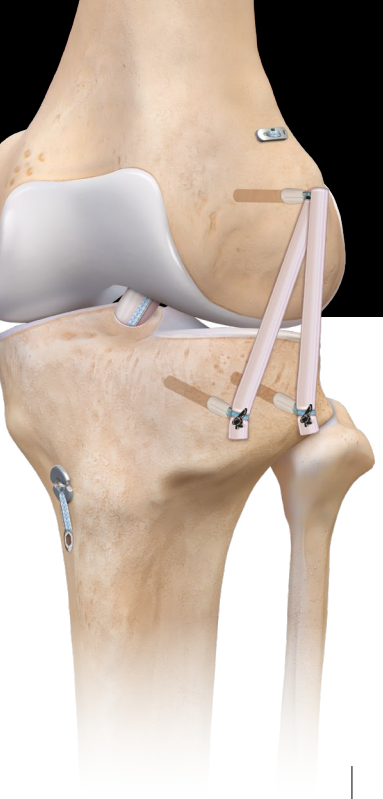

Lateral Extra-Articular Procedure Scientific Update

A review of the design rationale, techniques, and outcomes

Although contemporary ACL reconstruction is generally thought to deliver good results with excellent control of anterior-posterior (AP) laxity, the persistence of some degree of rotational instability characterized by a positive pivot-shift test in some patients is not uncommon. The goal of lateral extra-articular augmentation or reconstruction is to eliminate residual laxity and reduce the risk of ACL graft rupture. Iliotibial band tenodesis or anterolateral ligament reconstruction could play a role in augmenting rotational stability in the ACL-reconstructed knee. These procedures are most likely to benefit hyperlax patients, revision cases, pivoting athletes, and those with IKDC grade III pivot shifts. The following document summarizes published studies that describe anatomy, biomechanical data, and clinical outcomes.

Clinical Outcome Studies

Pettinari F, Carrozzo A, Saithna A, Ali AA, Alayane A, Barosso M, Vieira TD, Sonnery-Cottet B

Effect of lateral extra-articular procedures combined with ACL reconstruction on the rate of graft rupture in patients aged older than 30 years: a matched-pair analysis of 1102 patients from the SANTI Study Group. *Am J Sports Med.* 2024;52(7):1765-1772. doi:10.1177/03635465241247760

- The authors of this study compared clinical outcomes of isolated ACL reconstruction (ACLR) versus ACLR combined with lateral extra-articular procedures (LEAPs) in patients more than 30 years old.
- 551 patients who underwent isolated ACLR with either hamstring tendon (HT), quadriceps tendon (QT), or bone-patellar tendon-bone (BPTB) autografts were matched 1:1 with patients who received combined ACLR with HT and LEAP (ALL or Lemaire) with a mean follow-up of 97 months.
- Isolated ACLR resulted in a 2.7% retear rate, while combined ACLR and LEAP led to a retear rate of only 0.7%. Patients in the isolated ACLR group also experienced a higher rate of secondary meniscectomy (5.6%) compared to those in the combined ACLR and LEAP group (2.2%).

Takeaway

ACLR combined with LEAPs had more than a 3-fold lower risk of graft failure compared to ACLR alone. This study highlights the long-term benefits of a combined ACLR and LEAP approach in patients beyond the traditional high-risk demographic regardless of graft choice.

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Saithna A, Guy S, Carrozzo A, Bulle S, Vieira TD, Fayard JM, Sonnery-Cottet B

Lateral extra-articular procedures significantly reduce ACL graft rupture rates in elite alpine skiers. *Arthroscopy.* 2023;39(6):E17-E18. doi:https://doi.org/10.1016/j.arthro.2023.01.056

- Retear rates following ACLR with and without LEAPs were compared in elite alpine skiers from the French National Ski Team with a minimum 2-year follow-up.
- 81 elite athletes were included, 50 of which underwent isolated ACLR with either HT or BPTB autograft, while 31 received combined ACLR with HT and LEAPs (ALL or Lemaire).
- The isolated ACLR group had a 34% retear rate, while combined ACLR and LEAP group had a retear rate of 6.5%.

Takeaway

The addition of LEAPs to ACLR significantly reduced the risk of graft failure in a notoriously high-risk group of athletes.

