

Editorial Commentary: Let's ALL Agree—Anterior Cruciate Ligament Reconstruction Outcomes Need to Be Improved and Extra-Articular Procedures Have an Essential Role



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Abstract: We are united as an orthopaedic community in trying to improve the outcomes of anterior cruciate ligament (ACL) reconstruction. Graft rupture rates of 10% to 28% are reported in high-risk populations, reoperation for non-graft rupture—related indications are reported in 18% to 26%, and only 50% to 65% of recreational athletes return to their preinjury level of sports. Numerous groups across the world have published studies providing evidence demonstrating significant clinical efficacy of lateral extra-articular tenodesis in improving the outcomes of ACL surgery. Finally, the reductions in ACL graft rupture rates augmented with anterolateral ligament or a modified Lemaire reconstruction appear to be broadly comparable. In our hands, anterolateral ligament may result in fewer adverse events.

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First, we would like to congratulate Getgood, Hewison, Bryant, Litchfield, Heard, Buchko, Hiemstra, Willits, Firth, MacDonald, and the Stability Group for their prospective randomized controlled trial entitled “No Difference in Functional Outcomes When Lateral Extra-Articular Tenodesis is Added to Anterior Cruciate Ligament Reconstruction in Young Active Patients: The Stability Study.”¹ The results of this trial have been highly anticipated due to the considerable controversy surrounding this topic. Regular readers of *Arthroscopy* will be familiar with the heated exchanges that have taken place through letters to the editor regarding whether it is a modified Lemaire, anterolateral ligament (ALL) reconstruction, or another type of procedure that is the most appropriate extra-articular tenodesis.²⁻⁵ However, these discussions have been limited due to a lack of published contemporary clinical

outcomes for the modified Lemaire procedure and have instead focused on cadaveric biomechanical studies that may not reliably extrapolate to clinical practice.⁶⁻¹¹

In the meantime, numerous groups across the world have published studies providing evidence demonstrating significant clinical efficacy of anterolateral ligament reconstruction (ALLR) in improving the outcomes of ACL surgery. The Stability study is therefore a welcome addition to the literature and represents a very well-conducted, high-quality study. The main importance of this study, and for that matter any clinical study on this topic, is the fact that we are all united as an orthopaedic community to try and improve the outcomes of ACL reconstruction. Every sports surgeon has a responsibility to look objectively at published contemporary clinical results and ask themselves whether these are acceptable or whether there is a need to improve outcomes: Graft rupture rates of 10% to 28% are reported in high-risk populations,^{12,13} reoperation rates for non-graft rupture—related indications are reported between 18% and 26% of patients,¹⁴ and only 50% to 65% of recreational athletes return to their preinjury level of sport.¹⁵ Such poor outcomes would not be accepted in any other subspecialty in orthopaedics, and there is clearly a need to improve. The Stability study adds to the wealth of clinical data

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supporting extra-articular tenodesis (EAT) procedures and allows us to speak with a united voice that EAT procedures have an essential role.^{1,16}

The rationale for adding an EAT includes the following:

- numerous clinical studies demonstrating a reduction in ACL graft rupture rates with an EAT¹⁷⁻²⁰;
- all clinical series of combined anterior cruciate ligament reconstruction (ACLR) + EAT since 2015 have reported good clinical outcomes in adults²¹⁻³² and skeletally immature patients^{33,34};
- numerous clinical studies demonstrating a high proportion (up to 90% in acute ACL-injured knees) of injuries to anterolateral structures, both on imaging and at open lateral exploration³⁵⁻³⁸; and finally
- the fact that the theoretical early degenerative change has never been clinically demonstrated.³⁹

So, as Rossi said in his brilliant editorial commentary, “Anterolateral Ligament Augmentation for the Anterior Cruciate Ligament-Deficient Knee Debate—The Proof Is in the Pudding,”⁴⁰ “The story is not anymore “if” augmentation should be considered but “when” and, maybe more important, “how” to augment.”

Of course, the debate regarding which EAT is best can only be answered through future comparative clinical studies.⁴¹ However, some observations can be drawn in the interim. The Stability Group studied a modified Lemaire, whereas the SANTI Study Group has extensively studied reconstruction of the ALL. Biomechanically, there are some differences between the procedures since the ALL demonstrates nonisometric behavior, being tight in extension and slack in flexion, thus allowing physiological internal rotation of the tibia at 90° of flexion.⁴² In contrast, the modified Lemaire is isometric, with a tendency to limit physiological internal rotation of the tibia at 90° of flexion, without knowing whether it is clinically important or not.⁴³

