Outcome of a Combined Anterior Cruciate Ligament and Anterolateral Ligament Reconstruction Technique With a Minimum 2-Year Follow-up

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Am J Sports Med published online March 4, 2015

DOI: 10.1177/0363546515571571

AJSM PreView, published on March 4, 2015 as doi:10.1177/0363546515571571

Outcome of a Combined Anterior Cruciate Ligament and Anterolateral Ligament Reconstruction Technique With a Minimum 2-Year Follow-up

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Background: The anterolateral ligament has recently been identified as an important structure involved in rotational laxity after anterior cruciate ligament (ACL) rupture. Results of a combined ACL and anterolateral ligament (ALL) reconstruction technique have never been reported.

Purpose: To report subjective and objective outcomes after combined ACL and minimally invasive ALL reconstruction with a minimum 2-year follow-up.

Study Design: Case series; Level of evidence, 4.

Methods: A total of 92 patients underwent a combined ACL and ALL reconstruction. Indications for a combined procedure were associated Segond fracture, chronic ACL lesion, grade 3 pivot shift, high level of sporting activity, pivoting sports, and radiographic lateral femoral notch sign. Patients were assessed pre- and postoperatively with objective and subjective International Knee Documentation Committee (IKDC) score, Lysholm score, and Tegner activity scale. Instrumented knee testing was performed with the Rolimeter arthrometer. The Knee injury and Osteoarthritis Outcome Score (KOOS) was obtained at the last follow-up. Complications including graft failure or contralateral ACL rupture were also recorded.

Results: The mean follow-up time was 32.4 ± 3.9 months. One patient (1.1%) was lost to follow-up, 1 patient (1.1%) suffered an ACL graft rupture, and 7 patients (7.6%) had a contralateral ACL rupture, leaving 83 patients for final evaluation. At the last follow-up, all patients had full range of motion. The Lysholm, subjective IKDC, and objective IKDC scores were significantly improved (all $P < .0001$). The Tegner activity scale at the last follow-up (7.1 ± 1.8) was slightly lower than before surgery (7.3 ± 1.7) ($P < .01$). The mean differential anterior laxity was 8 ± 1.9 mm before surgery and significantly decreased to 0.7 ± 0.8 mm at the last follow-up ($P < .0001$). Preoperatively, 41 patients had a grade 1 pivot shift, 23 had a grade 2, and 19 had a grade 3 according to the IKDC criteria. Postoperatively, 76 patients had a negative pivot shift (grade 0), and 7 patients were grade 1 ($P < .0001$).

Conclusion: This study demonstrates that a combined reconstruction can be an effective procedure without specific complications at a minimum follow-up of 2 years. Longer term and comparative follow-up studies are necessary to determine whether these combined reconstructions improve the results of ACL treatment.

Keywords: ACL reconstruction; anterolateral ligament; rotational instability; pivot-shift

Anterior cruciate ligament (ACL) reconstruction has evolved considerably over the past 30 years. From a historical point of view, surgeons were always concerned that rotational control of the knee was key to ensuring its stability.[18] This notion led to the advent of isolated extra-articular lateral reconstructions for the ACL-deficient knee.[25,26] However, the results of these isolated peripheral reconstructions were mixed, and it became evident that attention needed to be directed to the reconstruction of the ACL. Even though the results of contemporary ACL reconstruction are satisfactory and reliable over time, a lack of rotational stability, confirmed by a positive pivot-shift test,[14] often persists during clinical

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One or more of the authors has declared the following potential conflict of interest or source of funding: B.S.-C. is a paid consultant, receives research support, and has made presentations for Arthrex. M.T. is a paid consultant, receives research support, and has made presentations for Arthrex.

