Editorial Commentary: Clinical and Basic Science Evidence Supports the Use of Suture Tape Augmentation of Posterior Cruciate Ligament Reconstruction

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Abstract: Although isolated posterior cruciate ligament (PCL) injuries often can be treated successfully without surgical intervention, in the setting of persistent instability or multiligamentous knee injury, PCL reconstruction is indicated. PCL reconstructions often have resulted in persistent postoperative laxity. Recent research suggests there may be a role for suture tape–augmented grafts, which have demonstrated decreased clinical and radiographic laxity as well as improved rates of return to previous level of activity, as compared with PCL reconstruction alone. Several biomechanical studies also have supported the use of suture tape augmentation in PCL reconstruction, and the use of suture tape augmentation or internal bracing and ligament surgery is gaining widespread popularity. These ultrahigh molecular weight polyethylene/polyester suture tapes have been shown to be safe and effective. We may be at the point at which the evidence supports the use of suture tape augmentation of PCL reconstruction.

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In the article by Zhang, Wang, Gao, Zheng, and Gong,[1] entitled "Suture Tape Augmentation Improves Posterior Stability After Isolated Posterior Cruciate Ligament Reconstruction Using Hamstring Tendon Autograft With Single-Bundle Transtibial Technique," the authors make a compelling argument to support the use of internal brace or suture tape augmentation in posterior cruciate ligament (PCL) reconstruction.

The authors should be commended for a very well-thought-out study. This was a single-surgeon study with 59 isolated PCL reconstructions all using semitendinosis/gracilis autograft, all single bundle, and all transtibial techniques followed for a minimum of 2 years. There were 28 patients in the control group (no suture tape augmentation) and 31 patients in the study group (suture tape augmentation). Standard patient-reported outcomes included the International Knee Documentation Committee subjective, Lysholm, and Tegner scores, return to sport, as well as clinical examination with posterior drawer testing, and Telos posterior stress radiographs.

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The groups were very well matched with regards to follow-up, body mass index, preoperative range of motion, laxity grade, activity score, and preoperative patient-reported outcomes. In addition, they had an independent assessor blinded to the study groups performing the posterior drawer examination. Indications for surgery were isolated grade 3 PCL-deficient knees or grade 2 PCL-deficient knees that failed nonoperative care. They excluded any patients with multiple ligament injuries, previous surgery, malalignment, or bone fractures of the ipsilateral limb. Therefore, the authors took many variables into consideration in order to come up with a very clean study from a methodological standpoint.

Single-bundle PCL reconstruction with autograft is a validated technique for PCL reconstruction. In a systematic review by Hudgens et al.[2] comparing autograft and allograft in PCL reconstructions, the authors noted no difference in patient-reported outcomes. In another systematic review by Kohen et al.,[3] no differences were noted comparing single-bundle versus double-bundle PCL reconstruction. In another systematic review by May et al.[4] comparing transtibial versus inlay PCL reconstruction, no evidence-based outcome differences were noted.

There were several notable findings in the study by Zhang et al., including return to preinjury activity level of 21% in the control group versus almost 50% in the study group. Furthermore, more than 20% of the patients in the control group had persistent grade II laxity compared with 0 patients in the study group. That said, only 2 patients in the control group underwent revision PCL reconstruction. Another notable finding was the Telos stress radiographs, which showed on average 1.5 mm side-to-side difference in the study group versus over 3 mm side-to-side difference in the control group.

Why is this study so important? Well for one thing, PCL reconstructions historically have not demonstrated as favorable outcomes as anterior cruciate ligament (ACL) reconstructions, with residual laxity not only being common but acceptable. One can recall years ago, when general consensus taught that going from a grade 3 posterior drawer to a grade 2 was considered successful.

With the advent of newer techniques, several outcome studies have shown posterior stress view data at approximately 2 mm side-to-side difference. Freychet et al.[5] reported a 1.1-mm side-to-side difference with kneeling stress views with an all-inside/all-socket single-bundle technique using allograft, and LaPrade et al.[6] reported similar findings with a double-bundle allograft technique. Therefore, when it comes to PCL reconstructions, anything to improve on persistent residual laxity should be considered.

The use of suture tape augmentation or internal bracing and ligament surgery is gaining widespread popularity. These ultrahigh molecular weight polyethylene/polyester suture tapes have been shown to be safe and effective in several studies.[7] A study out of the Mayo Clinic comparing hamstring autograft ACL reconstruction with and without suture tape augmentation showed no increased risk of complications or synovitis.[8] Although there were no significant differences in patient-reported outcomes or graft failure rates, the suture tape group had greater Tegner scores postoperatively. More recently, Daniel et al.[9] reported on 200 ACL reconstructions, 100 with suture tape augmentation compared with 100 without. The authors showed a statistically significant decrease in failure rates (8% vs 1%).

Several biomechanical studies also have supported the use of suture tape augmentation in PCL reconstruction. Levy et al.[10] as well as Trasolini et al.[11] both showed adding suture tape augmentation increased ultimate load to failure and decreased total elongation of the reconstructed grafts.

Clinical studies are now becoming available supporting this biomechanical data. In a recent study by Therrien et al.,[12] the authors compared 50 PCL reconstructions with and without suture tape augmentation in a predominantly multiligament knee injured cohort using allograft with a single bundle technique. Although no differences were found in patient-reported outcomes or graft failure rates, the kneeling stress radiographs did trend toward favoring the suture tape group, although findings did not reach significance.

There are several potential downsides to using suture tape augmentation. Cost is certainly an issue as well as the rare cases of infection, where this heavy braided material can certainly trap bacteria. That said, the concept of "stress shielding" is the one with which most surgeons are concerned. In one notable study by Bachmaier et al.,[13] the authors demonstrated that independent suture tape augmentation with ACL reconstruction reduced peak loads on the soft-tissue grafts. The authors demonstrated that load sharing occurs and peak loads are actually transferred to the suture tape, which resulted in decreased elongation of the construct. Their load-distribution curves showed that at low loads the graft took all of the load, but at peak loads the suture tape started to share the loads, protecting the graft. At no time were the loads completely transferred to the suture tape, refuting the notion that "stress shielding" of the graft occurs. Instead, they presented the concept of "synergistic load sharing."

As the authors respectfully note, their study is not without limitations. The most important to mention is that the authors allowed patients to decide whether to use suture tape augmentation or not. They presented the theoretical advantages and disadvantages of using suture tape with limited available clinical data. This led to significant selection bias and therefore the generalizability of the conclusions remains a challenge. An appropriately powered randomized clinical trial would be the next step in solidifying evidence-based recommendations on this topic.

That said, we congratulate the authors on performing an excellent study with data that are quite compelling. Coupled with other clinical and biomechanical studies, we may be at the point where the evidence supports the use of suture tape augmentation in all PCL reconstructions.

Disclosures

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: B.A.L. reports a relationship with Arthrex that includes consulting or advisory and royalty payments; serves on the editorial board of the following journals: *Journal of Knee Surgery, Knee Surgery, Sports Traumatology, Arthroscopy*, and *Orthopedics Today*; and serves on the AONA Speakers Bureau. All other authors (S.A.L., L.A.R.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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