Despite these differences, the reductions in graft rupture rates with each procedure appear to be broadly comparable. The Stability Group reported an 11% graft rupture rate after isolated hamstring ACLR versus 4% following ACLR with a concomitant modified Lemaire, therefore confirming the effectiveness of this type of EAT.¹⁶ Similarly, in our prospective, nonrandomized study of more than 500 patients, we also reported broadly comparable, and significantly lower graft rupture rates with a concomitant ALLR.¹⁹ However, it is also important to highlight some potentially important differences in clinical outcomes, particularly with respect to rates of adverse events. In 2017, Thunat et al.⁴⁴ showed a low rate of reoperation after combined ACLR + ALLR in 548 patients, with less than 1% of patients experiencing ALLR-related complications. Moreover, in an interim analysis of results from our randomized controlled trial (ClinicalTrials.gov:

NCT03740022) we found no evidence of an increased risk of short-term adverse events after combined ACLR + ALLR when compared with isolated ACLR.⁴⁵ In contrast, the Stability group reported greater rates of adverse events (n = 23 LET-related complications in 151 patients) with their technique for modified Lemaire, including overconstraint of the lateral compartment, iatrogenic injury to the lateral collateral ligament, unspecified difficulties with the EAT graft, hardware irritation requiring removal, pain or sensitivity over the lateral extra-articular tenodesis staple, hematoma at the lateral extra-articular tenodesis site, iliotibial band snapping, and increased early pain and delayed functional recovery (including delayed return to sport).^{1,16} It is for these reasons that we prefer an ALLR and reserve the modified Lemaire for revision of ACL reconstructions. However, it is only with additional well-designed comparative clinical trials that we will be able to know which EAT is the most suitable and particularly for which types of patients.⁴¹

As a final thought, it is important to highlight that the main purpose of the current study was to assess functional outcomes.¹ For patients, this simply means being able to return to their chosen sport at the preinjury level, and unfortunately this was not reported. Instead, the authors chose the Limb Symmetry Index based upon 4 hop tests as the primary outcome measure. It is recognized that Limb Symmetry Index may underestimate performance deficits (due to bilateral deficits following ACLR) and should be interpreted with caution.⁴⁶ However, their finding that there was no difference between groups remains an important one.¹

Once again, we congratulate the Stability Group for their excellent work. It is only with clinical articles of this quality that we can improve outcomes for our patients.

References

1. Getgood A, Hewison C, Bryant D, et al, and Stability Study Group. No difference in functional outcomes when lateral extra-articular tenodesis is added to anterior cruciate ligament reconstruction in young active patients: The Stability Study. *Arthroscopy* 2020;36:1690-1701.
2. Williams A. Editorial Commentary: The anterolateral ligament: the emperor's new clothes? *Arthroscopy* 2018;34:1015-1021.
3. Sonnery-Cottet B, Claes S, Blakeney WG, et al. Scientific Anterior Cruciate Ligament Network International (SANTI) Study Group. *Anterolateral ligament: Let's stick to the facts!* *Arthroscopy* 2018;34:2259-2262.
4. Ferretti A. Response to “Editorial Commentary: The anterolateral ligament: The emperor's new clothes?” *Arthroscopy* 2018;34:2262-2266.
5. Kartus JT. Editorial Commentary: The anterolateral ligament of the knee seems more fact than fiction. *Arthroscopy* 2017;33:155-156.
6. Schon JM, Moatshe G, Brady AW, et al. Anatomic anterolateral ligament reconstruction of the knee leads to