The American Journal of Sports Medicine, Vol. XX, No. X
DOI: 10.1177/0363546515571571

examination after ACL surgery.[6] Besides causing difficulties with pivoting sports, this lack of rotational control was thought to contribute to secondary meniscal or cartilaginous problems,[45] and it led surgeons to reconsider the anatomy and biomechanics of the ACL. Double-bundle ACL reconstruction[54] emerged in an attempt to minimize this persistent rotational laxity, but evidence for clinical or biomechanical efficiency has been mixed to date.[28]

New insights into the existence and function of a distinct ligamentous structure on the anterolateral aspect of the knee, the anterolateral ligament (ALL),[8,11,15] have refocused attention on primary restraint of the rotational laxity of the knee after ACL injury. According to a kinematic study,[31] if a high correlation between the pivot shift and lesions to these anterolateral structures exists, an anatomic ACL with an anterolateral reconstruction appears synergistic in controlling the pivot shift.

The purpose of this case series was to report subjective and objective outcomes after combined ACL and ALL reconstruction with a minimum 2-year follow-up. We hypothesized that the described combined ACL and ALL reconstruction technique results in improved subjective and objective outcome scores and does not lead to specific complications at 2-year follow-up.

PATIENTS AND METHODS

In a consecutive series of 396 ACL reconstructions performed between January 2011 and January 2012 by the first author (B.S-C.), 92 combined ACL reconstructions with minimally invasive ALL reconstructions were carried out (Figure 1). All patients had experienced a knee trauma with signs of an ACL tear on clinical, radiographic, and magnetic resonance imaging (MRI) examination. The patients had been unable to resume their previous levels of activity because of instability symptoms and were scheduled for ACL reconstruction. Exclusion criteria were ACL revision procedures, knee dislocations, major concomitant procedures such as high tibial osteotomy or other knee ligament reconstructions, and previous contralateral ACL reconstructions. Indications for a combined procedure included 1 or more of the following criteria:

- Associated Segond fracture (n = 1)
- Chronic ACL lesion (n = 5)
- Grade 3 pivot shift (n = 19)
- High level of sporting activity (n = 14)
- Participation in pivoting sports (eg, soccer, rugby, handball, basketball) (n = 76)
- Lateral femoral notch sign[16] on radiographs (n = 21)

Patients were assessed pre- and postoperatively with the subjective and objective International Knee Documentation Committee (IKDC) evaluation form, Tegner activity scale (TAS), and Lysholm score. Physical examinations were performed by an author other than the primary surgeon (B.F.). This examination included passive motion deficit measurement with a goniometer and complete ligament examination following the instruction for the 2000 IKDC knee examination form.

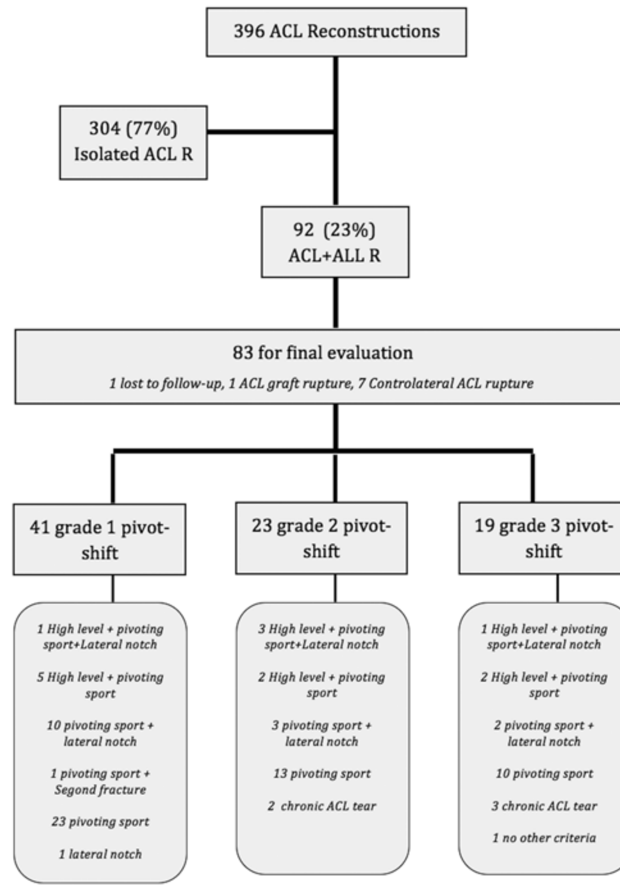

Figure 1. Patient flowchart. ACL, anterior cruciate ligament; ALL, anterolateral ligament; R, reconstruction.

