A new technique for combined anterior cruciate ligament and anterolateral ligament reconstructions is described. An iliotibial band strip is used as an ALL graft, leaving the distal insertion intact and fix it with a knotless anchor on the femoral origin, after tunneling it under the lateral collateral ligament.

Keywords: anterolateral ligament; reconstruction; surgical technique.

INTRODUCTION

Anterior cruciate ligament (ACL) tears are one of the most common knee injuries with an annual incidence of 68.6 per 100,000 person-years (17) and frequently require surgical reconstruction. However, re-rupture of the ACL graft is reported in approximately 1.7% to 18% of patients (15,31) and a remaining post-operative pivot shift is seen in 11% to 60% of patients (10,11,29). Therefore, several authors advocate the use of a lateral extra-articular tenodesis (LET) in combination with an ACL reconstruction and report good to excellent clinical results (3,23).

Since a detailed anatomical description of the anterolateral ligament (ALL) was given (2), ALL reconstructions as a LET procedure are becoming more popular and several techniques are described (1,5,22). To date, two outcome study were identified showing a significant reduced ACL failure rate (26) and good clinical results at 2-year follow-up (27). Biomechanical studies have shown that the ALL functions as a secondary stabilizer to the ACL in resisting anterior tibial translation and internal tibial rotation. (13,14,25,28,30). In the literature however, there is no consensus on graft choice, fixation method and ALL landmarks. The aim of this article was to describe our technique for combined ACL and ALL reconstructions.

SURGICAL TECHNIQUE

The patient is placed in supine position on a standard operating table with the injured leg in an automatic leg holder (Maquet, Rastatt, Germany). The knee is able to move freely through the full range of motion and a tourniquet is inflated high on

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the thigh. Before the application of the povidone-iodine – coated cutaneous drape, bony landmarks, the joint level and the incisions are marked. (Figure 1). The surgical technique for a combined ACL and ALL reconstruction is performed in 5 consecutive steps:

1. **ACL Graft Preparation**
   An 3cm long incision is made over the pes anserine parallel with the hamstring tendons. With respect to the infrapatellar branches of the n. saphenous, the semitendinosus is harvested with a closed stripper and prepared as a quadruple ACL graft of at least 8mm using a suspensory fixation system (Tightrope, Arthrex, Naples, USA). If less diameter, the gracilis tendon is taken and a six-strand ACL graft is made.

2. **ACL Tunnel Positioning**
   A high parapatellar anterolateral portal was made as a viewing portal for the arthroscopic part of the procedure. A low anteromedial portal was established as the working portal for the femoral ACL drilling. An arthroscopic debridement of the anterior cruciate ligament and notch was performed to have a clear view on the medial wall of the LFC. A femoral offset guide of 5 mm (6mm if ACL graft ≥ 9mm) was placed behind the LFC while the knee was fully flexed. Next an ACL tightrope drill pin of 4mm was placed at a 2 or 10 o’clock position (for the left and the right knee, respectively) and subsequently overreamed to the size of the ACL graft with a total tunnel length of 25mm.

Next the tibial tunnel is made by placing a drill pin within the native ACL tibial footprint and by overreaming it to the size of the ACL graft. Before passing the ACL graft, ALL tunnel preparation is performed to avoid tunnel collision.

3. **ALL Graft Preparation**
   A straight lateral incision is established from the lateral epicondyle (LE) to a point just inferior of Gerdy’s tubercle, and dissection of the subcutaneous tissue is performed until the fibers of the ITB are seen. (Figure 1, Figure 2) A 6-8cm long and 1cm width strip is cut in the posterior part of the iliotibial band (ITB).
The distal insertion of the ITB remained intact and the graft is tunneled under the lateral collateral ligament (LCL), just beneath his femoral insertion. (Figure 3, Figure 4)

The ALL insertion point is identified, as described by the ALL Expert Group, just proximal and posterior of the LE (24). From this position, a 2.4mm guidewire is drilled anteriorly in the axial plane and perpendicular to the anatomical axis of the femur in the coronal plane. (Figure 5)

It is verified under arthroscopic view if the guidewire doesn’t interfere with the femoral ACL tunnel. (Figure 6) If so, the guidewire is repositioned to a more anterior and/or proximal direction, with attention to not violating the trochlear groove. The guidewire is then overdrilled to increase the diameter to 4.5mm with a total tunnel length of 25mm.

