *Knee Surg Sports Traumatol Arthrosc.* 2018 Aug;26(8):2302-2309.
doi: 10.1007/s00167-018-4949-8. Epub 2018 Apr 27.

Repair of the lateral posterior meniscal root improves stability in an ACL-deficient knee

Philipp Forkel ¹, Constantin von Deimling ², Lucca Lacheta ¹, Florian B Imhoff ¹, Peter Foehr ²,
Lukas Willinger ¹, Felix Dyrna ¹, Wolf Petersen ³, Andreas B Imhoff ⁴, Rainer Burgkart ²

> *Orthop J Sports Med.* 2017 Jun 15;5(6):2325967117695756. doi: 10.1177/2325967117695756.
eCollection 2017 Jun.

Lateral Meniscus Posterior Root and Meniscofemoral Ligaments as Stabilizing Structures in the ACL-Deficient Knee: A Biomechanical Study

Jonathan M Frank ^{1 2}, Gilbert Moatshe ^{1 3 4}, Alex W Brady ¹, Grant J Dornan ¹,
Ashley Coggins ¹, Kyle J Muckenhirn ¹, Erik L Slette ¹, Jacob D Mikula ¹, Robert F LaPrade ^{1 2}

> *Am J Sports Med.* 2015 Apr;43(4):905-11. doi: 10.1177/0363546514563910. Epub 2015 Jan 14.

Effect of lateral meniscal root tear on the stability of the anterior cruciate ligament-deficient knee

Theodore B Shybut ¹, Charles E Vega ², Jebran Haddad ², Jerry W Alexander ³,
Jonathon E Gold ³, Philip C Noble ³, Walter R Lowe ⁴

- Present in 6.6-16% of patients with an ACL tear
- Significant increase in anterior tibial translation (ATT) during simulated pivot shift
- Significant increase in tibial internal rotation (IR)



Anterolateral corner (ALC) injury

Kaplan fibers most commonly injured

> [Knee Surg Sports Traumatol Arthrosc.](#) 2022 Jan;30(1):176-183.
doi: 10.1007/s00167-021-06543-6. Epub 2021 Apr 1.

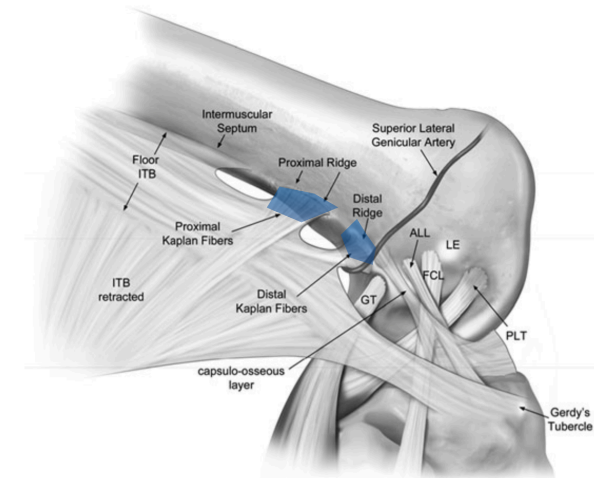
Anterolateral complex injuries occur in the majority of 'isolated' anterior cruciate ligament ruptures

Ganesh Balendra¹, Lukas Willinger², Vishal Pai¹, Adam Mitchell¹, Justin Lee¹, Mary Jones¹, Andy Williams³

> [Am J Sports Med.](#) 2020 Nov;48(13):3194-3199. doi: 10.1177/0363546520956302.
Epub 2020 Sep 24.