Postoperatively, patients were assessed with Knee injury and Osteoarthritis Outcome Score (KOOS). Instrumented knee testing was performed before surgery and at the last follow-up with the Rolimeter arthrometer (Aircast). This study received institutional review board approval.

Statistical Methods

Statistical analysis was performed with SPSS software (IBM Corp). Descriptive statistics including means and standard deviations were obtained from continuous data. The paired t test was used to compare the preoperative and postoperative numerical data. The Fisher exact test was used to compare the preoperative and postoperative pivot-shift test results and IKDC objective evaluation. The level of significance was set at $P < .05$.

Surgical Technique

Given increasing knowledge about the anatomy of the ALL, our historical technique of lateral iliotibial band (ITB) tenodesis was adapted to achieve a more anatomic reconstruction of this recently characterized structure.[9] We developed a double-bundle ALL reconstruction to

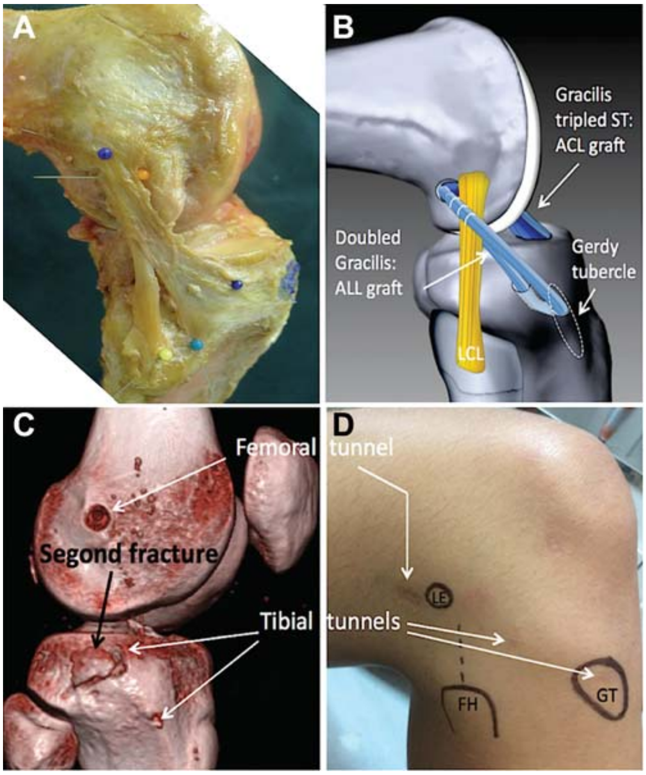

Figure 2. Images of the anterolateral ligament (ALL), the site of the graft, and its surrounding structures. (A) Anatomic, (B) graphic, (C) 3-dimensional computed tomography scan, and (D) surface markings. ACL, anterior cruciate ligament; FH, femoral head; GT, Gerdy tubercle; LE, lateral epicondyle.

replicate the triangular shape of the native ALL. This inverted Y-shaped configuration accurately mimics the shape of the native ALL, with its respective narrow and broad femoral and tibial attachments (Figure 2A), while the single proximal limb of the ALL reconstruction approximates the isometric insertion point of the ALL on the femur (Figure 2B).

Surgical Setup

The patient was placed in the supine position with a lateral post just proximal to the knee, level with a padded tourniquet, and with a foot roll to prevent the hip from externally rotating and to keep the knee flexion at 90°. In this way, the knee could be moved freely through its full range of motion. Three bony landmarks were marked before application of the betadine-coated cutaneous drape: the head of the fibula, the Gerdy tubercle, and the lateral epicondyle. The distal insertion of the ALL was taken to be roughly halfway between the Gerdy tubercle and the middle of the fibular head (Figure 2, C and D).