Moussa MK, Lefèvre N, Valentin E, Coughlan A, Zgolli A, Gerometta A, Meyer A, Hardy A

Impact of lateral extra-articular procedure augmentation on rerupture risk and Tegner Activity Scale outcomes in adolescent anterior cruciate ligament: a matched comparative study with a minimum 2-year follow-up. *Am J Sports Med.* 2024;52(4):892-901. doi:10.1177/03635465231223703

- This respective study evaluated how the addition of LEAPs to ACLRs will impact clinical outcomes in adolescent patients.
- 253 patients with a mean age of 16.1 years and minimum 2-year follow-up were included. 132 patients underwent isolated ACLR, while 121 received an ACLR and lateral extra-articular tenodesis (LET), an anterolateral ligament reconstruction (ALLR), or a or modified Macintosh procedure.
- Patients with an open physis were treated with either a physeal-sparing technique using a quadrupled HT autograft or a partial transphyseal iliotibial-band-based procedure (combined intra- and extra-articular reconstruction). Those with a closed physis were treated with either a quadrupled HT autograft, a BPTB autograft, or an iliotibial-band-based modified Macintosh procedure.
- The isolated ACLR group had a significantly higher retear rate (13.6%) compared to the ACLR and LEAP group (2.5%). In addition, the isolated ACLR group had a significantly lower Tegner score (6.3) than the combined ACLR and LEAP group (7.2).

Takeaway

Combined ACLR and LEAP augmentation resulted in a 6-fold lower retear rate and higher post-op activity levels in patients younger than 18 years of age.

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Pioger C,
Gousopoulos L,
Hopper GP,
Vieira TD,
Campos JP,
El Helou A,
Philippe C,
Saithna A,
Sonnery-Cottet B

Clinical outcomes after combined ACL and anterolateral ligament reconstruction versus isolated ACL reconstruction with bone-patellar tendon-bone grafts: a matched-pair analysis of 2018 patients from the SANTI Study Group. *Am J Sports Med.* 2022;50(13):3493-3501. doi:10.1177/03635465221128261

- In this level III matched-pair analysis, the authors compared clinical outcomes following ACLR with BPTB autograft versus combined ACLR and anterolateral ligament reconstruction (ALLR) with an HT autograft.
- 1009 matched pairs with an average age of 26 years and mean follow-up of 101 months were included.
- Patients in the isolated ACLR group had a greater than 3-fold higher risk of graft rupture (9.9% retear rate) compared to those in the combined ACLR and ALLR group (3.5% retear rate).

Takeaway

Combined ACLR and ALLR with HT autograft resulted in significantly less graft ruptures and reoperations compared to isolated ACLR with BPTB autografts.

Shatrov J,
Freychet B,
Hopper GP,
Coulin B,
El Helou A,
An JS,
Vieira TD,
Sonnery-Cottet B

Radiographic incidence of knee osteoarthritis after isolated ACL reconstruction versus combined ACL and ALL reconstruction: a prospective matched study from the SANTI Study Group. *Am J Sports Med.* 2023;51(7):1686-1697. doi:10.1177/03635465231168899

- This study aimed to address concerns that ALLR may be associated with an increased risk of osteoarthrosis (OA) when combined with ACLR.
- 80 patients with an average age of 26.9 and mean follow-up of 104 months were included. 38 underwent isolated ACLR with either BPTB or HT autograft, while 42 underwent combined ACLR and ALLR with HT autograft.

Takeaway

ACLR and ALL did not increase the risk of OA in the lateral tibiofemoral (TF) compartment compared to isolated ACLR. There was, however, a greater than 4-fold risk of medial Patellofemoral (PF) joint space narrowing associated with isolated BPTB ACLR. In addition, lateral meniscus tears increased the risk of lateral TF narrowing by 4.9 times, highlighting the importance of addressing all concomitant injuries.

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Hopper G, Haddock A, Pioger C, C Philippe, El Helou A, J P Campos, L Gousopoulos, Al Carrozzo, Viera TD, B Sonnery-Cottet

Improving the outcomes of anterior cruciate ligament surgery in professional athletes: an analysis of 342 patients with a mean follow-up of 100 months. *Orthop Procs.* 2023;105-B(SUPP_18):3-3. doi:10.1302/1358-992X.2023.18.003

- This retrospective study compared reoperation rates for 342 professional athletes who underwent ACLR with or without LEAPs and modernized meniscal repair techniques.
- 130 athletes had isolated ACLR with BPTB autograft before the introduction of LEAPs and improved meniscal repair techniques, while 212 underwent ACLR after with combined HT and ALL. Patients were evaluated over the course of several years with a mean follow-up of 100 months.

