Anterior cruciate ligament reconstruction with anterolateral stabilization by a modified Lemaire technique in adolescent professional football player: a case report

Hudetz, Damir; Molnar, Vilim; Jelec, Željko; Rod, Eduard; Matišić, Vid; Borić, Igor; Primorac, Dragan

Source / Izvornik: **Acta Chirurgica Croatica, 2021, 18, 15 - 20**

Journal article, Published version
Rad u časopisu, Objavljena verzija rada (izdavačev PDF)

https://doi.org/10.5281/zenodo.5501491

Permanent link / Trajna poveznica: https://urn.nsk.hr/urn:nbn:hr:184:865630

Rights / Prava: Attribution-NonCommercial-NoDerivatives 4.0 International/Imenovanje-Nekomercijalno-Bez prerada 4.0 međunarodna

Download date / Datum preuzimanja: **2024-10-04**

Repository / Repozitorij:

Repository of the University of Rijeka, Faculty of Medicine - FMRI Repository

UNIRI DIGITALNA KNJIŽNICA

dabar
DIGITALNI AKADEMSKI ARHIVI I REPOZITORIJI

Acta Chir Croat 2021; 18: 15-20

ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION WITH ANTEROLATERAL STABILIZATION BY A MODIFIED LEMAIRE TECHNIQUE IN ADOLESCENT PROFESSIONAL FOOTBALL PLAYER: A CASE REPORT

Damir Hudetz[1,2,3], Vilim Molnar[1], Željko Jeleč[1,4], Eduard Rod[1], Vid Matišić[1], Igor Borić[1,5,6,7,8], Dragan Primorac[1,2,5,6,7,9,10,11,12]

ABSTRACT

Background: Anterior cruciate ligament (ACL) tear is one of the most common injuries in professional athletes. Additional procedures, such as anterolateral ligament reconstruction and lateral extra-articular tenodesis attempt to reduce rotational instability, the most common cause of re-injury in patients with a non-isolated ACL tear.

Case study: A 17-year-old professional football player suffered a right knee injury in a direct hit to the lateral side of the knee. Magnetic resonance imaging showed anterior cruciate ligament tear and lateral knee structures soft tissue contusion. Due to the injury of the lateral structures and the increased risk of ACL re-rupture, it was decided to perform ACL reconstruction with additional anterolateral stabilization by a modified Lemaire technique without additional screw fixation in the area of the lateral femoral epicondyle, which could damage the epiphyseal plate and, concurrently, impair bone growth.

Conclusion: The addition of lateral extra-articular tenodesis by a modified Lemaire technique prevents rotational instability in a patient with expressed pivot-shift before the surgery, without overconstraint of the knee and additional damage to the epiphyseal plate.

KEYWORDS: anterior cruciate ligament reconstruction, lateral extra-articular tenodesis, Lemaire procedure, professional football player

INTRODUCTION

PAnterior cruciate ligament (ACL) tear is one of the most common injuries in professional athletes [1]. Ever since arthroscopic ACL reconstructions using autologous tendon grafts have first been performed, operative techniques were improving so that the reconstructed ACL has a function as close as possible to the native ACL. Nevertheless, recurrent ruptures of the reconstructed ACL are a problem especially in professional athletes who are expected to continue the sport at the top level after surgery and rehabilitation [2].

Residual rotational instability after ACL reconstruction is one of the most common causes of re-injury. It is common in patients who, in addition to ACL rupture, have damage to other knee structures such as meniscus root tear, anterolateral ligament and distal Kaplan fiber sectioning, collateral ligament injury, posterolateral and posteromedial knee angle injury [3]. For this reason, patients with injury to other knee structures often undergo additional anterolateral stabilization by anterolateral ligament reconstruction or lateral extra-articular tenodesis (LET) to attempt to reduce internal tibial rotation and anterior tibial translation [4].

