Technical Note

# All-Onlay Anterolateral Ligament Reconstruction Technique of the Knee

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**Abstract:** The anterolateral ligament has gained attention as a secondary stabilizer of anterolateral rotatory stability of the knee. This has had implications among sports medicine specialists as an adjunct procedure with anterior cruciate ligament reconstruction to improve stability. As indications have evolved for its use as an anterior cruciate ligament reconstruction augment, so have the techniques for reconstruction. As such, we present a simple, efficient, and reproducible technique for all-onlay reconstruction with low-profile instrumentation that mitigates concerns for tunnel convergence.

The overall incidence of anterior cruciate ligament (ACL) ruptures has been reported as high as 68.6 ruptures per 100,000 person-years,[1] with known peak incidences occurring between the ages of 19 and 25 years old in male patients and 14 and 18 years old in female patients.[1] ACL reconstruction is commonly performed in the young active patient in the setting of ACL injury. Unfortunately, in certain populations and under certain conditions, persistent instability of the athletic knee may remain despite appropriate ACL reconstruction technique.[2,3]

Causes of continued instability may be caused by graft type (allograft vs autograft), technical errors, or simply persistent rotary instability caused by injury of the anterolateral ligament (ALL).[4] Unfortunately, even with reconstruction of the ALL complex, there may still be clinical signs of instability.[5,6] The ALL has descriptions as long back as 1879 by Dr. Paul Segond, with observations of avulsion fractures in the area of what we believe to be the tibial attachment of the ALL—the so-called “Segond fracture.”[7] Biomechanical studies of the ALL structure have been aimed at identifying its role in knee stability[8-10] and therefore its utility in reconstruction when this ligament is insufficient.

Various techniques for lateral extra-articular reconstruction have been described throughout the literature. ALL augmentation combined with ACL reconstruction has shown good clinical results.[5,11] Unfortunately, these techniques have not been without problems. For example, in addition to concerns over increased operative time and cost for extra-articular augmentation, tunnel convergence has been shown to be a concern,[12,13] which can have devastating consequences if not identified.

There is clear, demonstrated benefits of augmentation of ACL reconstruction with ALL reconstruction.[5,11] However, technical concerns of tunnel convergence with concomitant ALL and ACL reconstruction exist, and surgeons have been working to address the complications that can arise as a result of augmentation.[12,13] The purpose of the design of our ALL reconstruction technique is to create a simple, efficient, and reproducible, method for all-onlay reconstruction with low-profile instrumentation that mitigates concerns for tunnel convergence.

## Surgical Technique

### Preoperative Planning

Our first step in evaluation of the patient is to take a complete history and a focused ligamentous clinical examination of the injured knee. Our history consists of understanding whether the injury is in the setting of a

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previous ACL reconstruction or whether this is a primary injury in a native knee without previous surgery. Our indications for planning an ACL reconstruction with an ALL reconstruction augmentation include ACL reconstruction in the revision setting. In particular, consideration is given to ALL reconstruction in those individuals who have had ACL reconstruction with well-executed technique (e.g., proper tunnel placement), in which ACL reconstruction technique is not the presumed "cause" of failure.

Our indications for planning an ACL reconstruction with ALL reconstruction augmentation include revision ACL reconstructions and in nonrevision patients with hyperextension >10° (Video 1). Our standard imaging workup includes standard 4 view radiograph of the knee assessing overall joint alignment. In some cases, a Segond fracture may be seen, which is indicative of ALL injury, and a pathognomonic radiographic finding in patients with ACL injury. Magnetic resonance imaging scanning is also recommended for a more detailed evaluation of ligamentous damage and possible associated intra-articular damage of the knee.

## Positioning

The patient is positioned in the supine position on a flat-top table with the leg portion of the table flexed to 100°, such that the operative leg can flex to 90°. The contralateral leg is abducted, the hip flexed to 20° to 30°, and the knee flexed to 60° in a well-leg holder. A nonsterile tourniquet is applied to the proximal thigh of the operative extremity, and this is insufflated to 250 mm Hg during the surgical procedure. The operative thigh, distal to the tourniquet but proximal to the knee, is placed in a circumferential arthroscopic leg holder (AliMed, Dedham, MA). This stabilizes the knee from varus or valgus displacement during the case. The extremity is then prepped in standard sterile fashion (Fig 1).

## Surgical Approach

It is the surgeon's preference to most commonly perform ACL reconstruction with quadriceps autograft, but it should be noted that this described method of ALL reconstruction can be performed with any standard ACL reconstruction technique. We start the surgical case by marking out the anatomic landmarks of the fibular head, Gerdy tubercle, lateral epicondyle of the femur, and the femoral and tibial insertions of the ALL (Fig 2). In addition to these landmarks, we mark out our standard landmarks for quadriceps tendon harvest ∼2 cm in length just proximal to the superior pole of the patella to harvest an all-soft tissue quadriceps autograft.