- overconstraint at any fixation angle. *Am J Sports Med* 2016;44:2546-2556.
7. Huser LE, Noyes FR, Jurgensmeier D, Levy MS. Anterolateral ligament and iliotibial band control of rotational stability in the anterior cruciate ligament-intact knee: Defined by tibiofemoral compartment translations and rotations. *Arthroscopy* 2017;33:595-604.
 8. Shimakawa T, Burkhart TA, Dunning CE, Degen RM, Getgood AM. Lateral compartment contact pressures do not increase after lateral extra-articular tenodesis and subsequent subtotal meniscectomy. *Orthop J Sports Med* 2019;25:2325967119854657.
 9. Inderhaug E, Stephen JM, Williams A, Amis AA. Anterolateral tenodesis or anterolateral ligament complex reconstruction: Effect of flexion angle at graft fixation when combined with ACL reconstruction. *Am J Sports Med* 2017;45:3089-3097.
 10. Neri T, Parker DA, Beach A, Boyer B, Farizon F, Philippot R. Anterolateral ligament of the knee: What we know about its anatomy, histology, biomechanical properties and function. *Surg Technol Int* 2018;33:312-318.
 11. Ariel de Lima D, Helito CP, Lacerda de Lima L, et al. Anatomy of the anterolateral ligament of the knee: A systematic review. *Arthroscopy* 2019;35:670-681.
 12. Wiggins AJ, Grandhi RK, Schneider DK, Stanfield D, Webster KE, Myer GD. Risk of secondary injury in younger athletes after anterior cruciate ligament reconstruction: A systematic review and meta-analysis. *Am J Sports Med* 2016;44:1861-1876.
 13. Webster KE, Feller JA. Exploring the high reinjury rate in younger patients undergoing anterior cruciate ligament reconstruction. *Am J Sports Med* 2016;44:2827-2832.
 14. Hettrich CM, Dunn WR, Reinke EK, MOON Group, Spindler KP. The rate of subsequent surgery and predictors after anterior cruciate ligament reconstruction: Two- and 6-year follow-up results from a multicenter cohort. *Am J Sports Med* 2013;41:1534-1540.
 15. McCullough KA, Phelps KD, Spindler KP, Matava MJ, Dunn WR, Parker RD, MOON Group, et al. Return to high school- and college-level football after anterior cruciate ligament reconstruction: A multicenter orthopaedic outcomes network (MOON) cohort study. *Am J Sports Med* 2012;40:2523-2529.
 16. Getgood AMJ, Bryant DM, Litchfield R, et al; STABILITY Study Group. Lateral extra-articular tenodesis reduces failure of hamstring tendon autograft anterior cruciate ligament reconstruction: 2-year outcomes from the stability study randomized clinical trial. *Am J Sports Med* 2020;48:285-297.
 17. Noyes FR, Barber SD. The effect of an extra-articular procedure on allograft reconstructions for chronic ruptures of the anterior cruciate ligament. *J Bone Joint Surg Am* 1991;73:882-892.
 18. Imbert P, Lustig S, Steltzlen C, et al; French Arthroscopy Society. Midterm results of combined intra- and extra-articular ACL reconstruction compared to historical ACL reconstruction data. Multicenter study of the French Arthroscopy Society. *Orthop Traumatol Surg Res* 2017;103: S215-S221.
 19. Sonnery-Cottet B, Saithna A, Cavalier M, et al. Anterolateral ligament reconstruction is associated with significantly reduced ACL graft rupture rates at a minimum follow-up of 2 years: a prospective comparative study of 502 patients from the SANTI Study Group. *Am J Sports Med* 2017;45:1547-1557.
 20. Helito CP, Sobrado MF, Giglio PN, et al. Combined reconstruction of the anterolateral ligament in patients with anterior cruciate ligament injury and ligamentous hyperlaxity leads to better clinical stability and a lower failure rate than isolated anterior cruciate ligament reconstruction. *Arthroscopy* 2019;35:2648-2654.
 21. Sonnery-Cottet B, Thaunat M, Freychet B, Pupim BH, 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;43:1598-1605.
 22. Ferretti A, Monaco E, Ponzio A, et al. Combined intra-articular and extra-articular reconstruction in anterior cruciate ligament-deficient knee: 25 years later. *Arthroscopy* 2016;32:2039-2047.
 23. Zaffagnini S, Marcheggiani Muccioli GM, Grassi A, et al. Over-the-top ACL reconstruction plus extra-articular lateral tenodesis with hamstring tendon grafts: prospective evaluation with 20-year minimum follow-up. *Am J Sports Med* 2017;45:3233-3242.
 24. Helito CP, Camargo DB, Sobrado MF, et al. Combined reconstruction of the anterolateral ligament in chronic ACL injuries leads to better clinical outcomes than isolated ACL reconstruction. *Knee Surg Sports Traumatol Arthrosc* 2018;26:3652-3659.
 25. Ponzio A, Monaco E, Basigliani L, et al. Long-term results of anterior cruciate ligament reconstruction using hamstring grafts and the outside-in technique: A comparison between 5- and 15-year follow-up. *Orthop J Sports Med* 2018;30:2325967118792263.
 26. Sonnery-Cottet B, Saithna A, Blakeney WG, et al. Anterolateral ligament reconstruction protects the repaired medial meniscus: A comparative study of 383 anterior cruciate ligament reconstructions from the Santi study group with a minimum follow-up of 2 years. *Am J Sports Med* 2018;46:1819-1826.
 27. Ueki H, Katagiri H, Otabe K, et al. Contribution of additional anterolateral structure augmentation to controlling pivot shift in anterior cruciate ligament reconstruction. *Am J Sports Med* 2019;47:2093-2101.
 28. Rosenstiel N, Praz C, Ouanezar H, et al. Combined anterior cruciate and anterolateral ligament reconstruction in the professional athlete: Clinical outcomes from the scientific anterior cruciate ligament network international study group in a series of 70 patients with a minimum follow-up of 2 years. *Arthroscopy* 2019;35:885-892.
 29. Lee DW, Kim JG, Cho SI, Kim DH. Clinical outcomes of isolated revision anterior cruciate ligament reconstruction or in combination with anatomic anterolateral ligament reconstruction. *Am J Sports Med* 2019;47:324-333.
 30. Saithna A, Daggett M, Helito CP, et al. Clinical results of combined ACL and anterolateral ligament reconstruction: A narrative review from the Santi study group [published online February 5, 2020]. *J Knee Surg*. <https://doi.org/10.1055/s-0040-1701220>.
 31. Grassi A, Zicaro JP, Costa-Paz M, et al; ESSKA Arthroscopy Committee. Good mid-term outcomes and low rates