Graft Harvesting

The semitendinosus tendon (STT) and the gracilis tendon were harvested with an open tendon stripper. The tibial insertion of the STT was preserved, thereby improving fixation and vascularization of the graft. This graft preparation allowed us to obtain an ACL graft with a diameter of 8 to 10 mm.

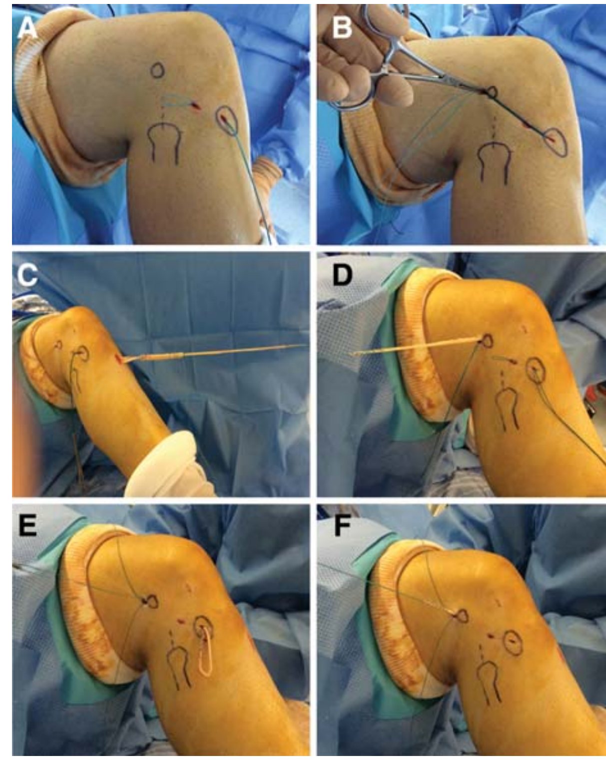

Figure 3. Intraoperative photographs of combined anterior cruciate ligament (ACL) and anterolateral ligament (ALL) graft preparation and fixation. (A) Looped suture through the stab incision and tibial osseous tunnel. The proximal tunnel outlet is located between the Gerdy tubercle and the fibula head; the distal tunnel outlet is located at the superolateral corner of the Gerdy tubercle. (B) Isometric behavior evaluation through full range of motion. (C) The prepared ACL/ALL graft. (D) The ALL graft emerging through the stab incision of the outside-in femoral tunnel after ACL graft passage. (E) The ALL graft routed from the femur to the tibia, emerging through the distal incision of the tibial tunnel. (F) The ALL graft routed back from the tibia toward the femur and emerging through the femoral tunnel incision.

Tibial Tunnel Placement and Drilling

With the knee at 30° of flexion, the tibial ACL remnant was inspected. If it was fixed to the posterior cruciate ligament or a nonanatomic site on the femoral condyle, the ACL remnant was carefully mobilized, preserving its entire synovial cover and tibial attachment. The tibial guide was introduced through the anteromedial portal and positioned so that the guide wire either split or stayed within the center of the ACL tibial stump. If the location of the guide wire was satisfactory, the tunnel was drilled with increasing drill-bit diameters, stopping as soon as the bone of the tibial plateau was breached. The drill remained strictly within the ACL remnant to conserve residual tissue. A shaver was passed through the tibial tunnel, into the ACL remnant, so that the remnant was hollowed out for passage of the graft. The interior of the synovial sleeve was debrided to avoid overpacking of the intercondylar notch and resultant anterior tissue impingement and extension deficit.

Proximal Tunnel and Gerdy Tubercle/ALL Graft Attachment Preparation

Two stab incisions were made, the lower/distal one just above the superolateral corner of the Gerdy tubercle and the second one above and lateral to this point (Figure 3A); a 3.2-mm drill was used to create a bony tunnel. The proximal drill hole was situated in the site of the Segond fracture (ie, through the tibial footprint of the ALL), while the distal hole was located anterior and inferior to this site, both to ensure a good osseous tunnel and to better replicate the isometry of the ALL.