Another demanding group of patients to perform ACL reconstruction are pediatric patients with open epiphyseal plates in whom surgery and fixation of the ACL or LET graft in the area of the growth plate could cause lower extremity length discrepancies [5]. Furthermore, almost every fourth young athlete with an ACL injury who returns to a risky sport will get another

[1] *St. Catherine Specialty Hospital, 49210 Zabok/10000 Zagreb, Croatia*
[2] *Faculty of Medicine, Josip Juraj Strossmayer University of Osijek, 31000 Osijek, Croatia*
[3] *Department of Orthopedics, Clinical Hospital "Sveti Duh", 10000 Zagreb, Croatia*
[4] *Department of Nursing, University North, 48 000 Varaždin, Croatia*
[5] *Medical School, University of Split, 21000 Split, Croatia*
[6] *Medical School, University of Rijeka, 51000 Rijeka, Croatia*
[7] *Medical School, University of Mostar, 88000 Mostar, Bosnia and Herzegovina*
[8] *Department of Health Studies, University of Split, 21000 Split, Croatia*
[9] *Eberly College of Science, The Pennsylvania State University, University Park, State College, PA 16802, USA*
[10] *The Henry C. Lee College of Criminal Justice and Forensic Sciences, University of New Haven, West Haven, CT 06516, USA*
[11] *Faculty of Dental Medicine and Health, Josip Juraj Strossmayer University of Osijek, 31000 Osijek, Croatia*
[12] *Medical School REGIOMED, 96 450 Coburg, Germany*
Corresponding author: *Damir Hudetz, St. Catherine Specialty Hospital, 49210 Zabok/10000 Zagreb, Croatia*
e-mail: *ortohud@gmail.com*
DOI: *10.5281/zenodo.5501491*

ACL injury at some point in their career, most often in the early days of returning to the game [2].

Here, we present a case of a 17-year old patient who underwent anterior cruciate ligament reconstruction with a quadruple semitendinosus tendon with anterolateral stabilization with LET by a modified Lemaire technique without additional screw fixation in the area of the lateral femoral epicondyle.

CASE STUDY

A 17-year-old professional football player suffered a right knee injury by a direct hit to the lateral side of the knee. After the next injury, when playing football again, swelling occurred. During the clinical examination, the positive Lachmann test and positive Jerk test were verified. Joint laxity and hypermobility, proven by the Beighton hypermobility score (9/9), were also dominant (Figure 1). Magnetic resonance imaging showed anterior cruciate ligament tear and lateral knee soft tissue structures contusion. Due to the injury of the lateral structures and the increased risk of ACL re-rupture, it was decided to perform ACL reconstruction with additional anterolateral stabilization with the modified Lemaire technique.

The patient was placed in a supine position on the operating table in spinal anesthesia. Before the start of the operation, another clinical examination was performed. After arthroscopy through standard anteromedial and anterolateral portals confirmed ACL rupture, an additional vertical incision was made to take the semitendinosus tendon for ACL graft preparation (Figure 2). The tendon was processed at the station to model a quadruple ACL graft 65 mm long, 9 mm wide distally (tibial side) and 8.5 mm proximally (femoral side). Muscle tissue remnants have been preserved on the graft as described in the study Ćuti and colleagues [6] (Figure 3). Also, an incision was made above the distal part of the iliotibial band and the middle part of the band was taken, approximately 6 mm in diameter and 10 cm in length (Figures 4-6). The bundle of the iliotibial band was dissected to Gerdi's tubercle and proximally whipstitched (Figure 7). The bundle was pulled below the lateral collateral ligament and the site of fixation proximal and dorsal to the lateral epicondyle was marked after the X-ray control, to avoid drilling through the epiphyseal plate (Figures 8-9). Through the anteromedial portal, a femoral tunnel 30/23 was placed on the prepared marking with an 8.5 mm FlipCutter® Drill (Arthrex) using an outside-in guide (Figures 10-12). The tibial tunnel for ACL reconstruction was placed in a preserved ACL stump using a 30/9mm FlipCutter® Drill (Arthrex) at an angle of 55 degrees. The anterior cruciate ligament was reconstructed by the prepared semitendinosus graft with the All-inside technique. The graft was fixated proximally and distally with TightRope® RT Graft Fixation Implant (Arthrex) in 30 degrees of flexion (Figure 13). The prepared bundle of the iliotibial tract was passed under the lateral collateral ligament and was fixed in 70 degrees of flexion by the "button" of femoral TightRope® RT Graft Fixation Implant in neutral rotation (Figure 14). Arthroscopically, good tension and stability of the graft and the absence of impingement in the extension were proven (Figure 15). The X-ray showed a good position of tunnels and fixation implants (Figure 16). The wounds were thoroughly washed, drainage was placed, and the wounds were sutured in layers and bandaged (Figures 17-18).