- of residual rotatory laxity, complications and failures after revision anterior cruciate ligament reconstruction (ACL) and lateral extra-articular tenodesis (LET). *Knee Surg Sports Traumatol Arthrosc* 2020;28:418-431.
32. Ra HJ, Kim JH, Lee DH. Comparative clinical outcomes of anterolateral ligament reconstruction versus lateral extra-articular tenodesis in combination with anterior cruciate ligament reconstruction: Systematic review and meta-analysis [published online March 5, 2020]. *Arch Orthop Trauma Surg*. doi: 10.1007/s00402-020-03393-8.
 33. Kocher MS, Heyworth BE, Fabricant PD, Tepolt FA, Micheli LJ. Outcomes of physeal-sparing ACL reconstruction with iliotibial band autograft in skeletally immature prepubescent children. *J Bone Joint Surg Am* 2018 5;100:1087-1094.
 34. Wilson PL, Wyatt CW, Wagner KJ 3rd, Boes N, Sabatino MJ, Ellis HB Jr. Combined transphyseal and lateral extra-articular pediatric anterior cruciate ligament reconstruction: A novel technique to reduce ACL reinjury while allowing for growth. *Am J Sports Med* 2019;47:3356-3364.
 35. Helito CP, Helito PVP, Leão RV, Demange MK, Bordalo-Rodrigues M. Anterolateral ligament abnormalities are associated with peripheral ligament and osseous injuries in acute ruptures of the anterior cruciate ligament. *Knee Surg Sports Traumatol Arthrosc* 2017;25:1140-1148.
 36. Cavaignac E, Faruch M, Wytrykowski K, Constant O, Murgier J, Berard E, Chiron P. Ultrasonographic evaluation of anterolateral ligament injuries: Correlation with magnetic resonance imaging and pivot-shift testing. *Arthroscopy* 2017;33:1384-1390.
 37. Muramatsu K, Saithna A, Watanabe H, et al. Three-dimensional magnetic resonance imaging of the anterolateral ligament of the knee: An evaluation of intact and anterior cruciate ligament-deficient knees from the Scientific Anterior Cruciate Ligament Network International (SANTI) Study Group. *Arthroscopy* 2018;34:2207-2217.
 38. Ferretti A, Monaco E, Fabbri M, Maestri B, De Carli A. Prevalence and classification of injuries of anterolateral complex in acute anterior cruciate ligament tears. *Arthroscopy* 2017;33:147-154.
 39. Devitt BM, Bouguennec N, Barfod KW, Porter T, Webster KE, Feller JA. Combined anterior cruciate ligament reconstruction and lateral extra-articular tenodesis does not result in an increased rate of osteoarthritis: A systematic review and best evidence synthesis. *Knee Surg Sports Traumatol Arthrosc* 2017;25:1149-1160.
 40. Rossi MJ. Editorial Commentary: Anterolateral ligament augmentation for the anterior cruciate ligament-deficient knee debate—the proof is in the pudding. *Arthroscopy* 2019;35:893-895.
 41. Reider B. ACL or ACL. *Am J Sports Med* 2020;48:281-284.
 42. Imbert P, Lutz C, Daggett M, et al. Isometric characteristics of the anterolateral ligament of the knee: A cadaveric navigation study. *Arthroscopy* 2016;32:2017-2024.
 43. Kittl C, Halewood C, Stephen JM, et al. Length change patterns in the lateral extra-articular structures of the knee and related reconstructions. *Am J Sports Med* 2015;43:354-362.
 44. Thauinat M, Clowez G, Saithna A, et al. Reoperation rates after combined anterior cruciate ligament and anterolateral ligament reconstruction: A series of 548 patients from The SANTI Study Group with a minimum follow-up of 2 years. *Am J Sports Med* 2017;45:2569-2577.
 45. Sonnery-Cottet, B, Pioger, C, Vieira, TD, et al. Combined ACL and anterolateral reconstruction is not associated with a higher risk of adverse outcomes: Preliminary results from the SANTI randomized controlled trial [published online May 1, 2020]. *Orthop J Sports Med*. doi: 10.1177/2325967120918490.
 46. Gokeler A, Welling W, Benjaminse A, Lemmink K, Seil R, Zaffagnini S. A critical analysis of limb symmetry indices of hop tests in athletes after anterior cruciate ligament reconstruction: A case control study. *Orthop Traumatol Surg Res* 2017;103:947-951.