A looped No. 5.0 suture was passed through the tunnel. Using a surgical clamp, the surgeon positioned the strands of the looped suture in an area slightly posterior and proximal to the lateral epicondyle. The knee was then taken through full range of motion to better identify the femoral isometric point (Figure 3B). A stab incision was made at the level of the defined isometric point. This location was then used as the entry point for the femoral ACL jig, to prepare the outside-in femoral tunnel.

Femoral Tunnel Placement and Drilling

The outside-in ACL femoral guide (Arthrex) was introduced through the anteromedial portal, inserted at the femoral footprint of the ACL. The guide angulation was then adjusted to allow drill sleeve placement in the stab incision at the level of the previously identified isometric point on the lateral femoral condyle, slightly proximal and posterior to the lateral epicondyle. After guide pin placement, the femoral tunnel was drilled at the graft diameter.

Graft Preparation

The STT graft was tripled over 2 suture loops to obtain a length of 12 cm from its tibial insertion. The gracilis graft was detached from its tibial insertion and sutured to the tripled STT graft. The extremity of the gracilis strand was then whip-stitched with a traction suture (Figure 3C). In this way, the ACL graft was composed of a tripled STT with an additional strand of the gracilis tendon, and the ALL graft consisted of a looped gracilis tendon in a Y-shape configuration (Figure 2B). This graft preparation allowed us to obtain an ACL graft with a diameter of 8 to 10 mm.

Graft Passage

The ACL/ALL grafts were then routed proximally through the knee, by use of a traction suture on each, to emerge at the lateral cortex of the femoral tunnel (Figure 3D). The tibial portion of the ACL graft was then fixed with a bioabsorbable interference screw (Arthrex). The ACL graft was secured in the femoral tunnel with an outside-in bioabsorbable interference screw (Arthrex) with the knee in 20° of flexion.

Gracilis Tendon/ALL Reconstruction

A suture grasper was passed through the lateral stab incision (used for the femoral tunnel) from proximal to distal, deep to the fibers of the ITB, and emerging at the proximal stab incision over the Gerdy tubercle. The suture loop was grasped and withdrawn to the proximal portal to hook the gracilis tendon traction suture. By pulling the traction suture distally, the surgeon could distally route the gracilis under the ITB through the intraosseous tunnel to emerge at the proximal incision at the ALL tibial insertion (Figure 3E). The suture grasper was then passed from proximal to the distal stab incision on the tibia under the ITB, grasping the traction suture of the gracilis tendon graft, which was retracted proximally to emerge at the proximal incision (Figure 3F). An interference screw (Arthrex) was used to secure the tendon in the distal tibial tunnel in extension and neutral rotation to reduce the risk of overtightening in external rotation, which could limit internal rotation. The ALL graft was then tensioned and tied over the first gracilis strand by use of the ACL graft traction suture. The residual stump of the ALL graft was then cut short, just distal to the suture knot. Skin incisions were closed in the standard fashion with No. 2.0 Vicryl (Ethicon Inc) absorbable subdermal sutures and a skin suture.

Postoperative Rehabilitation

Patients then began a classic rehabilitation program, entailing full weightbearing after the procedure, without brace, and progressive range of motion exercises. A gradual return to sports activities was allowed starting at 4 months for nonpivoting sports, at 6 months for pivoting noncontact sports, and at 8 to 9 months for pivoting contact sports.

RESULTS

There were 92 patients, with 68 men and 24 women. The mean ± SD age at surgery was 24 ± 9 years. The mean time from injury to surgery was 19 ± 41 months, and the mean follow-up time was 32.4 ± 3.9 months (Table 1).

