

## SUBSPECIALTY PROCEDURES

# MODIFIED LEMAIRE LATERAL EXTRA-ARTICULAR TENODESIS AUGMENTATION OF ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

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### Abstract

**Background:** A modified Lemaire lateral extra-articular tenodesis (LET) is a procedure that is designed to address anterolateral complex (ALC) deficiency. The procedure is performed as an augmentation to anterior cruciate ligament reconstruction (ACLR) to reduce anterolateral rotatory laxity. Studies have demonstrated improved rotational control and reduced failure rates of ACLR when LET is added. This is particularly helpful in young patients with high-grade rotatory laxity returning to contact pivoting sport, and in the revision ACLR scenario.

**Description:** A 6-cm skin incision is placed just posterior to the lateral epicondyle. The subcutaneous tissue is dissected down to the iliotibial band (ITB). A 1-cm-wide by 8-cm-long strip of the posterior half of the ITB is fashioned, leaving the distal attachment at Gerdy's tubercle intact. The free end is whipstitched with number-1 Vicryl suture, tunneled deep to the fibular collateral ligament (FCL), and attached to the metaphyseal flare of the lateral femoral condyle at the insertion of the distal Kaplan fibers of the ITB. Fixation is performed with a staple, with the graft tensioned to no more than 20 N (by simply holding it taut and not "tensioned"), with the knee held at 60° of flexion and neutral rotation of the tibia.

**Alternatives:** A number of procedures to address ALC deficiency have been described. The most common methods currently are variations of the ITB LET (Lemaire [ITB graft detached proximally, passed under the FCL, and attached to the femur] or Ellison [ITB graft detached distally, passed deep to the FCL, and reattached at Gerdy's tubercle]) or anterolateral ligament reconstructions. No clinical studies have been performed that demonstrate that one technique is superior to another.

**Rationale:** Current ACLR procedures focus on intra-articular graft placement to replace the ACL. Unfortunately, high rates of graft failure and persistent rotatory laxity (pivot shift) have been observed, particularly in young, high-demand individuals returning to contact pivoting sport. ALC deficiency has been shown to be a major cause of high-grade anterolateral rotatory laxity. The

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LET procedure is therefore designed to augment ACLR and reduce anterolateral rotation. The aim of adding LET to ACLR is to reduce the strain on the ACLR graft, reduce the prevalence of the pivot shift, and thereby potentially reduce the rate of ACLR graft failure.

### Introductory Statement

The modified Lemaire lateral extra-articular tenodesis (LET) has been shown to reduce anterolateral rotatory laxity in the anterior cruciate ligament (ACL)-reconstructed knee<sup>1</sup> and hence may be important to help reduce failure of ACL reconstruction (ACLR) in young patients returning to contact pivoting sports who are at a high risk of graft failure, or in the revision ACLR scenario<sup>2</sup>.

### Indications & Contraindications

#### Indications

The following indications were developed from a recent International ALC [Anterolateral Complex] Consensus Group Meeting<sup>2</sup> and represent the current thinking as to when LET may be added to ACLR:

- Revision ACLR.
- High-grade rotational laxity (a grade-2 or 3 pivot shift).
- Generalized ligamentous laxity or genu recurvatum of  $>10^\circ$ .
- A young patient ( $<25$  years old) returning to a contact pivoting sport.

#### Contraindications

There are no specific contraindications; however, caution should be observed in patients with:

- Posterolateral corner injury.
- Lateral compartment osteoarthritis.

### Step-by-Step Description of Procedure

#### Step 1: Completion of ACLR

*The ACLR is completed prior to performing a modified Lemaire LET.*

- Pass, tension, and fix the ACL graft in a standard manner. When the ACLR is complete, perform a modified Lemaire LET (Video 1).

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**Video 1** Modified Lemaire extra-articular tenodesis surgical technique.

## Step 2: Lateral Skin Incision

*Perform the lateral skin incision.*

- Position the leg with the knee at approximately 80° of flexion.
- Make a minimum 6-cm longitudinal incision 1 cm posterior to the lateral femoral epicondyle, starting 2 cm proximal to Gerdy's tubercle (Figs. 1-A and 1-B).
- If greater visualization is required, particularly in patients with abundant subcutaneous tissue, extend the incision proximally.
- Dissect the subcutaneous fat down to the iliotibial band (ITB) and sweep the fat posteriorly to identify the posterior border of the ITB, enabling palpation of Gerdy's tubercle distally.