On the first postoperative day, the drainage was removed, the patient was mobilized and discharged from the hospital for home treatment. The patient's right leg was placed in a brace locked in extension for one week, consecutively opened for a range of motion from 0 to 90 degrees during physical therapy for the first 4 weeks after surgery.

The patient came for follow-up assessment two weeks and one month after the operation, after which the crutches were gradually discarded. Additional physical therapy was requested in terms of continuing to strengthen the hamstrings, adductors and the medial head of the quadriceps muscle. Three months after the surgery, the patient was without knee pain and swelling, and clinical examination showed normal knee stability and mobility.

DISCUSSION

According to the International Anterolateral Complex Consensus Group, indications for adding the LET to ACL reconstruction procedure are revision ACL reconstruction, high-grade pivot shift, generalized ligamentous laxity or genu recurvatum of more than 10 degrees, and young patients returning to pivoting activities [7]. Since our patient was a 17-year-old presenting with pivot-shift and ligamentous laxity proven by the Beighton hypermobility score (9/9), it was correct to perform additional anterolateral stabilization by a modified Lemaire technique. Furthermore, the patient had MRI confirmed contusion of lateral knee soft tissue structures. If left untreated, anterolateral complex injuries can lead to residual anterolateral rotational instability after ACL reconstruction, which can jeopardize ACL reconstruction outcomes and increase the risk of graft rupture or subsequent meniscus injury, especially in patients returning to exercise or sports activity [7,8]. Besides, secondary ACL injury in young athletes returning to sport is 30 to 40 times more common than primary ACL injury in hitherto uninjured young athletes [2].

Biomechanical studies have shown that LET, as an adjunct to ACL reconstruction, reduces anterior tibial translation and anterolateral rotational instability, with reduced force on the graft itself when anteriorly directed loading is applied [4,8–10]. Thus, LET protects the ACL graft in the postoperative period. ACL reconstruction with a modified Lemaire procedure for knees with

rotational instability allows for equivalent isokinetic muscle recovery as well as stand-alone ACLR in knees without rotational instability [8]. Therefore, adding LET to standard ACL reconstruction provides additional stability without compromising isokinetic muscle recovery at the time of return-to-play.

Compromised limb growth after ACL reconstruction in children is not given enough attention and the same problems are insufficiently reported, which is why the knowledge on the topic is insufficient [5]. Although there are no concrete conclusions and guidelines on this issue, according to a systematic review by Gupta et al., the all-epiphyseal ACL reconstruction technique can achieve good postoperative functional outcomes while minimizing the risk of the growth plate disturbance and potentially related discrepancies in leg length [11]. In addition to trying to compromise the growth plate as little as possible with this ACL reconstruction technique, we have also performed a modified Lemaire technique of lateral extra-articular tenodesis. By suturing the iliotibial bundle for the "button" of femoral TightRope® RT, we avoided additional fixation that would further damage the growth zone (Figure 14).

The limitation of this case report was the short follow-up period of the patient. Nevertheless, the main goal of this article was to present a new anterolateral stabilization technique that does not use additional fixation methods that could damage the growth plate. Also, a follow-up period of three months was sufficient to show satisfactory stability without overconstraint of the knee.

CONCLUSION

The addition of LET by a modified Lemaire technique prevents rotational instability in a patient with expressed pivot-shift before the surgery, without overconstraint of the knee and additional damage to the epiphyseal plate, if the iliotibial bundle is sutured to "button" of femoral TightRope® RT.

CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest.

The patient and his mother gave their informed consent prior to the patient's inclusion in a case report.