Our initial step is to proceed with a standard ACL reconstruction. The author's preferred technique is an all-inside, all-soft tissue quadriceps tendon autograft ACL reconstruction using suspensory fixation on the tibia as well as the femur. After graft preparation of the ACL, tunnel placement of the tibial tunnel, and tunnel placement of the femoral tunnel, we then turn our attention to placement of the ALL. Of note, the ACL graft has not yet been passed or fixated. Our desired graft dimensions and type for ALL reconstruction is a 4.5- to 5.0-mm × 230- to 250-mm gracilis allograft.

We begin the ALL reconstruction by making an ∼10- to 20-mm incision just posterior and proximal to the lateral epicondyle. Dissection is taken down through the subcutaneous tissue and the iliotibial (IT) band is split. We then hold this retracted with 2 Senn retractors (AliMed) (Fig 3). Electrocautery is used to mark the site of the femoral attachment of the ALL. While holding the IT band retracted, the guide for the 2.6-mm FiberTak (Arthrex, Naples, FL) knotless anchor is placed at the femoral insertion and drilled to hard stop on the guide. After this, the anchor is malleted into place.

Next, we turn our attention to the tibial side of the ALL footprint, which is located ∼2 cm posterior to the Gerdy tubercle and ∼2 cm anterior to the tip of the fibular head.[7] We start by making 2 small stab incisions between the Gerdy tubercle and the fibular head, with each incision being separated by ∼2 cm of distance (Fig 2). After this, care is taken to elevate the subcutaneous soft-tissue bridge between the 3 stab incisions. Then, similar to the anchor placement at the femoral attachment, 2 Arthrex FiberTak knotless anchors (Arthrex) are placed at the tibial attachment of the ALL complex (Fig 4).

Once all anchors have been placed, we then systematically place the gracilis allograft in proximal-to-distal and then distal-to-proximal fashion, with use of a hemostat, taking care to place the graft deep to the IT band while passing it through the looped blue tape of the Arthrex FiberTak knotless anchor (Arthrex) (Fig 5). Once the graft has been appropriately placed, we then secure the graft at its tibial insertion by pulling tension on the blue tape of the tibial anchors which secures the graft distally on the tibia in an onlay fashion (Video 1). We then place the knee into full extension and while holding tension on the graft proximally we secure the graft at the femoral footprint in an onlay fashion while pulling tight the blue strand of the FiberTak knotless anchor (Arthrex). Before cutting the excess suture, we then create a rip stop suture for back up security of the femoral attachment by passing one black strand through the graft proximal to the loop and one black strand distal to the loop and then tying over the blue loop (Video 1). This secures the graft in an onlay fashion both proximally and distally and the remaining sutures may be cut—see diagram (Fig 6).

In the final step, the proximal graft is confirmed to be deep to the IT band and the IT band is closed over

**Fig 1.** Demonstrating standard surgical position with the right lower extremity draped with circumferential leg holder with the leg of the bed flexed down to 90° and contralateral leg flexed in well-leg holder.

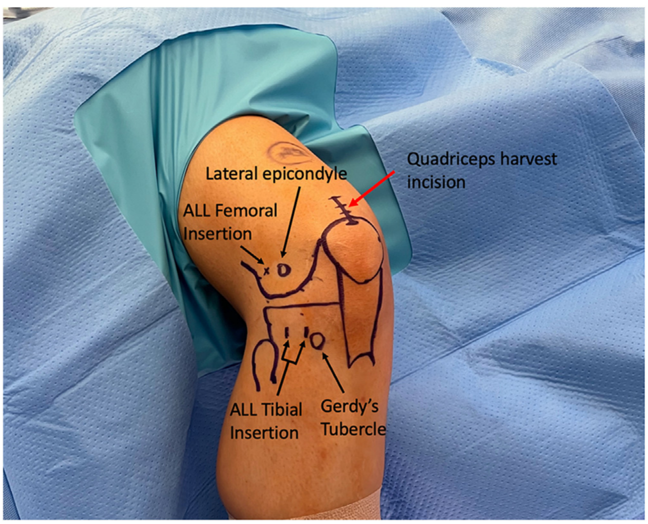


**Fig 2.** Landmarks include lateral epicondyle, Gerdy tubercle, and fibular head. Anterolateral ligament (ALL) femoral insertion is marked out proximally and 2 small stab incisions mark the site of the tibial insertion in the right lower extremity.

**Fig 3.** Lateral incision through the iliotibial band to isolate the femoral insertion of the anterolateral ligament in the right lower extremity.

**Fig 4.** Showing placement all 3 anchor sites in the right lower extremity: femoral anchor, 2 distal anchors ∼2 cm apart.