Takeaway

Professional athletes who underwent isolated ACLR with BPTB before October 2012 had a significantly higher rate of secondary surgery (30%) compared to those who received ACLR with combined HT and ALL after October 2012 (16.5%). Additionally, patients in the combined HT and ALL group had a nearly 2-fold decrease in graft failures (6.6%) compared to the isolated ACLR group (13.1%).

Pioger C, Ayata M, Pettinari F, Ali AA, Alayane A, Campos JP, Vieira TD, Saithna A, Sonnery-Cottet B

Secondary meniscectomy rates and risk factors for failed repair of ramp lesions performed at the time of primary ACL reconstruction: an analysis of 1037 patients from the SANTI Study Group. *Am J Sports Med.* 2024;52(8):1944-1951. doi:10.1177/03635465241253841

- This case-control study evaluated the rate of secondary meniscectomies for treatment of failed ramp repairs performed during primary ACLR. The impact of combined ACLR and LEAP on meniscal ramp repair survivorship was also observed.
- A total of 1037 patients were included with a mean follow-up of 72 months.

Takeaway

The addition of LEAP to ACLR increased the survivorship of ramp repairs by more than twofold.

Monaco E, Carrozzo A, Saithna A, Conteduca F, Annibaldi A, Marzilli F, Minucci M, Sonnery-Cottet B, Ferretti A

Isolated ACL reconstruction versus ACL reconstruction combined with lateral extra-articular tenodesis: a comparative study of clinical outcomes in adolescent patients. *Am J Sports Med.* 2022;50(12):3244-3255. doi:10.1177/03635465221118377

- Level III retrospective comparative cohort study looking at 111 patients undergoing ACLR with a mean age of 16 years old and mean outcome of 43 months.
- All ACLR were performed with quadrupled HT autograft and fixated using the TightRope® implant on the femur and biocomposite interference screws in the tibia.
- Patients with a Tegner score greater than 7 and grade ⅔ pivot shift received an ACLR and LET or a strip of the iliotibial band looped around the fibular collateral ligament, reflected on itself, and sewn in with Vicryl®. Lower-risk patients with a Tegner score less than 6 and a grade 1 or lower pivot received an isolated ACLR.

Takeaway

The isolated ACL group had a 15% retear rate (6/40) with 1 contralateral ACL tear, while the ACL/LET group had 0 retears (0/71) including the contralateral side.

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Cavaignac E, Mesnier T, Marot V, Fernandez A, Faruch M, Berard E, Sonnery-Cottet B

Effect of lateral extra-articular tenodesis on anterior cruciate ligament graft incorporation. *Orthop J Sports Med.* 2020;8(11):2325967120960097. doi:10.1177/2325967120960097

- In this Level 3 cohort study, 62 patients underwent ACL reconstruction using quadrupled semitendinosus autograft.
- At 1-year postoperatively, the MRI appearance of ACL grafts showed generally better incorporation and maturation when combined with LET.

Takeaway

ACL grafts showed generally better incorporation and maturation, while also experiencing significantly decreased loads when combined with LET.

Sonnery-Cottet B, Haidar I, Rayes J, Fradin T, Ngbilo C, Vieira TD, Freychet B, Ouanezar H, Saithna A

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;3635465211028990. doi:10.1177/03635465211028990

- First-ever long-term outcomes study comparing isolated ACL reconstruction with combined ACL and ALL reconstruction using anatomic ALL positioning with fixation in full extension.
- Authors followed 172 patients (86 matched pairs) for a mean of 104 months.
- Findings were in line with previous shorter-term studies, which found patients having undergone combined ACL and ALL reconstruction experienced significantly better ACL graft survivorship (96% vs 82.6%), lower overall rates of reoperation (nongraft-rupture related, secondary meniscectomy, excision of cyclops lesion, arthroscopic lavage) (15.3% vs 32.6%), and lower rates of revision ACLR (3.5% vs 17.4%).

Takeaway

Patients undergoing isolated ACLR had a greater than 5-fold greater risk of graft rupture, regardless of their preinjury level of activity.