4. ACL Graft Fixation

After preparation of both ACL and ALL tunnels, the ACL graft is passed from the tibia to the femur. The femoral fixation is performed with the knee in 45° of flexion and neutral rotation.
double fixation with first a post screw and then an interference screw is used.

5. ALL Graft Fixation

The free end of the ITB strip is whipstitched with No. 2 absorbable suture for a length of 1cm and the suture wires are passed through the eyelet of a 4.75mm knotless anchor (SwiveLock, Arthrex, Naples, USA). (Figure 7) Fixation of the ALL graft is performed with the knee in 45° of flexion and neutral rotation.

DISCUSSION

The aim of this article was to describe our technique for combined ACL and ALL reconstructions. The renewed interest in the anterolateral compartment is largely attributed to the high number of patients with remaining anterolateral rotatory instability after isolated ACL reconstructions (ACLR). It has been demonstrated that the supplementation of a LET procedure is effective in reducing this rotational laxity (9). Moreover, biomechanical studies highlighted the importance of the ALL as an anterior and rotational stabilizer in the knee (13,16).

As a consequence, ALL reconstructions (ALLR) are gaining popularity and several surgical techniques for anatomic ALLR are described in literature, but there is still a lack of comparative biomechanical and clinical studies.

Biomechanical studies described the potential overstuffing of the tibiofemoral joint by an ALLR (6,8,18). Therefore, graft choice is important and commonly used graft types are gracilis (4,7,21,22), semitendinosus (1), iliotibial band (12) and polyester tape (32). It has been demonstrated that hamstring grafts have a 5-8x higher elastic modulus than the ALL and so could theoretically overconstrain the lateral compartment (19,20). The ITB however, had also a higher elastic modulus than the ALL, but data showed significant lower values in comparison to the hamstring tendons (19). Another biomechanical study on the structural properties of the different ALL grafts demonstrated a significant higher stiffness for the gracilis relative to the ITB (33). Therefore, we prefer the ITB band over the hamstring tendons to reduce the risk of overtightening the lateral compartment.

Cadaveric and radiographic studies from our group showed a high risk of tunnel collision (67%) in combined ACL and ALL reconstructions and this could be avoided by aiming the ALL tunnel anteriorly and perpendicular to the anatomical axis of the femur. (Unpublished data, January 2018) Because tunnel collision can lead to graft rupture, ALL tunnel orientation need to be adjusted. Attention should also be given to the ALL femoral fixation method. The ALL Expert Group reached a consensus about his origin, being proximal and posterior to the lateral epicondyle on the femur (24). Because of this close proximity to the LCL origin, there is a high risk of iatrogenic damage to this ligament when a large diameter femoral ALL tunnel is drilled (7).

To reduce that risk, we prefer to create a smaller 4.5mm tunnel instead of larger diameter tunnels (1,22). Also the positioning of the leg in ALL graft fixation has been heterogeneous in the literature, and the ALL Expert Group reached a consensus to fix the graft with the knee in full extension and the foot in neutral rotation. However, Parsons et al. (16) showed that the ALL is an important stabilizer of internal rotation at knee flexion angles greater than 35° and therefore we prefer a fixation of the ALL at 45° of flexion.

Our recommendation is to perform combined ACL and ALL reconstructions in patients participating in pivoting sports, adolescents, patients with a high-grade pivot shift, high-level athletics, hyperlax patients and revision cases. However, future studies are required to evaluate the efficacy and long-term results of the different ALL reconstruction techniques.

REFERENCES