Complications or Reinterventions

One patient was operated for a cyclops syndrome and 1 for a partial lateral meniscectomy; 5 patients underwent operation for a partial medial meniscectomy after failure of the meniscal repair performed at the surgery. One patient (1.1%) had an ACL graft rupture 1 year after the ACL reconstruction, and 7 patients (7.6%) had a contralateral

TABLE 1
Patient Demographics (N = 92 Patients)

Sex, male/female, n	68/24
Age at surgery, y, mean ± SD	24 ± 9
Body mass index, mean ± SD	24 ± 2.7
Time from injury to surgery, mo, mean ± SD	19 ± 41
Follow-up time, mo, mean ± SD	32.4 ± 3.9
Lost to follow-up, n	1
Graft rupture during the study period, n	1
Contralateral anterior cruciate ligament rupture during the study period, n	7
Reintervention (cyclops syndrome, meniscectomy), n	7
Patients available for final evaluation, n	83

ACL rupture. One patient was lost to follow-up, leaving 83 patients for final evaluation (Table 1).

Subjective Knee Evaluation

The mean ± SD IKDC subjective score was 58.7 ± 15.4 before surgery and 86.7 ± 12.3 at the last postoperative follow-up ($P < .0001$). The mean Lysholm score was 51.4 ± 5.2 before surgery and 92 ± 9.8 at the last follow-up ($P < .0001$). The TAS result before surgery (7.3 ± 1.7) was slightly higher than that at last follow-up (7.1 ± 1.8) ($P < .01$). At final evaluation, the mean KOOS score was 88 ± 11.3 (Table 2).

Objective Evaluation

No patients demonstrated limitation of range of motion. Among the 83 patients evaluated, 52 (62.7%) patients were graded C and 31 (37.3%) were graded D on the IKDC objective score before surgery. At the last follow-up, 76 (91.6%) patient were graded A, and 7 (8.4%) patients were graded B ($P < .0001$). Preoperatively, 41 (49.4%) patients had grade 1, 23 (27.7%) patients had grade 2, and 19 (22.9%) patients had grade 3 pivot-shift test results. Postoperatively, 76 (91.6%) patients had a negative pivot shift and 7 (8.4%) patients had a grade 1 ($P < .0001$). The mean side-to-side differential anterior laxity with the Rolimeter device was 8 ± 1.9 mm before surgery and decreased significantly to 0.7 ± 0.8 mm at the last follow-up ($P < .0001$) (Table 2).

Sport Activity Level

There were 59 (71.1%) patients who returned to the same activity level and 24 (28.9%) who returned to a lower level, 14 for reasons unrelated to the injured knee and 10 because of the knee (6 anterior knee pain, 2 painful tibial tunnel, 2 apprehension).

TABLE 2
Postoperative Outcomes[a]

	Preoperative	Postoperative	P
IKDC subjective score	58.7 ± 15.4	86.7 ± 12.3	<.0001
IKDC objective score			<.0001
A		76 (91.6)	
B		7 (8.4)	
C	52 (62.7)		
D	31 (37.3)		
Lysholm	51.4 ± 5.2	92 ± 9.8	<.0001
Tegner	7.3 ± 1.7	7.1 ± 1.8	<.01
Pivot shift (IKDC grade)			<.0001
0 (equal)	0	76 (91.6)	
1 (glide)	41 (49.4)	7 (8.4)	
2 (clunk)	23 (27.7)		
3 (gross)	19 (22.9)		
Instrumented anteroposterior laxity side-to-side, mm	8 ± 1.9	0.7 ± 0.8	<.0001
KOOS score		88 ± 11.3	

[a]Values are reported as mean ± SD or n (%). IKDC, International Knee Documentation Committee.

DISCUSSION

Our study demonstrates functional, objective, and subjective results similar to those previously reported with ACL reconstruction and ACL with lateral tenodesis reconstruction.[13,19,27,48] Our combined ACL and ALL reconstruction allowed good anteroposterior and rotational laxity control without specific complications such stiffness or limited range of motion. In the literature, at 2-year follow-up, it appears that the rate of graft rupture is similar to the rate of contralateral rupture except for younger patients, in whom the risk is higher.[51,52] At 5-year follow-up, the risk of ACL tear in the contralateral knee (11.8%) is double the risk of ACL graft rupture in the ipsilateral knee (5.8%).[55] With more than 2 years of follow-up, our series shows a contralateral ACL rate rupture (6.6%) similar to that described in the recent literature.[17,38,51,52] Interestingly, our ACL graft rupture rate for this combined reconstruction (1.1%) was lower than that published.[17,38,51,52]