Fig. 1-A

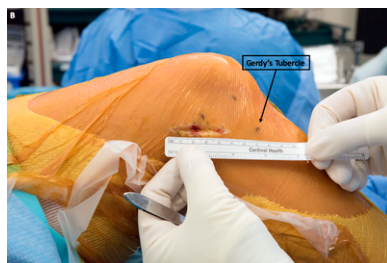


Fig. 1-B

**Figs. 1-A and 1-B** With the knee positioned at 80° of flexion (**Fig. 1-A**), a lateral skin incision is placed just posterior to the lateral epicondyle (**Fig. 1-B**).

## Step 3: Fashioning of ITB Graft

*Fashion the ITB graft.*

- Harvest an 8-cm-long by 1-cm-wide strip of ITB from the posterior half of the ITB, ensuring that the most posterior fibers of the deep ITB (capsulo-osseous layer) remain intact (Figs. 2-A, 2-B, and 3).
- Leave the distal attachment at Gerdy's tubercle intact.
- Release the deep attachments to the vastus lateralis off the proximal 6 cm of the graft and place a whipstitch with number-1 Vicryl suture (Ethicon) in the free end.

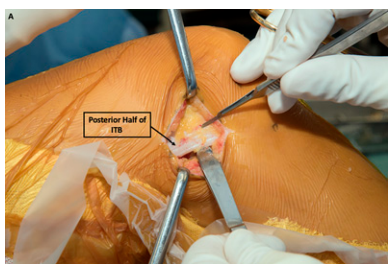


Fig. 2-A

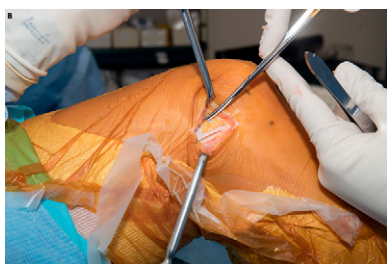


Fig. 2-B



Fig. 3

**Figs. 2-A and 2-B** In fashioning the ITB graft, a strip of ITB is harvested from the posterior half of the ITB (**Fig. 2-A**), making sure that the most posterior fibers of the deep ITB (capsulo-osseous layer) remain intact (**Fig. 2-B**).

**Fig. 3** The ITB graft measures 8 cm long and 1 cm wide.

### Step 4: Passage of the ITB Graft Deep to the Fibular Collateral Ligament (FCL)

*Pass the ITB graft beneath the FCL.*

- Identify the FCL by palpation. Place the leg in a figure-of-4 position to aid in identification.
- Make small capsular incisions anterior and posterior to the proximal portion of the FCL and place Metzenbaum scissors deep to the FCL from anterior to posterior to bluntly dissect out a tract for graft passage.
- Attempt to remain extracapsular, while ensuring there is no iatrogenic damage to the popliteus or FCL.
- Then pass the ITB graft beneath the FCL from distal to proximal using a right-angled clamp (Fig. 4).

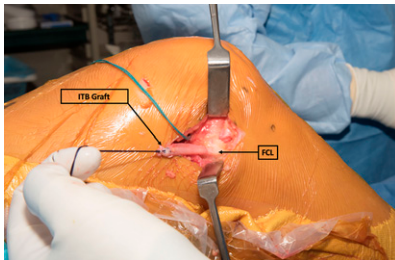


Fig. 4

**Fig. 4** The ITB graft is tunneled under the femoral attachment of the FCL.

## Step 5: Fixation of ITB Graft to Femur

*Fix the ITB graft to the femur.*

- Using electrocautery, clear the lateral femoral supracondylar area of the small fat pad found proximal to the lateral head of the gastrocnemius.
- Cauterize the superolateral genicular artery, which may be found here, to avoid unwanted bleeding.
- Identify the attachment site just anterior and proximal to the lateral head of the gastrocnemius tendon, on the lateral metaphyseal flare of the lateral femoral condyle.
- Clear the periosteum using a Cobb elevator on the metaphyseal flare of the lateral femoral condyle.
- Take care not to damage ACL femoral fixation as the suspensory loop button is often found close to this location.
- Then hold the graft taut, but not over tensioned ( $<20$  N), with the knee at  $60^\circ$  of flexion and the foot in neutral rotation to avoid lateral compartment overconstraint.
- Secure the graft using a small Richards staple (Smith & Nephew) and then fold the graft back distally and suture it onto itself using a whipstitch with number-1 Vicryl suture (Figs. 5 and 6).