REFERENCES:

1. *Siegel L, Vandenakker-Albanese C, Siegel D. Anterior Cruciate Ligament Injuries. Clin J Sport Med. 2012;22:349–55.*
2. *Wiggins AJ, Grandhi RK, Schneider DK, Stanfield D, Webster KE, Myer GD. Risk of Secondary Injury in Younger Athletes After Anterior Cruciate Ligament Reconstruction. Am J Sports Med. 2016;44:1861–76.*
3. *Bernholt DL, Kennedy MI, Crawford MD, DePhillipo NN, LaPrade RF. Combined Anterior Cruciate Ligament Reconstruction and Lateral Extra-Articular Tenodesis. Arthrosc Tech. 2019;8:e855–9.*
4. *Geeslin AG, Moatshe G, Chahla J, Kruckeberg BM, Muckenhirn KJ, Dornan GJ, et al. Anterolateral Knee Extra-articular Stabilizers: A Robotic Study Comparing Anterolateral Ligament Reconstruction and Modified Lemaire Lateral Extra-articular Tenodesis. Am J Sports Med. 2018;46:607–16.*
5. *Collins MJ, Arns TA, Leroux T, Black A, Mascarenhas R, Bach BR, et al. Growth Abnormalities Following Anterior Cruciate Ligament Reconstruction in the Skeletally Immature Patient: A Systematic Review. Arthroscopy. 2016;32:1714–23.*
6. *Ćuti T, Antunović M, Marijanović I, Ivković A, Vukasović A, Matić I, et al. Capacity of muscle derived stem cells and pericytes to promote tendon graft integration and ligamentization following anterior cruciate ligament reconstruction. Int Orthop. 2017;41:1189–98.*
7. *Getgood A, Brown C, Lording T, Amis A, Claes S, Geeslin A, et al. The anterolateral complex of the knee: results from the International ALC Consensus Group Meeting. Knee Surgery, Sport Traumatol Arthrosc. 2019;27:166–76.*
8. *Joseph L, Demey G, Chamu T, Schmidt A, Germain A, van Rooij F, et al. Adding a modified Lemaire procedure to ACLR in knees with severe rotational knee instability does not compromise isokinetic muscle recovery at the time of return-to-play. J Exp Orthop. 2020;7:84.*
9. *Slette EL, Mikula JD, Schon JM, Marchetti DC, Kheir MM, Turnbull TL, et al. Biomechanical Results of Lateral Extra-articular Tenodesis Procedures of the Knee: A Systematic Review. Arthroscopy. 2016;32:2592–611.*
10. *Hewison CE, Tran MN, Kaniki N, Remtulla A, Bryant D, Getgood AM. Lateral Extra-articular Tenodesis Reduces Rotational Laxity When Combined with Anterior Cruciate Ligament Reconstruction: A Systematic Review of the Literature. Arthroscopy. 2015;31:2022–34.*
11. *Gupta A, Tejpal T, Shanmugaraj A, Horner NS, Gohal C, Khan M. All-epiphyseal anterior cruciate ligament reconstruction produces good functional outcomes and low complication rates in pediatric patients: a systematic review. Knee Surgery, Sport Traumatol Arthrosc. 2020;28:2444–52.*

FIGURES

Figure 1. Knee hyperextension is one of the landmarks of joint laxity and hypermobility (Beighton score), which was seen in physical examination right before the surgery.

Figure 2. Semitendinosus tendon harvesting for an anterior cruciate ligament graft.

Figure 3. Quadruple semitendinosus graft for all-inside anterior cruciate ligament reconstruction with preserved muscle tissue remnants.

Figure 4. Surgical landmarks on the lateral side of the knee, showing Gerdy's tubercle, the fibular head, and the lateral femoral epicondyle together with planned incision for iliotibial band bundle preparation.

Figure 5. Incision above lateral epicondyle for iliotibial band dissection.

Figure 6. A bundle of iliotibial band dissected for anterolateral knee stabilization by a modified Lemaire technique.