Despite satisfactory clinical results, isolated ACL reconstructions do not restore normal kinematics and biomechanics of the knee, and they particularly do not fully control knee rotational instability.[22,36] A positive pivot-shift test of varying grades and proportions can persist in up to 25% of patients after ACL reconstruction.[5] The development of the double-bundle ACL reconstruction has prompted a new interest in this lack of rotational control. The discovery of the posterolateral bundle has allowed a more "anatomic" restoration of the ACL with an expectation of improved biomechanical behavior.[54] However, the clinical benefit of these double-bundle reconstructions continues to be debated.[28] In our experience, double-bundle reconstruction[42] has not provided an obvious benefit in rotational control and has led to an increase in the rate of cyclops syndrome.[43,44] It is in this context that the lateral tenodesis has been considered, with a view to improving this insufficient rotational control. A lateral extra-articular tenodesis, which is peripheral to the center of rotation of the knee, provides a better lever arm for controlling internal rotation than the intra-articular reconstruction.[2] Two controlled clinical trials involving ACL with extra-articular lateral tenodesis versus double-bundle ACL reconstruction have been published. Monaco et al,[30] in a computer-assisted study, found that the addition of a lateral extra-articular reconstruction to a standard single-bundle ACL reconstruction was more effective in reducing the internal rotation of the tibia at 30° of knee flexion than both a standard single-bundle ACL reconstruction and an anatomic double-bundle reconstruction. Zaffagnini et al[55] studied whether the in vivo static and dynamic behavior obtained using over-the-top single-bundle with extra-articular tenodesis reconstruction was comparable with the results achieved by anatomic double-bundle approach. The investigators found that both reconstructions worked similarly for static knee laxity. The extra-articular procedure played an important role in better constraining the displacement of the lateral tibial compartment, whereas the anatomic double-bundle reconstruction better restored the dynamic behavior of the knee joint, highlighted under the pivot-shift stress test.

For several authors,[1,18,34] the anterolateral structures of the knee are an important restraint to internal rotation of the lateral compartment and are almost always injured during ACL rupture. From a biomechanical point of view, several studies have shown that these anterolateral structures of the knee work in synergy with the ACL.[20,24,53] A recent study[32] demonstrated that the lesion of the anterolateral femorotibial ligament increases tibial rotation and could be correlated to the pivot-shift phenomenon. Although the extra-articular reconstruction had little effect in reducing the anterior displacement of the tibia at 30° of flexion, it was more effective than was intra-articular ACL reconstruction in reducing the axial tibial rotation.[9] The authors concluded that anatomic ACL reconstruction and lateral tenodesis were synergistic in controlling the pivot-shift phenomenon.[31] In a multicenter French study on ACL reconstruction revision, the authors[48] assessed the influence of an associated lateral extra-articular tenodesis on knee stability and IKDC score. They found that when a lateral tenodesis was performed, 80% of patients had a negative pivot-shift test, versus 63% in those without a tenodesis (P = .03). However, there was no significant difference in IKDC score.

It remains perplexingly difficult to anatomically define the "anterolateral structures." From Kaplan[21] to Vieira et al,[49] various anterolateral structures of the knee have been described as organized in 2 layers,[21] 3 layers,[29] or 5 layers[47] and as containing the lateral joint capsule and other ligaments. This has led to confusion and difficulty in achieving an anatomic reconstruction of these structures. An identifiable ALL has only recently been described by several authors.[4,8,11,15,50] Its existence was suspected as early as 1879, when Segond[40] described the now-eponymous avulsion fractures of the proximal tibia above and behind the Gerdy tubercle. The ALL shares an origin from the lateral femoral condyle near the lateral collateral ligament (LCL) and runs obliquely parallel but deep to the ITB. The ALL inserts on the midportion of the proximal tibia halfway between the Gerdy tubercle and the fibular head. The close proximity to the ITB and the LCL may have contributed to difficulty identifying the ALL and, more specifically, its femoral insertion, until now. Different femoral insertions have been described in anatomic studies,[8,11] and authors have reported that the ALL and LCL fibers often integrate at the level of their femoral insertion. Existence of the ALL has been recently confirmed by ultrasound imaging[7] and identified during an arthroscopic exploration of the knee.[41] Claes et al[8] were the first to hypothesize the importance of the ALL in controlling internal tibial rotation and its role in preventing the pivot-shift phenomenon.

