

How to Avoid Knee Tunnel Convergence When Performing a Modified Lemaire Extra-Articular Tenodesis



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Abstract: There has been a significant increase in the number of anterior cruciate ligament (ACL) reconstruction (ACLR) procedures being performed with a lateral extra-articular procedure (LEAP). However, tunnel convergence in combined ACLR and LEAP techniques has been described and can lead to damage to the graft or graft failure. This technical note describes how to avoid knee tunnel convergence when performing a modified Lemaire extra-articular tenodesis using a knotless suture anchor.

Introduction

There has been a significant increase in the number of anterior cruciate ligament (ACL) reconstruction (ACLR) procedures being performed with a lateral extra-articular procedure (LEAP). This owes to the increasing body of literature on the anterolateral ligament (ALL) and its role in rotational control of the knee.¹

The two most widely used LEAPs are modified Lemaire tenodesis and anterolateral ligament (ALL) reconstruction (ALLR).² Clinical studies have established meaningful advantages of combining an ACLR with a LEAP, including reducing ACLR graft rupture rates, protecting medial meniscal repairs, and improving

outcomes in high-risk groups, including revision ACLRs, chronic ACL injuries, and patients with hyperlaxity.³⁻⁷

However, tunnel convergence in combined ACLR and LEAP techniques has been described and can lead to damage to the graft or graft failure.^{8,9} Indeed, this can easily be avoided by using a combined ACLR and ALLR using outside-in femoral drilling.¹⁰ However, most surgeons continue to use an anteromedial portal drilling technique, which restricts the options to avoid tunnel convergence.

Surgical Technique

This technical note describes how to avoid tunnel convergence when performing a modified Lemaire extra-articular tenodesis using a knotless suture anchor (Video 1). Pearls and pitfalls plus advantages and

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Table 1. Pearls and Pitfalls

Pearls	Pitfalls
<ul style="list-style-type: none">The inferior part of the iliotibial band (ITB) should be released to ensure the ITB can be closed at the end of the procedure.Applying varus stress can aid in identification of the lateral collateral ligament.The incisions around the lateral collateral ligament should be closed to prevent fluid extravasation.	<ul style="list-style-type: none">Ensure the graft is secured close to extension or the tibia will be fixed in external rotation.Securing the graft in full extension will result in impingement with the posterior aspect of the ITB

Table 2. Advantages and Disadvantages

Advantages	Disadvantages
Using the knotless anchor avoids tunnel convergence.	Identification of the lateral collateral ligament can often be difficult.
The same incision can be used if using outside-in drilling for the femoral tunnel of the ACLR.	
Avoids hardware prominence from staples or screws	Potential for overconstraint of knee internal rotation
Minimal disruption to surrounding tissues	

disadvantages of this procedure are described in Tables 1 and 2.

Patient Positioning and Landmarks

The patient is placed in the supine position on the operating table with a lateral support at the level of a padded tourniquet and a foot roll positioned to maintain 90° of knee flexion. The injured leg is prepared and draped with the surgeon's preferred method, similar to any arthroscopic procedure around the knee. Appropriate landmarks are palpated and marked, including the joint line, Gerdy's tubercle, and lateral epicondyle (Fig 1).

Surgical Approach

Preparation for the modified Lemaire extra-articular tenodesis can be performed prior to the ACLR. A 5-cm incision centered on the lateral epicondyle is suitable for this technique. The iliotibial band (ITB) is then identified, ensuring its insertion on Gerdy's tubercle can be palpated (Fig 2).