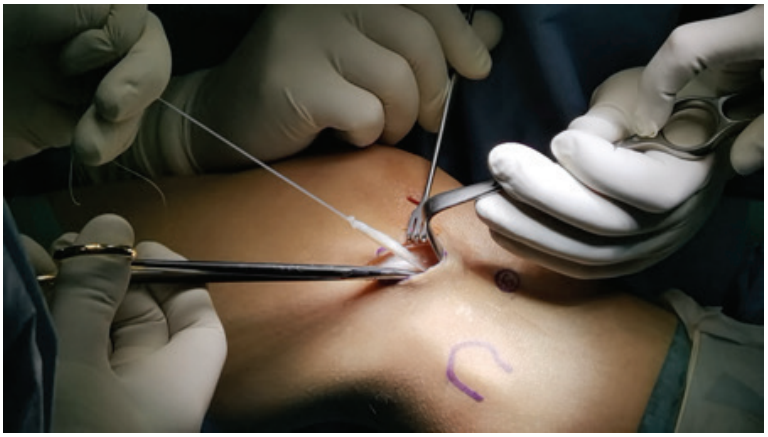

Figure 7. Proximally sutured dissected bundle of the iliotibial band for anterolateral knee stabilization by a modified Lemaire technique.

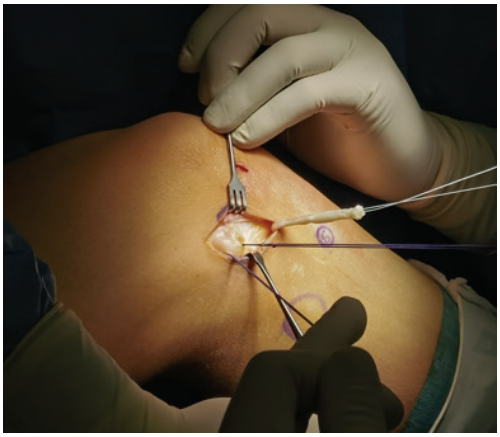

Figure 8. Pulling the bundle of the iliotibial band under the lateral collateral ligament.

Figure 9. X-ray controlled placing the guidewire below the femoral epiphyseal plate to avoid drilling the femoral tunnel, for anterior cruciate ligament reconstruction, through the epiphyseal plate

Figure 10. Preparing the femoral tunnel for anterior cruciate ligament reconstruction with the FlipCutter® Drill (Arthrex) using an outside-in guide.

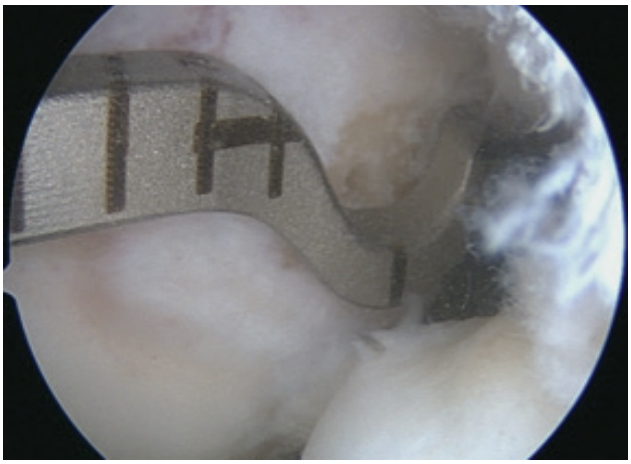

Figure 11. Joint-side femoral tunnel localization using an outside-in guide for the reconstruction of the anterior cruciate ligament.

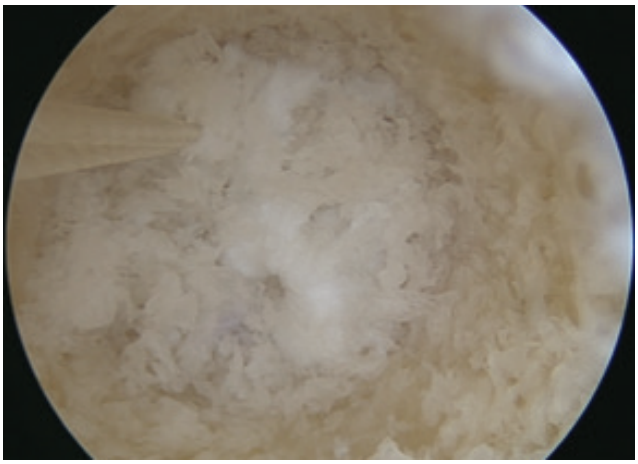

Figure 12. Femoral tunnel for anterior cruciate ligament reconstruction without involving the epiphyseal plate.