Previous comparative studies of ACL reconstruction with or without extra-articular lateral tenodesis failed to demonstrate better clinical outcomes in favor of the lateral tenodesis.[3,33,35,37,46] Moreover, for some authors, the additional extra-articular lateral tenodesis was causing donor site morbidity, cosmesis problems,[37] stiffness, loss of motion, patellofemoral crepitation, poor subjective results,[3,33,37] and degenerative changes in the lateral compartment.[37,46] These poor results could now be explained by a combination of imperfectly anatomic ACL reconstruction, an empirical extra-articular lateral tenodesis, and a postoperative protocol involving immobilization of the knee and a slow rehabilitation program.

Our specifications for achieving an extra-articular tenodesis should therefore avoid all these problems and complications.[10,13] We have chosen the gracilis tendon for our lateral tenodesis in a combined reconstruction technique similar to that already described.[27] For cosmetic reasons and to limit the risk of stiffness, the graft was routed percutaneously under the ITB but above the LCL.[19] To reduce the risk of limitations of range of motion, we felt that it was essential to have an "isometric" lateral tenodesis. We carefully determine the insertion site according to the published recommendations, and the graft is secured with a minimum tension in a neutral rotation of the tibia.[23,39]

Our indications for combined ACL and ALL reconstruction are not limited to grade 2 or 3 pivot shift but include associated Segond fracture, chronic ACL lesion, high level of sporting activity, participation in pivoting sports (eg, soccer, rugby, handball, basketball), and a lateral femoral notch sign[16] on radiographs. In our experience, isolated ACL reconstruction for these patients does not confer an efficient rotational control and has demonstrated a high rerupture rate. Nevertheless, longer term comparative studies are necessary to determine more objectively the surgical indication for these combined ACL and ALL reconstruction.

This study has some limitations. It is a retrospective study without a control group; the pivot-shift test used to evaluate rotational instability is a subjective test; and the follow-up is limited to 2 years, which is too short to evaluate potential degenerative changes. Some authors have reported that extra-articular lateral tenodesis was associated with lateral chondral degeneration.[37,46] However, it has been suggested that no overconstraint of the lateral compartment was demonstrated when an extra-articular tenodesis was performed with an anatomic ACL reconstruction.[12] A long-term prospective clinical and radiographic evaluation by Marcacci et al[27] showed no increase in osteoarthritis of the lateral compartment with an additional lateral reconstruction. We had initially chosen to position the femoral ALL insertion proximal to the lateral femoral epicondyle, corresponding to the isometric point already known. Since then, further anatomic[8] and arthroscopic[41] dissections have found the ALL femoral insertion distal to the lateral epicondyle. However, the site of the femoral insertion continues to be a subject of debate. Dodds et al[10] found it proximal to the epicondyle, and Caterine et al,[4] in a more recent article, found a variation of both its proximal and distal femoral insertion.

CONCLUSION

Because of the recent identification of the ALL and the absence of perfect rotational control of the knee with our current ACL reconstruction techniques, an extra-articular lateral tenodesis will become relevant. Further anatomic and biomechanical studies of the anterolateral structures and in particular the ALL, demonstrating its role in the rotational control of the knee, are needed to improve clinical results and reduce the problems encountered in the past. This study demonstrates that a combined ACL and ALL reconstruction can be an effective procedure without specific complications at a minimum follow-up of 2 years. Longer term follow-up studies are necessary to determine whether these combined ALL reconstructions improve the results of contemporary ACL treatment, especially with regard to problematic, persistent rotational laxity or graft rupture.

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