Graft Harvest and Preparation

An incision is made in the posterior aspect of the ITB, starting at Gerdy's tubercle and extending 9 cm

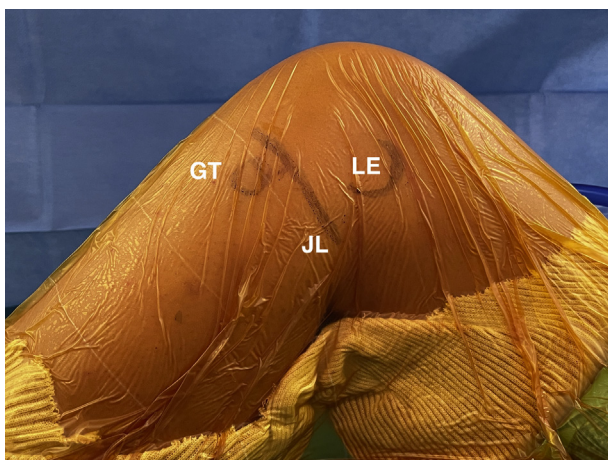


Fig 1. Patient positioning and landmarks. Left knee, lateral view. Positioned at 90° of knee flexion. Landmarks marked. GT, Gerdy's tubercle; LE, lateral epicondyle; JL, joint line.

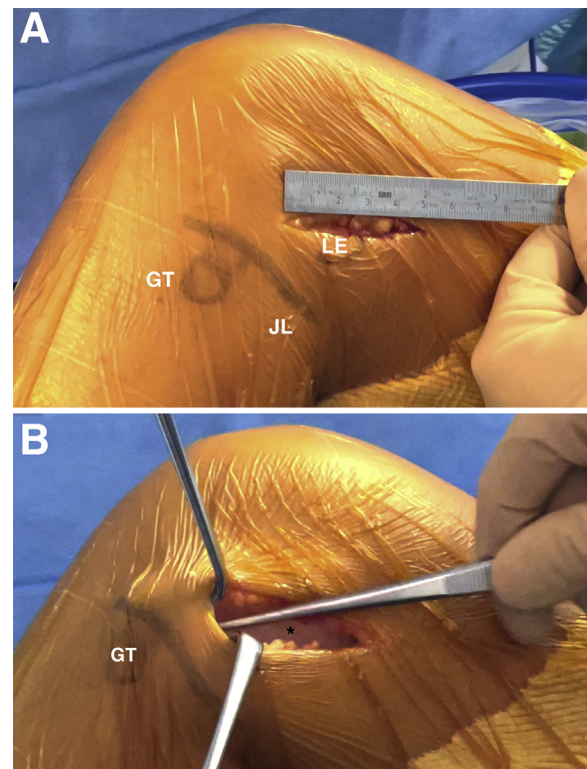


Fig 2. Surgical approach. Left knee, lateral view. (A) 5-cm incision centered on the lateral epicondyle. (B) The iliotibial band (*) is identified and Gerdy's tubercle palpated. GT, Gerdy's tubercle; JL, joint line; LE, lateral epicondyle.

proximally in the line of the fibers. Extending the incision proximally beyond the fat pad ensures the graft will be long enough. A second parallel incision is made in the ITB, 1 cm anteriorly. The incisions are then connected to create a strip of ITB (Fig 3).

The strip of ITB is peeled back to Gerdy's tubercle; then it is whip stitched using a number-0 suture