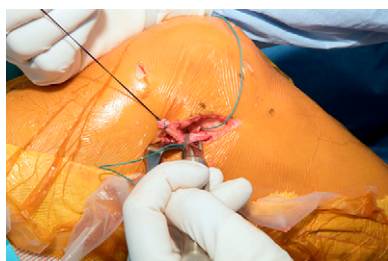


Fig. 5

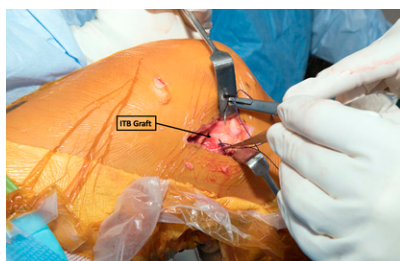


Fig. 6

**Fig. 5** Fixation of the ITB graft with a staple. The knee is at  $60^\circ$  of flexion and neutral tibial rotation.

**Fig. 6** The ITB graft is folded over the staple and is sutured onto itself.

## Step 6: Closure of the ITB

*Perform partial closure of the ITB.*

- Irrigate the wound, confirm hemostasis, and perform closure in layers.
- Close the posterior aspect of the ITB with interrupted number-1 Vicryl sutures up to the level of the transverse retinacular ligament.
- Do not close the ITB completely to avoid overtightening the lateral patellofemoral joint.

## Step 7: Postoperative Rehabilitation

*Postoperatively, manage the patient with weight-bearing and range of motion performed as tolerated.*

- Postoperative rehabilitation is the same as for any ACLR. Manage the patient with weight-bearing and range of motion performed as tolerated so long as there is no substantial meniscal repair.

## Results

The modified Lemaire LET has recently been shown to reduce anterolateral rotatory laxity in the ACL-reconstructed knee<sup>1</sup>. A number of early studies comparing ACLR with or without a lateral tenodesis showed promising results with respect to lower rates of failure with the addition of the LET<sup>3,4</sup>; however, concerns were raised with regard to restriction of external rotation, pain, and subsequent overconstraint<sup>5</sup>. This led to the procedure being mostly abandoned in the United States. In Europe, many centers continued to utilize the technique with great success<sup>6,7</sup>.

This has been illustrated by recent systematic reviews showing improved anterolateral and anteroposterior stability as measured by the pivot-shift test and the Lachman test and/or KT-1000 arthrometer (Medmetric), respectively, when LET was combined with ACLR<sup>1,8-10</sup>. However, pooled functional scores did not show superiority. Devitt et al. found that LET is not beneficial when used in early primary ACLR ( $\leq 1$  year), but it does reduce postoperative pivot-shift in delayed ACLR ( $> 1$  year)<sup>10</sup>. They also showed in a 2017 systematic review that LET with ACLR did not result in increased rates of osteoarthritis, as has previously been suggested<sup>11</sup>. Instead, meniscal involvement at the time of injury was a greater predictor of osteoarthritis. This finding has also been observed by Ferretti et al.<sup>12</sup> and Marcacci et al.<sup>6</sup> in their long-term follow-up studies. The notion that LET may be graft-protective has previously been demonstrated by Engebretsen et al., who showed that the forces going through the ACL graft may be reduced by 43% in vitro<sup>13</sup>.

## Pitfalls & Challenges

- While the FCL is usually readily palpable, in some cases it can be difficult to palpate. The knee can be placed into a figure-of-4 position to stretch the FCL and increase its tautness, thereby making it easier to palpate.
- The region of the femoral metaphyseal flare proximal and lateral to the lateral gastrocnemius head should be cleared of fat using electrocautery because branches of the superolateral genicular artery and its venae comitantes are in proximity.
- Care must be taken to identify the suspensory loop femoral fixation of the ACL graft (if one is used) as it is typically close to the desired attachment site for the LET graft.
- While biomechanical studies have suggested that the flexion angle can be between 30° and 70° of flexion<sup>14</sup>, our preference is for the LET graft to be held taut during femoral fixation (tensioned  $< 20$  N) with the knee placed at 60° of flexion and the foot in neutral rotation to avoid overconstraining the lateral compartment.

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