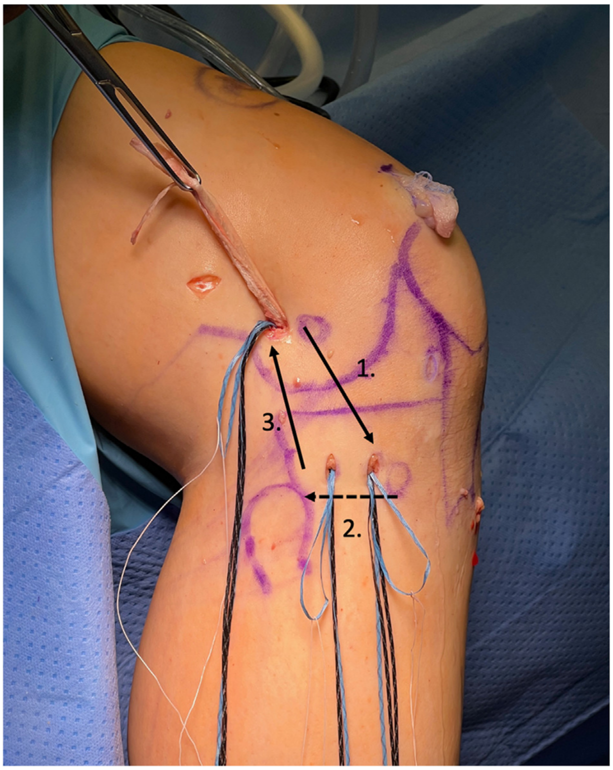


**Fig 5.** Showing the sequence of steps of placement of the allograft in the right lower extremity: 1. Starting proximally pulling the graft distally through the anterior tibial incision. 2. From the anterior tibial incision to the posterior incision. 3. Back up through the femoral incision.

the graft with a 0-VICRYL suture (Fig 7). After the final step of ALL placement, the ACL graft passage and tensioning is performed in a standard fashion.

## Discussion

Although the ALL has been a known complex since the 19th century by Dr. Paul Segond,[7] more recently it has gained attention for being a helpful augment to ACL reconstruction in providing greater stability[8,9] and in some reports, better outcomes.[5,11] However, there has been known difficulties with the addition of its reconstruction in conjunction with ACL reconstruction.[12,13] These issues include cost, operative time, and tunnel convergence,[12,13] which may be problematic and increase risk for reconstruction failure. Our technique provides an efficient, reproducible all-onlay technique that mitigates the concerns for possible tunnel convergence (Tables 1 and 2).

## Disclosures

All authors (N.L.G., K.M., E.R., J.C., A.E.J., B.J.L.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

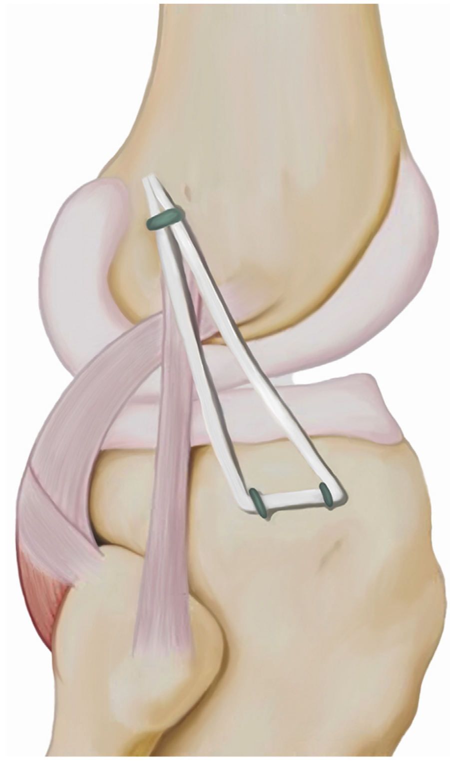

**Fig 6.** Schematic diagram of all-onlay anterolateral ligament reconstruction with single strand 4.5- to 5.0- × 220- to 250-mm gracilis allograft.

**Fig 7.** Showing closure of iliotibial band over the anterolateral ligament graft in the right lower extremity.

**Table 1.** Advantages and Disadvantages

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|---|---|
| Advantages | |
| | Avoids concern for tunnel convergence of femoral ACL tunnel |
| | Provides broad tibial footprint for stability |
| | Small incisions to decrease soft-tissue morbidity |
| | Two limb technique provides increased strength of construct |
| Disadvantages | |
| | Need for longer graft as it is 2 limbs rather than single limb |
| | Currently limited implant choice for all-onlay technique |
| | An assistant required for tensioning while securing graft onlay |

ACL, anterior cruciate ligament.

**Table 2.** Pearls and Pitfalls

| | |
|---|---|
| Pearls | |
| | We recommend tensioning of the graft in extension |
| | Care must be taken to pass the graft deep to the IT band |
| | Graft length should be 220-250 mm as it uses a 2-limb construct |
| | Place the ALL anchors prior to passing the ACL graft into the tunnels |
| Pitfalls | |
| | Overtensioning of graft may result in range of motion limitations |
| | Failure to create subcutaneous tissue clearance between tibial incisions |
| | Failure to place the graft deep to the IT band |

ACL, anterior cruciate ligament; ALL, anterolateral ligament; IT, iliotibial band.

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