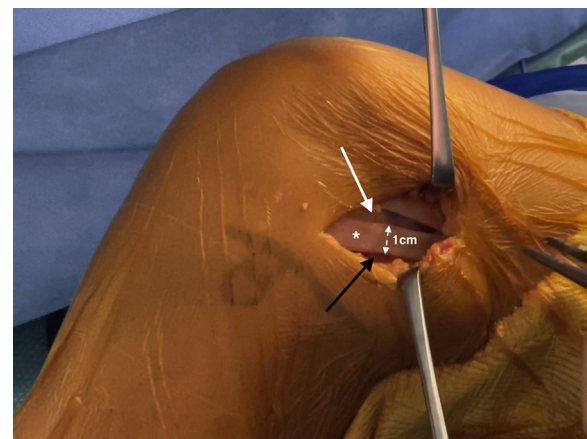
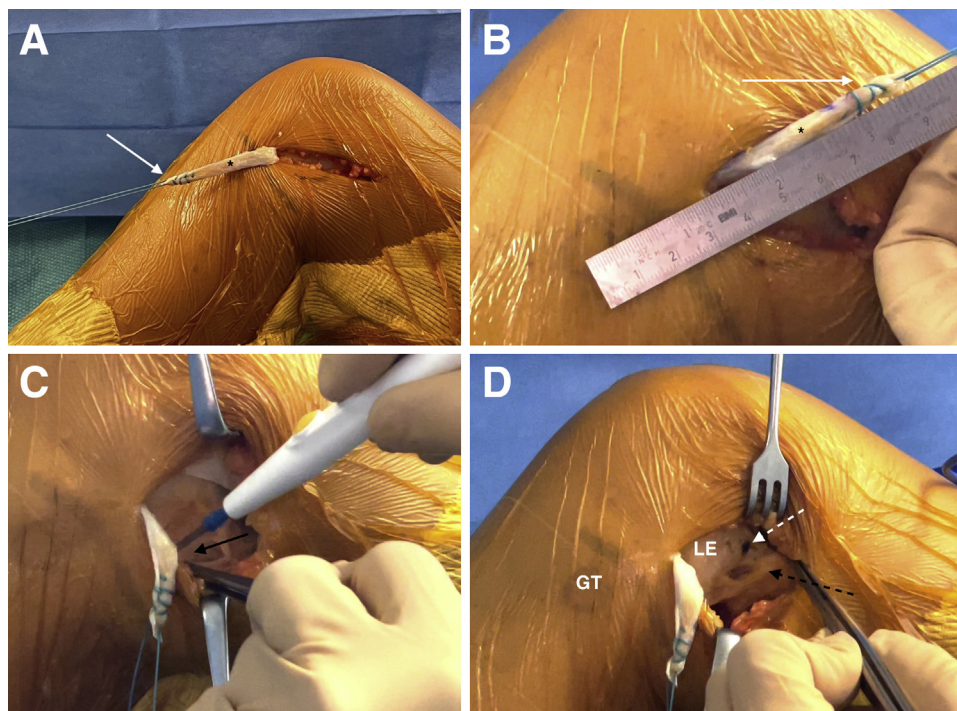


Fig 3. Graft harvest. Left knee, lateral view. The initial incision (black arrow) is made in the posterior aspect of the iliotibial band (*) then a second incision (white arrow) is made 1 cm anteriorly.

Fig 4. Graft Preparation. Left knee, lateral view. (A and B) The 9-cm strip of iliotibial band (ITB) (*) is whip stitched (white arrow) to aid in passage and fixation of the graft. (C) The inferior part of the ITB is released (black arrow) to ensure the ITB can be closed at the end of the procedure. (D) The fat pad (black dashed arrow) is released to identify the insertion point for the anchor (white dashed arrow). GT, Gerdy's tubercle; LE, lateral epicondyle.



(Mersilene, Ethicon) to aid in graft passage and fixation. The inferior part of the ITB is then released to ensure the ITB can be closed at the end of the procedure. The fat pad is also released to identify the insertion point for the anchor (Fig 4).

Graft Passage

The femoral attachment of the lateral collateral ligament (LCL) is identified. Applying varus stress can aid in its identification. An incision is then made on either side of the LCL to create a tunnel, and the graft is passed underneath the LCL using the previously whip stitched suture. The incisions around the LCL are then closed to prevent fluid extravasation (Fig 5).

Diagnostic Arthroscopy and ACL Reconstruction

High anterolateral and anteromedial arthroscopy portals are then established. A diagnostic arthroscopy is performed, and any meniscal and cartilage lesions are then addressed before the ACLR. Our preferred technique for ACLR incorporates outside-in drilling; therefore, the previously made incision can be used for the femoral tunnel.

