

Editorial Commentary: Revision Anterior Cruciate Ligament Using Soft Tissue Autograft Quadriceps Is Effective but Not Recommended for All Comers



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Abstract: The average revision rate is between 3.2% and 11.1% following primary anterior cruciate ligament (ACL) reconstructions,¹ and an objective failure rate of 13.7% has been reported for revision ACLR.² Prior implants, positioning of tunnels, and muscle weakness from the prior reconstruction present challenges. Additionally, graft choice for the revision reconstruction is restricted, depending on the primary reconstruction. Revision ACL reconstruction with the all-soft tissue quadriceps tendon autograft is a viable option with 83.3% of the patients surpassing the minimally clinically significant difference for International Knee Documentation Committee (IKDC) scores, which is similar to outcomes for revision ACL reconstruction (ACLR) using bone-patella-bone and hamstring tendon autografts. Furthermore, objective strength data suggest that it is possible to achieve equal limb symmetry index strength ratios even in the setting of prior bone-patella tendon-bone autograft. However, although I am cautiously optimistic regarding soft tissue quadriceps autograft in revision ACLR, I would be hesitant to recommend it for all comers. In my experience, young high school/collegiate female athletes with primary reconstruction using BPTB autograft may not be able to tolerate a secondary insult to the extensor mechanism via quadriceps tendon (QT) autograft harvest, where hematoma and arthrofibrosis could be concerns. Furthermore, increased posterior tibial slope may require evaluation and treatment, and the addition of a lateral extra-articular tenodesis may reduce residual rotatory laxity in ACL revision patients.

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In the United States, there is an overall anterior cruciate ligament (ACL) injury incidence of 68.6 per 100,000, and ACL reconstruction (ACLR) is common as well with 75% of subjects undergoing ACLR within the first year of injury, including 98.3% of subjects younger than 18 years of age.³ The average revision rate at minimum 10-year follow-up has been cited between 3.2% to 11.1% following primary ACL reconstructions,¹ and an objective failure rate of 13.7% has been reported for revision ACLR.² A vast majority of patients, particularly patients attempting a return to playing a sport, will opt to undergo a revision ACLR after rerupture of the ACL graft. Fundamentally, revisions present headaches linked to prior implants, positioning of tunnels, and muscle weakness from the prior reconstruction. Additionally, graft choice for the revision reconstruction

is limited by what was used for the primary reconstruction.

ACLR revision cases are difficult and, as in any clinical scenario in medicine, when there are multiple viable options, inherently, there is no one correct answer. In this elegant study, "Revision Anterior Cruciate Ligament Reconstruction With the All-Soft Tissue Quadriceps Tendon Autograft Has Acceptable Early and Intermediate-Term Outcomes" by Hunnicutt, Haynes, Slone, Prince, Boden, and Xerogeanes,⁴ the authors not only demonstrated quadriceps autograft as a viable graft option for revision cases, but they were able to demonstrate no significant differences in quadriceps or hamstring limb symmetry index (LSI) strength ratios between patients with previous hamstring (HT) vs patella tendon (BPTB) autografts. The authors provide a timely study in a well-written article advocating for the use of soft tissue quadriceps autograft in revision ACLR cases. I would like to thank the authors for performing a well-designed study with impressive data, including KT-1000 side-to-side data, patient reported outcomes, and strength testing. There is value to the literature for this timely important topic. With a relatively large

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cohort, there is good clinical impact and data from this study to support revision ACLR using all-soft tissue QT autografts.

The message is interesting, as it focuses on revision management using a single graft for all comers regardless of primary reconstruction graft selection. The authors demonstrated at 42.2 months, mean IKDC scores significantly improved (54.3 ± 13.0 vs 82.8 ± 13.8) with 83.3% of the patients (28.5 points) surpassing the minimally clinically significant difference (MCID) of 11.5 for IKDC scores. This improvement is consistent with reports for ACL revisions using BPTB and HT autografts. Furthermore, the results demonstrated reasonable complication rates (11/80 patients with follow-up), minimal graft laxity, and significantly improved quadriceps LSIs from 6 months to 12 months postoperatively. This objective strength data are valuable especially in counseling, suggesting it is possible to achieve equal LSI strength ratios, even in the setting of prior BPTB autograft.

As with any study, there are limitations. There is a lack of pivot shift test data for knee stability. While anterior translation data have been used as a benchmark for successful outcomes post-ACLR, residual rotatory laxity has been discussed as a possible cause for higher failure rate after revision ACLR.⁵ Further, although a post hoc analysis was performed demonstrating 315 subjects would be required for a small effect size, there were only 21 in the BTB group vs 29 in the hamstring group for the strength comparison. Finally, the results of the study may be different in a contact athletic population. Although, the cohort's mean age was 22.6 years and had an equal representation of males and females, which is more reflective of the patient population undergoing ACLR. Additionally, all patients in this cohort underwent revision ACLR by a single surgeon, thus minimizing variability in operative technique and postoperative protocols.

The study provides evidence for a relatively easily obtained thick graft for revision ACLR cases. Although I am cautiously optimistic regarding soft tissue quadriceps autograft in revision ACLR, I would be hesitant to recommend it for all comers. In my experience, young high school/collegiate female athletes with primary reconstruction using BPTB autograft may not be able to tolerate a secondary insult to the extensor mechanism via QT autograft harvest, where hematoma and

arthrofibrosis may be concerns. Furthermore, increased posterior tibial slope has been identified as one of the factors that increases the risk of ACL tearing and also increases the risk of failure of ACL reconstruction. These considerations must be accounted for in order to minimize failures. Finally, the addition of a lateral extra-articular tenodesis has been shown to allow for low rates of residual rotatory laxity and around 74% return to their previous sport.⁶

As surgeons, we need to continue to learn from the past, while also not being the first or last to adapt to innovation. This study is a great example. Using a minimally invasive technique, the authors were able to show the viability in revision cases of soft tissue quadriceps autograft regardless of primary ACLR graft selection. Continued prospective collection of patient data will be important moving forward, as we attempt to further help guide our decisions in revision ACLR.

References

1. Magnussen RA, Meschbach NT, Kaeding CC, Wright RW, Spindler KP. ACL graft and contralateral ACL tear risk within ten years following reconstruction: A systematic review. *JBJS Rev* 2015;3:01874474-201501000-00002.
2. Wright RW, Gill CS, Chen L, et al. Outcome of revision anterior cruciate ligament reconstruction: a systematic review. *J Bone Joint Surg Am* 2012;94:531-536.
3. Sanders TL, Maradit Kremers H, Bryan AJ, et al. Incidence of anterior cruciate ligament tears and reconstruction: A 21-year population-based study. *Am J Sports Med* 2016;44:1502-1507.
4. Hunnicutt JL, Haynes WB, Slone HS, Prince JA, Boden SA, Xerogeanes JW. Revision anterior cruciate ligament reconstruction with the all-soft tissue quadriceps tendon autograft has acceptable early and intermediate-term outcomes. *Arthroscopy* 2021;37:2848-2857.
5. Grassi A, Ardern CL, Marcheggiani Muccioli GM, Neri MP, Marcacci M, Zaffagnini S. Does revision ACL reconstruction measure up to primary surgery? A meta-analysis comparing patient-reported and clinician-reported outcomes, and radiographic results. *Br J Sports Med* 2016;50:716-724.
6. Grassi A, Zicaro JP, Costa-Paz M, et al. 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.