Technical Note

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

Graeme P. Hopper, M.D., F.R.C.S, Tr.&Orth., Abdo El Helou, M.D., Corentin Philippe, M.D.,
Joao Pedro Campos, M.D., Thais Dutra Vieira, M.D., and Bertrand Sonnery-Cottet, M.D.

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 disadvantages of using a knotless suture anchor in conjunction with an ACLR and LEAP are described. Table 1 presents a list of pearls and pitfalls.

Table 1. Pearls and Pitfalls

| Pearls                                      | Pitfalls                                      |
|---------------------------------------------|-----------------------------------------------|
| The inferior part of the iliotibial band (ITB) should be released to ensure the ITB can be closed at the end of the procedure. | Ensure the graft is secured close to extension or the tibia will be fixed in external rotation. |
| Applying varus stress can aid in identification of the lateral collateral ligament. | Securing the graft in full extension will result in impingement with the posterior aspect of the ITB. |
| The incisions around the lateral collateral ligament should be closed to prevent fluid extravasation. |                                              |

From the Centre Orthopédique Santy, FIFA Medical Centre of Excellence, Groupe Ramsay-Générale de Santé, Hopital Privé Jean Mermoz, Lyon, France.

The authors report the following potential conflicts of interest or sources of funding: B.S.-C. is a paid consultant, receives royalties and research support, and has made presentations for Arthrex. G.P.H. has received a fellowship grant from Arthrex. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received January 4, 2022; accepted February 8, 2022.

Address correspondence to Thais Dutra Vieira, M.D., Centre Orthopédique Santy, 24 Avenue Paul Santy, F-69008, Lyon, France. E-mail: thaisdutravieira@hotmail.com

© 2022 THE AUTHORS. Published by Elsevier Inc. on behalf of the Arthroscopy Association of North America. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

2212-6287/22/$ - see front matter
https://doi.org/10.1016/j.eats.2022.02.019

Arthroscopy Techniques, Vol 11, No 6 (June), 2022: pp e1111-e1115 e1111
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 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 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.

**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.
(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).
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. Jaecker et al. 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. 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
proximally and anteriorly to avoid this complication and confirmed this with a CT reconstruction study.\textsuperscript{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.\textsuperscript{3,7} Getgood et al.\textsuperscript{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.\textsuperscript{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.

References

1. Getgood A, Brown C, Lording T, et al. The anterolateral complex of the knee: Results from the International ALC Consensus Group Meeting. Knee Surg Sports Traumatol Arthrosc 2019;27:166-176.
2. Tramer JS, Fidai MS, Kadri O, Jildeh TR, Hooda Z, Makhni EC, et al. Anterolateral ligament reconstruction practice patterns across the United States. Orthop J Sports Med 2018;6:2325967118811063.
3. Getgood AMJ, Bryant DM, Litchfield R, et al. Lateral extra-articular tenodesis reduces failure of hamstring tendon autograft anterior cruciate ligament reconstruction: 2-year outcomes from the STABILITY study randomized clinical trial. Am J Sports Med 2020;48:285-297.
4. Helito CP, Camargo DB, Sobrado MF, et al. Combined reconstruction of the anterolateral ligament in chronic ACL injuries leads to better clinical outcomes than isolated ACL reconstruction. Knee Surg Sports Traumatol Arthrosc 2018;26:3652-3659.
5. Helito CP, Sobrado MF, Giglio PN, et al. Combined reconstruction of the anterolateral ligament in patients with anterior cruciate ligament injury and ligamentous hyperlaxity leads to better clinical stability and a lower failure rate than isolated anterior cruciate ligament reconstruction. Arthroscopy 2019;35:2648-2654.
6. Grassi A, Zicaro JP, Costa-Paz M, et al. Good mid-term outcomes and low rates of residual rotatory laxity, complications and failures after revision anterior cruciate ligament reconstruction (ACL) and lateral extra-articular tenodesis (LET). Knee Surg Sports Traumatol Arthrosc 2020;28:418-431.
7. Sonnery-Cottet B, Haidar I, Rayes J, Fradin T, Ngbilo C, Vieira TD, et al. Long-term graft rupture rates after combined ACL and anterolateral ligament reconstruction versus isolated ACL reconstruction: A matched-pair analysis from the SANTI study group. Am J Sports Med 2021;49:2889-2897.
8. Jaecker V, Ibe P, Endler CH, Pfeiffer TR, Herhot M, Shafizadeh S. High risk of tunnel convergence in combined anterior cruciate ligament reconstruction and lateral extra-articular tenodesis. Am J Sports Med 2019;47:2110-2115.
9. Smeets K, Bellemans J, Lamers G, et al. High risk of tunnel convergence during combined anterior cruciate ligament and anterolateral ligament reconstruction. Knee Surg Sports Traumatol Arthrosc 2019;27:611-617.
10. Thaunat M, Clowez G, Saithna A, et al. Reoperation rates after combined anterior cruciate ligament and anterolateral ligament reconstruction: A series of 548 patients from the SANTI Study Group with a minimum follow-up of 2 years. Am J Sports Med 2017;45:2569-2577.
11. Smeets K, Van Haver A, Van den Bempt S, et al. Risk analysis of tunnel collision in combined anterior cruciate ligament and anterolateral ligament reconstructions. Knee 2019;26:962-968.