Graft Fixation

The previously marked insertion point for the extra-articular tenodesis that was proximal and posterior to the lateral epicondyle is identified. A 2.6-mm drill is used to drill near the cortex followed by insertion of the 2.6-mm knotless suture anchor (2.6 FiberTak,

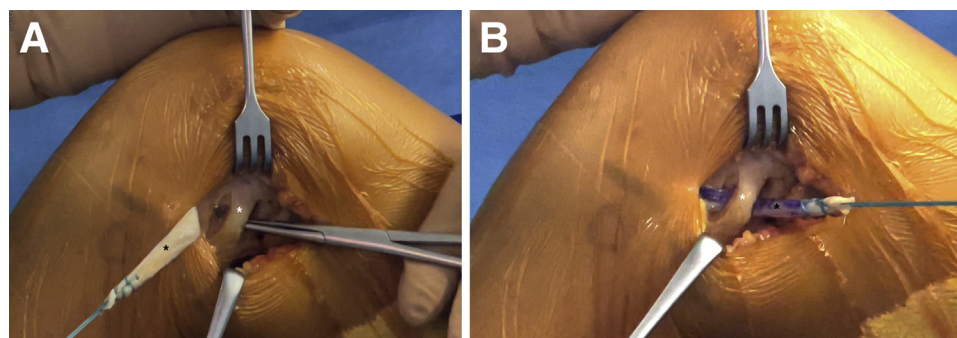


Fig 5. Graft passage. Left knee, lateral view. (A and B) The iliotibial band graft (black *) is passed underneath the lateral collateral ligament (white *).

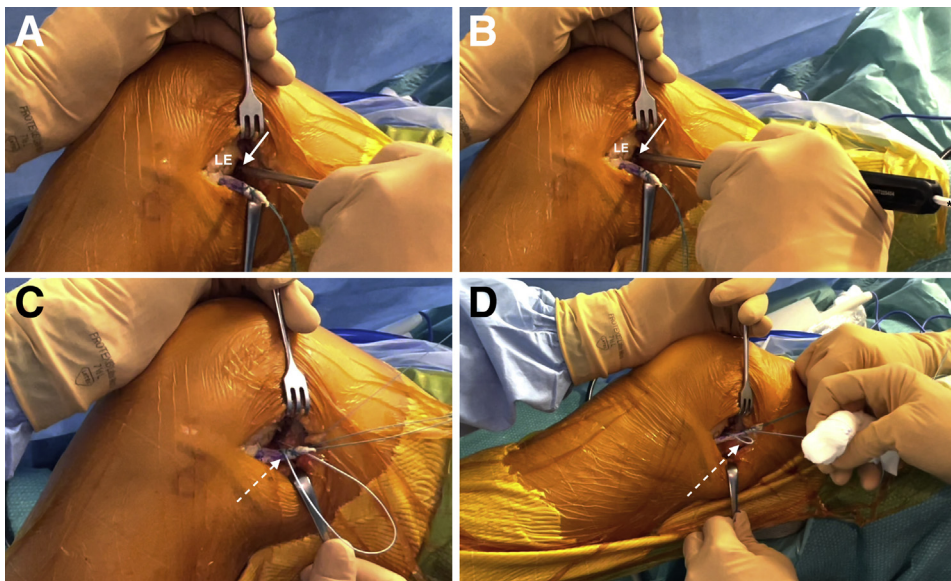


Fig 6. Graft fixation. Left knee, lateral view. (A and B) The insertion point proximal and posterior to the lateral epicondyle is identified (white arrow), and then a 2.6-mm drill is used (white *) followed by insertion of the knotless anchor (black *). (C and D) The graft is taken through the suture loop (white dotted arrow) and then fixed close to extension. LE, lateral epicondyle.

Arthrex). Importantly, the angle of the drill and anchor can be altered to ensure tunnel convergence is avoided. The whip stitched graft is then taken through a loop from the suture anchor, and the graft is fixed close to extension. This avoids fixing the tibia in external rotation (Fig 6).

