

Editorial Commentary: Buckle Up Surgeons: “Safety Belt” Reinforcement of Knee Anterior Cruciate Ligament Reconstruction Grafts



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Abstract: Safety belt, or cerclage, reinforcement of anterior cruciate ligament (ACL) grafts may protect against various modes of failure including creep and irreversible stretch, traumatic tearing, and slippage of the tendon-bone interface. A time-zero, biomechanical study shows that suture reinforcement may protect small and vulnerable hamstring ACL reconstruction grafts from these various modes of failure. Thus, in vivo comparative outcome analysis is indicated to determine if the benefits of reinforcement translate from the benchtop to the operating room.

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While anterior cruciate ligament reconstruction (ACL) is largely one of the more successful operations for us as sports surgeons, revisions still occur despite technically well-positioned sockets and use of autogenous tissue. Recent studies, including a recent meta-analysis by Samuelsen and Krych et al.,¹ have shown that smaller hamstring graft constructs may be predisposed to a higher rate of failure. Multiple studies have shown that this difference may be attributable, at least in part, to the unpredictability of graft size prior to harvest and using a graft smaller than 8 mm in diameter.²⁻⁴ This, in addition to noncompliant patients, leads us to examine novel ways to treat our patients better.

While the mode of failure is variable, creep and irreversible stretch of a vulnerable graft or slippage at the tendon-bone interface during the early phases of healing are likely culprits. While cerclage fixation is often a routine consideration for us to protect extensor mechanism repairs or patella fracture fixation, we have not previously thought to extend those principles to “reinforcement” and “insurance” for cruciate or collateral ligament reconstructions. Ironically, these grafts may be more prone to irreversible stretch in the early

phases of rehabilitation, but this is often not detected until the instability is clinically manifest after clearance and return to play for the athlete when it is just too late.

In this month’s issue, Bachmaier, Smith, Bley, and Wijdicks present “Independent Suture Tape Reinforcement of Small and Standard Diameter Grafts for Anterior Cruciate Ligament Reconstruction: A Biomechanical Full Construct Model,”⁵ a novel approach for augmentation of small-diameter soft-tissue grafts used for ACL reconstruction with a “safety belt” suture construct. The study reports compelling time-zero, biomechanical data that suture reinforcement and “internal bracing” may be valuable protection of an ACL reconstruction, and even critical for the vulnerable small graft. Reinforcement of a small-diameter graft significantly reduced elongation by up to 60% with a novel cyclic loading protocol that is replicative of typical forces subjected to the graft during the early and late rehabilitation phase after surgery. Furthermore, there was a noted improvement in ultimate failure strength of both small and standard-sized graft constructs by 64% and 40%, respectively. All of these values were accomplished without stress-shielding the graft or over-constraining the native ACL properties. This early protection of the vulnerable graft with its fixation until sufficient healing has occurred may be critical to improve outcomes and reduce risk factors for failure of ACL reconstruction. Like all biomechanical validations, this will need to be borne out in future clinical studies. This approach is novel given its independent “button-to-button” tensioning and fixation separate from the graft itself. This may be the solution to what has not been

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accomplished by simple allograft augmentation to increase hamstring graft size (the so-called “hybrid”); in fact, Pennock et al.⁶ recently published that allograft augmentation may paradoxically result in increased failure rates after hamstring ACL reconstruction.

So, buckle up surgeons! It is not yet the law, but this study offers optimism that suture “safety belt” reinforcement of soft-tissue repairs and ACL reconstructions may help to protect and reduce risk of failure for certain graft types. Congratulations to the authors on sharing novel and innovative work in ACL surgery.

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