Figure 13. TightRope® RT (Arthrex) "button" fixation on the femoral epicondyle.

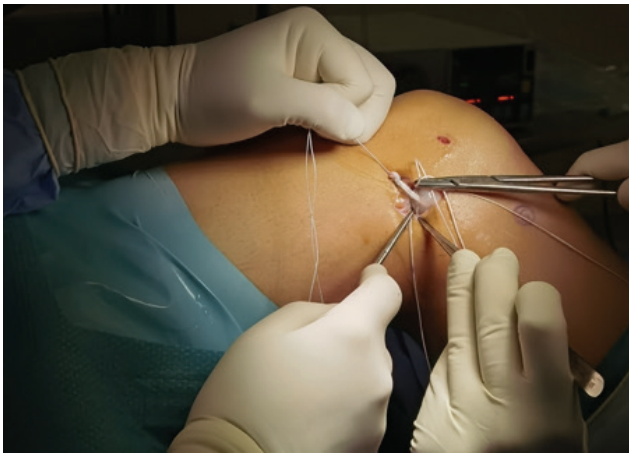

Figure 14. Fixating the iliotibial band bundle for the TightRope® RT (Arthrex) "button" on the lateral femoral epicondyle after anterior cruciate ligament reconstruction presents an anterolateral knee stabilization method that doesn't involve additional fixation implants which could damage the epiphyseal plate in the pediatric population and young adolescents.

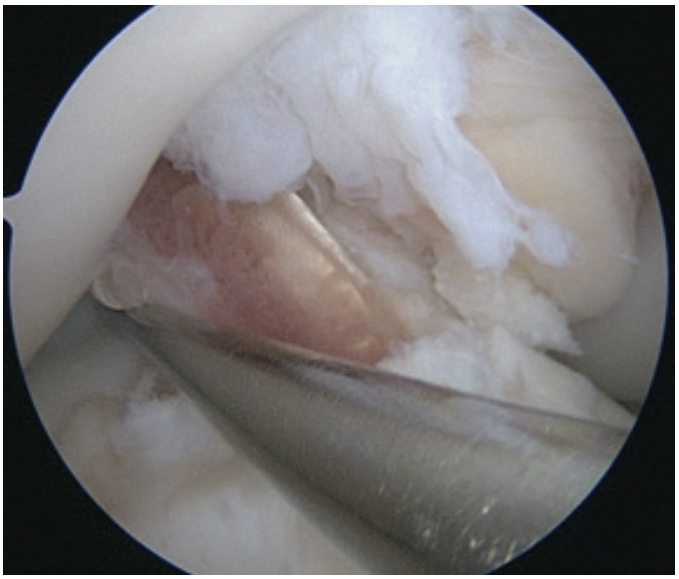

Figure 15. The uptight anterior cruciate ligament graft.

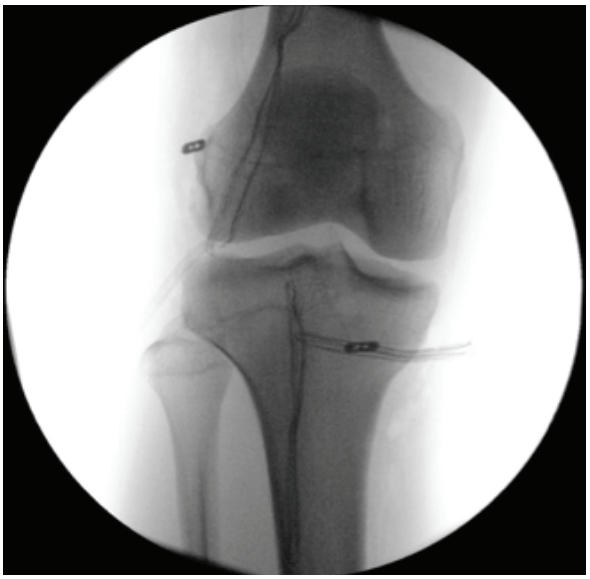

Figure 16. X-ray control after proximal and distal anterior cruciate ligament graft fixation.

Figure 17. Sutured iliotibial band after anterolateral stabilization with the modified Lemaire technique.

Figure 18. Patient's knee after the closure of the wounds.