The Incidence of Kaplan Fiber Injury Associated With Acute Anterior Cruciate Ligament Tear Based on Magnetic Resonance Imaging

Niv Marom¹, Harry G Greditzer 4th², Michael Roux², Daphne Ling^{1 3}, Caroline Boyle¹, Andrew D Pearle¹, Robert G Marx¹



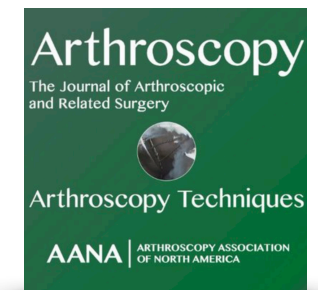
Arthroscopy: The Journal of Arthroscopic & Related Surgery

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Systematic Review

The Iliotibial Band is the Main Secondary Stabilizer for Anterolateral Rotatory Instability and both a Lemaire Tenodesis and Anterolateral Ligament Reconstruction Can Restore Native Knee Kinematics in the Anterior Cruciate Ligament Reconstructed Knee: A Systematic Review of Biomechanical Cadaveric Studies

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Rationale

Limited information exists on the impact of LMPR tears and Kaplan fiber injuries in ACL-deficient knees and the effects of their repairs on restoring stability after ACL reconstruction (ACLR).

Purpose Current Study

To determine the biomechanical effects of LMPR and Kaplan fiber tears in ACL-deficient knees and assess the impact of LMPR repair, modified Lemaire tenodesis, or both, after ACLR.



Hypotheses

- Both the LMPR and the Kaplan fibers are secondary stabilizers under tibial IR and pivot shift loading in the ACL-deficient knee, and injury to both has an additive biomechanical effect.
- Both a LMPR repair and a modified Lemaire LET are needed to restore knee kinematics comparable to the intact knee state.



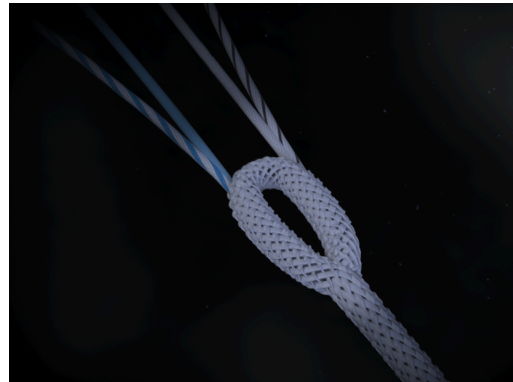
Methods

- Ten paired cadaveric knees
- KUKA 6 degrees of freedom robotic testing system
- Tibial IR measurements (5Nm)
- Pivot shift measurements (5Nm IR, 5Nm valgus, 90N ATT)
- 0-90 degrees testing, at 15 degrees increments
- Sequential sectioning of in random order of ACL, LMPR and Kaplan fibers
- LMPR repair, modified Lemaire extra-articular tenodesis in random order



Techniques

- ACL reconstruction Arthrex all-inside, quadrupled semi-tendinosus graft
- Modified Lemaire, fixation with Arthrex Fibertak
- LMPR Arthrex Sutureloc repair technique



Results

- Both the LMPR and Kaplan fibers act as secondary stabilizers to isolated IR and overall pivot shift loading in the ACL deficient knee
- Kaplan fiber tears have an additive biomechanical effect to the ACL deficient and LMPR tear knee state for isolated IR as well as for coupled IR and ATT during the pivot shift.
- ACLR alone did not fully restore stability, with significant residual increases in isolated IR (up to $5.3^\circ \pm 3.3^\circ$ at 60° , $p < 0.001$), coupled IR ($5.3^\circ \pm 3.7^\circ$ at 60° , $p < 0.001$), coupled ATT (2.8 ± 4.5 mm at 15° , $p < 0.001$), and coupled valgus rotation ($2.7^\circ \pm 2.5^\circ$ at 90° , $p < 0.001$) during pivot shift.
- Adding an LET to ACLR, with or without LMPR repair, restored stability comparable to the intact knee for isolated IR, coupled IR, and coupled ATT during pivot shift. LMPR repair in ACLR with Kaplan fiber injury restored valgus rotation stability at most flexion angles.



Conclusions

- Both the LMPR and Kaplan fibers act as secondary stabilizers to IR and pivot shift loading in the ACL deficient knee, with an additive biomechanical effect of the Kaplan fibers to the ACL with LMPR deficient knee for isolated IR and for coupled IR and ATT during the pivot shift.
- The most important reconstruction state which best restored stability comparable to the ACL intact state was the addition of a LET to either the ACLR alone or ACLR with LMPR repair state, except for valgus rotation during pivot shift, where an LMPR repair contributes most.



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