Hopper GP, Aithie JMS, Jenkins JM, Wilson WT, Mackay GM

Combined anterior cruciate ligament repair and anterolateral ligament internal brace augmentation: minimum 2-year patient-reported outcome measures. *Orthop J Sports Med.* 2020;8(12):2325967120968557. doi:10.1177/2325967120968557

- Level 4 case series evaluating patient-reported outcomes following primary ACL repair combined with ALL internal brace augmentation.
- 43 patients with mean age of 25.7 years and average follow-up of 44.8 months were evaluated following combined ACL repair + ALL internal brace augmentation. Inclusion criteria for combined ACL/ALL were as follows: acute proximal avulsion of the ACL, good tissue quality, high activity levels, grade 3 pivot shift or an associated Segond fracture.
- The mean KOOS for pain, symptoms, activities of daily living, sports/recreation and quality of life all improved at the 2-year follow-up. Mean WOMAC scores for pain, stiffness and function also improved, as well as VAS pain score and VR-12 physical score.

Takeaway

Combined ACL and ALL internal brace augmentation yielded favorable outcomes in 94.7% patients, suggesting the potential benefits of an additional ALL procedure for high-risk patients undergoing ACL primary repair.

Lau BC, Rames J, Belay E, Riboh JC, Amendola A, Lassiter T

Anterolateral complex reconstruction augmentation of anterior cruciate ligament reconstruction: biomechanics, indications, techniques, and clinical outcomes. *JBJS Rev.* 2019;7(11):e5. doi:10.2106/JBJS.RVW.19.00011

- Authors reviewed the biomechanics and indications for an extra-articular ligament augmentation, typical patient workup, surgical technique, rehabilitation protocol, and clinical outcomes of anterolateral ligament reconstruction and the modified Lemaire procedure.
- Indications are evolving, and new studies are continually being published with encouraging results.
- Authors determined that "Additional studies are necessary to determine the long-term outcomes of these procedures, particularly with respect to restoration of function and reduction of failures following ACL reconstruction."

Takeaway

Early clinical and biomechanical data suggests that anterolateral complex reconstruction may help increase the rotational stability of an ACL reconstruction.

Sonnery-Cottet, Thaunat M, Freychet B, Pupim BHB, Murphy CG, Claes S

Outcome of a combined anterior cruciate ligament and anterolateral ligament reconstruction technique with a minimum 2-year follow-up. *Am J Sports Med.* 2015;43(7):1598-1605. doi:10.1177/0363546515571571

- This 2-year follow-up evaluated 83 of 92 patients who underwent a combined ACL and ALL reconstruction.
- IKDC objective scores and pivot-shift evaluation postoperatively were significantly better in anterolateral ligament-reconstructed patients after 2 years.

Takeaway

A combined ACL and ALL reconstruction is a safe and potentially effective procedure to address rotational instability.

Anatomy and Biomechanical Studies

Blanke F, Boljen M, Lutter C, Oehler N

Does the anterolateral ligament protect the anterior cruciate ligament in the most common injury mechanisms? a human knee model study. *Knee.* 2021;29:381-389. doi:10.1016/j.knee.2021.02.026

- Authors used a knee finite element model to evaluate which extra-articular structures supported the ACL in excessive internal and external tibial rotation.
- Initially the model was tested including only the intact ACL, PCL, MCL, LCL, and medial and lateral meniscus, then additional structures—including ALL, POL, popliteal tendon—were added and tested separately then all together. Testing done in 25° of flexion.
- It was determined that the ACL was the most loaded structure in both tibial internal and external rotation and that the ALL was the main stabilizer of the tibia in internal rotation, reducing load on the ACL by 21%.
- 55% of the total load reduction of the ACL in the internal rotation was due to the ALL.

Takeaway

When all additional structure were present, The ALL was responsible for 55% of the total load reduction of the ACL in tibial internal rotation.

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Geeslin AG, Moatshe G, Chahla J, Kruckeberg BM, Muckenhirn KJ, Dornan GJ, Coggins A, Brady AW, Getgood AM, Godin JA, LaPrade RF

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(3):607-616. doi:10.1177/0363546517745268

- ALL reconstruction and LET have been described in combination with intra-articular ACL reconstruction to address rotational laxity. This study demonstrated that both procedures resulted in significant reductions of tibial internal rotation versus the intact state independent of graft tension or fixation angle, although anterior tibial translation was generally restored to intact values.
- Residual laxity was identified after isolated ACLR in the setting of ALL and Kaplan fiber deficiency.

Takeaway

The combination of ACLR in this setting with either ALL reconstruction or the modified Lemaire LET procedure resulted in significant reductions in tibiofemoral motion at most knee flexion angles.