The graft is then sutured back onto itself, and the fat pad is closed using a number-0 suture (Polysorb, Covidien). The iliotibial band is then closed with the same suture, aided by the previous release of its inferior part (Fig 7).

Postoperative Rehabilitation

Postoperative rehabilitation is based upon the ACLR rehabilitation and consists of brace-free, immediate full weight-bearing and progressive range of motion exercises, with restriction of range of motion to 0-90° for 6 weeks for patients who underwent meniscal repair. Early rehabilitation focused on maintaining full extension and quadriceps activation exercises. Return to sports was allowed at 4 months for nonpivoting sport,

6 months for pivoting noncontact sport, and 8 to 9 months for pivoting contact sports.

Discussion

This technical note describes how to avoid tunnel convergence when performing a modified Lemaire extra-articular tenodesis using a knotless suture anchor. The knotless suture anchor uses a minor 2.6-mm tunnel and can be easily directed to avoid any involvement with the ACL femoral tunnel. In addition, it has a low profile, avoiding hardware prominence, which is common when staples or screws are used.

Tunnel convergence has been reported in the literature with various LEAPs. Jaeger et al.⁸ described a high risk of tunnel convergence when a combined ACLR and Lemaire procedure was performed in a cadaveric study. In addition, another cadaveric study by Smeets et al.⁹ suggested there was a high risk of tunnel convergence when performing a combined ACLR and ALLR. They suggested the ALL tunnel should be aimed more

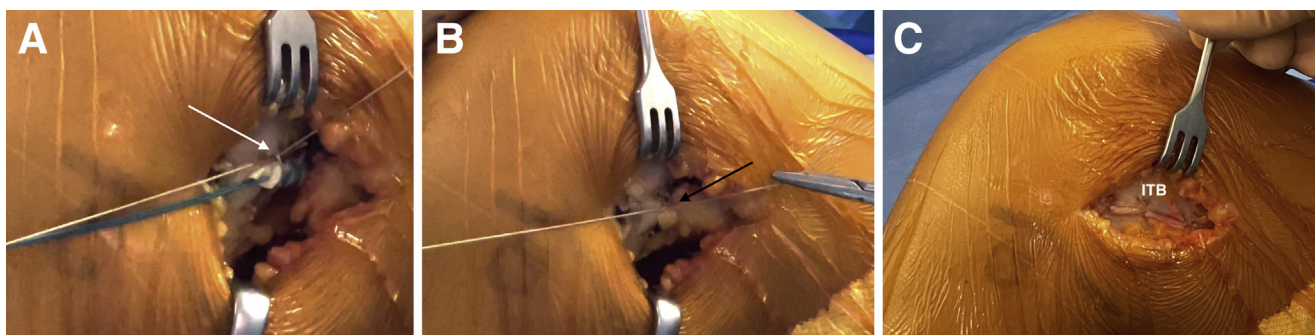


Fig 7. Closure. Left knee, lateral view. (A) Suturing the graft back on itself (white arrow). (B) Closure of the fat pad (black arrow). (C) The iliotibial band (ITB) is closed.

proximally and anteriorly to avoid this complication and confirmed this with a CT reconstruction study.¹¹

Indeed, the increasing body of evidence demonstrating the advantages of adding a LEAP to an ACLR, in particular, in reducing graft failure, means it is important to get it right the first time and avoid any secondary surgery.^{3,7} Getgood et al.³ reported a 2% rate of difficulties with the lateral extra-articular tenodesis at the time of surgery and a 3% rate of hardware removal postoperatively in the STABILITY trial. Conversely, Thaunat et al.¹⁰ reported a very low complication rate of 0.5% when performing an ALLR with the use of outside-in femoral drilling.

In summary, this technique describes how to avoid tunnel convergence when performing a modified Lemaire extra-articular tenodesis using a knotless suture anchor. It is a safe and reliable procedure and an effective alternative to traditional procedures.

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