Porter MD, Shadbolt B, Pomroy S

The augmentation of revision anterior cruciate ligament reconstruction with modified iliotibial band tenodesis to correct the pivot shift: a computer navigation study. *Am J Sports Med.* 2018;46(4):839-845. doi:10.1177/0363546517750123

- Level II cohort study analyzing the effects of adding ITB tenodesis to revision ACLR.

Takeaway

ITB tenodesis improved laxity, although it did not affect activity levels, when there was a persistent pivot shift after revision ACL reconstruction.

Rasmussen MT, Nitri M, Williams BT, Moulton SG, Cruz RS, Dornan GJ, Goldsmith MT, LaPrade RF

An in vitro robotic assessment of the anterolateral ligament, part 1: secondary role of the anterolateral ligament in the setting of an anterior cruciate ligament injury. *Am J Sports Med.* 2016;44(3):585-592. doi:10.1177/0363546515618387

- The ALL was a significant secondary stabilizer throughout flexion during an applied internal rotation torque and simulated pivot-shift test in the context of an ACL-deficient knee.
- Residual internal rotation and a positive pivot shift after ACLR may be attributed to an ALL injury. For these patients, surgical treatment of an ALL tear may be considered.

Takeaway

This study confirms that the ALL is an important lateral knee structure providing rotatory stability to the knee.

Pomajzl R, Maerz T, Shams C, Guettler J, Bicos J

A review of the anterolateral ligament of the knee: current knowledge regarding its incidence, anatomy, biomechanics, and surgical dissection. *Arthroscopy.* 2015;31(3):583-591. doi:10.1016/j.arthro.2014.09.010

- The authors systematically reviewed current literature on the anterolateral ligament (ALL) of the knee.
- The ALL demonstrated histological characteristics consistent with ligamentous microstructures.

Takeaway

"The ALL is a distinct ligamentous structure at the anterolateral aspect of the knee, and it is likely involved in tibial internal rotation stability and the Segond fracture."

Parsons EM, Gee AO, Spiekerman C, Cavanagh PR

The biomechanical function of the anterolateral ligament of the knee. *Am J Sports Med.* 2015;43(8):NP22. doi:10.1177/0363546515597218

- The ACL is the primary resister during anterior drawer at all flexion angles and during internal rotation at flexion angles less than 35˚.

Takeaway

The ALL is an important stabilizer of internal rotation at flexion angles greater than 35˚; however, it is minimally loaded during anterior drawer at all flexion angles.

Helito CP, Demange MK, Helito PVP, Costa HP, Bonadio MB, Pecora JR, Rodrigues MB, Camanho GL

Evaluation of the anterolateral ligament of the knee by means of magnetic resonance examination. *Rev Bras Ortop.* 2015;50(2):214-219. doi:10.1016/j.rboe.2015.03.009

- Using MRI, the ALL was viewed with signal characteristics similar to those of the other ligament structures of the knee.

Takeaway

The anterolateral ligament of the knee is best viewed in sequences in the coronal plane.

Kennedy MI, Claes S, Fuso FA, Williams BT, Goldsmith MT, Turnbull TL, Wijdicks CA, LaPrade RF

The anterolateral ligament: an anatomic, radiographic, and biomechanical analysis. *Am J Sports Med.* 2015;43(27):1606-1615. doi:10.1177/0363546515578253

- Femoral attachment was located 4.7 mm (95% CI, 3.5 mm to 5.9 mm) posterior and proximal to the fibular collateral ligament attachment.
- Anterolateral tibial attachment was approximately midway between the center of Gerdy's tubercle and the anterior margin of the fibular head.
- ALL originated on the femur 22.3 mm (95% CI, 20.7 mm to 23.9 mm) proximal to the joint line and inserted on the tibia 13.1 mm (95% CI, 12.3 mm to 13.9 mm) distal to the lateral tibial plateau.
- On the lateral view, the femoral attachment was 8.4 mm (95% CI, 6.8 mm to 10.0 mm) posterior and proximal to the lateral epicondyle; the tibial attachment was 19.0 mm (95% CI, 17.1 mm to 20.9 mm) posterior and superior to the center of Gerdy's tubercle.

Takeaway

"Defined ALL attachment locations can be reproducibly identified with intraoperative landmarks or radiographs. The biomechanical analysis suggests that most traditional soft tissue grafts are sufficient for ALL reconstruction."

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Rezansoff AJ, Caterine S, Spencer L, Tran MN, Litchfield RB, Getgood AM

Radiographic landmarks for surgical reconstruction of the anterolateral ligament of the knee. *Knee Surg Sports Traumatol Arthrosc.* 2015;23(11):3196-3201. doi:10.1007/s00167-014-3126-y

- ALL was found to be a mean distance of 24.7 mm ± 4.5 mm from the center of Gerdy's tubercle and 11.5 mm ± 2.9 mm distal from the lateral tibial plateau.
- The femoral origin of the ALL was found to be a mean of 3.3 mm ± 1.5 mm anterior-distal from the FCL origin in the first anatomical variant and 5.4 mm ± 1.4 mm posterior-proximal from the FCL origin in the second anatomical variant.

Takeaway

Using lateral fluoroscopy, the radiographic landmarks of the ALL origin and insertion were determined.

Caterine S, Litchfield R, Johnson M, Chronik B, Getgood AM

A cadaveric study of the anterolateral ligament: reintroducing the lateral capsular ligament. *Knee Surg Sports Traumatol Arthrosc.* 2015;23(11):3186-3195. doi:10.1007/s00167-014-3117-z

- MRI and histological sectioning were used to determine that the ALL is a thickening of the lateral joint capsule and can be referred to as an independent structure.

Takeaway

Anatomic insertion points on tibia are described, but it is difficult to determine the points on the femur as it fans out and interdigitates with FCL.

Claes S, Luyckx T, Vereecke E, Bellemans J

The Segond fracture: a bony injury of the anterolateral ligament of the knee. *Arthroscopy.* 2014;30(11):1475-1482. doi:10.1016/j.arthro.2014.05.039

- This study confirmed the hypothesis that the ALL inserts in the region on the proximal tibia from where Segond fractures consistently avulse, suggesting that the Segond fracture is actually a bony avulsion of the ALL.

Takeaway

Although the Segond fracture remains a useful radiographic clue for indirect detection of anterior cruciate ligament injuries, it should be considered a frank ligamentous avulsion itself.

Helito CP, Demange MK, Bonadio MB, Tirico LE, Gobbi RG, Pecora JR, Camanho GL

Radiographic landmarks for locating the femoral origin and tibial insertion of the knee anterolateral ligament. *Am J Sports Med.* 2014;42(10):2356-2362. doi:10.1177/0363546514543770

- "The origin of the ALL in the lateral view was found at an average ± SD of 47.5% ± 4.3% from the anterior edge of the femoral condyle and about 3.7 mm ± 1.1 mm below the Blumensaat line. In the frontal view, the origin was about 15.8 mm ± 1.9 mm from the distal condyle line. The ALL insertion was an average of 53.2% mm ± 5.8% from the anterior edge of the lateral tibial plateau in the lateral view and 7.0 mm ± 0.5 mm below the lateral tibial plateau in the frontal view. In anatomic dissections, the origin of the ALL was 1.9 mm ± 1.4 mm anterior and 4.1 mm ± 1.1 mm distal to the lateral collateral ligament, and the insertion was 4.4 mm ± 0.8 mm below the lateral tibial plateau cartilage."

Takeaway

Radiographic identification of anatomic landmarks of the ALL facilitate minimally invasive surgical reconstruction.

Dodds AL, Halewood C, Gupte CM, Williams A, Amis AA

The anterolateral ligament: anatomy length changes and association with the Segond fracture. *Bone Joint J.* 2014;96-B(3):325-331. doi:10.1302/0301-620X.96B3.33033

- The femoral attachment of the ALL was a mean of 8 mm (2 mm to 12 mm) proximal and 4.3 mm (0 mm to 12 mm) posterior to the most prominent point of the lateral epicondyle.
- The tibial attachment is posterior to Gerdy's tubercle and anterior to the fibula head.
- Distally, some fibers from the anterior edge of the LCL fanned out to attach to the tibia at the posterior part of the attachment of the ALL.

Takeaway

This study provided detailed anatomic data of the ALL.

Claes S, Vereecke E, Maes M, Victor J, Verdonk P, Bellemans J

Anatomy of the anterolateral ligament of the knee. *J Anat.* 2013;223(4):321-328. doi:10.1111/joa.12087

- This abstract brings new focus to the ALL as a rotatory stabilizer of the knee.
- History and anatomy of the ALL are discussed.
- Forty-one cadaveric specimens were examined to determine femoral and tibial attachment points of ALL.

Takeaway

This abstract brings new focus to the ALL as a rotatory stabilizer of the knee.