Suture Bridge Fixation for Tibial Eminence Fractures

To the Editor:

We read with great interest the article by Sawyer et al.[1] entitled "Biomechanical Analysis of Suture Bridge Fixation for Tibial Eminence Fractures." The authors present a biomechanical analysis in a porcine model of a technique for tibial eminence avulsion fracture fixation using a suture bridge configuration, which has been readily used in shoulder arthroscopy. Around the same time that Sawyer et al. submitted this article for publication, our group submitted and published a technique article describing the use of a suture bridge construct for tibial eminence fractures using a clinical case.[2] This may lend credence to the saying that "great minds think alike."

Although the principle is the same, the suture bridge construct that we described is slightly different from that of Sawyer et al.[1] We created the suture bridge using 2 suture anchors (TwinFix AB 4.5 mm; Smith & Nephew, Andover, MA) placed in the posterior fracture bed with each of the 4 suture limbs passed through the anterior cruciate ligament (ACL) and secured to the anterior tibia with 2 knotless anchors (3.5-mm Bio PushLock anchors; Arthrex, Naples, FL).[2] By passing the sutures through the ACL, we believed that this technique would be applicable to all avulsion fractures, including the more comminuted fractures. Furthermore, some evidence suggests that the ACL can be torn or attenuated and stretched with tibial spine fractures, and we believed that our technique could be applied to that situation as well.[3,4] Sawyer et al. used one PushLock anchor in the posterior fracture bed with 2 anchors anterior, creating a slightly different construct. In their study, they determined that the suture bridge configuration was statistically stronger biomechanically than a standard screw construct and a suture fixation method when testing for load to failure in a porcine knee model.

Subsequent to our publication, we have used the suture bridge technique to treat 2 more patients (3 total) with tibial eminence fractures. Because clinical and biomechanical data were not available until recently, our postoperative rehabilitation protocol was admittedly conservative. The protocol consisted of allowing the patient to bear weight as tolerated in an extension brace. For the first 2 weeks, the patient was allowed to move the injured knee from full extension to 60° of flexion, followed by an increase in flexion by 30° each subsequent 2-week period. Although the first patient presented in our technical note fared exceptionally well, recovering full range of motion with negative Lachman and pivot-shift test results, the 2

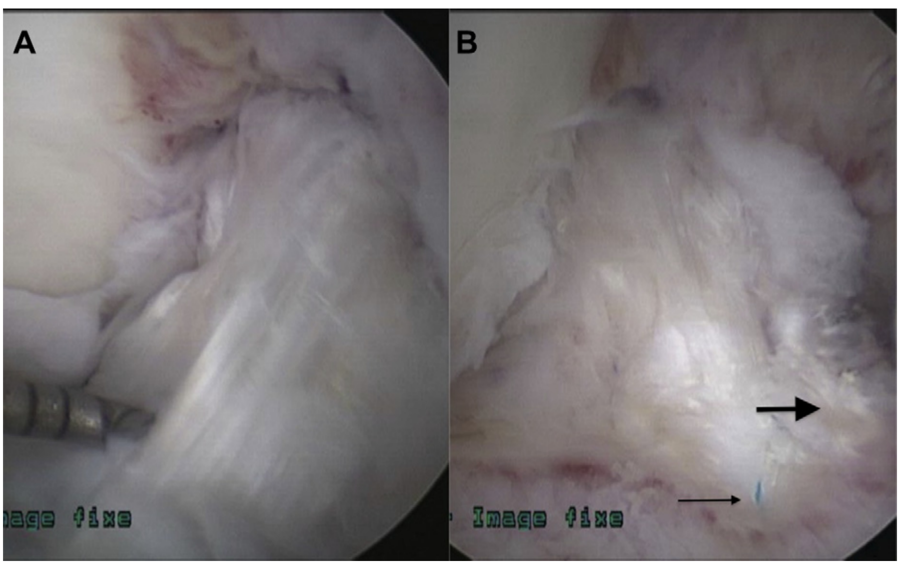

Fig 1. Arthroscopic images of a patient after use of a suture bridge construct for tibial eminence fracture fixation. (A) Assessment of ACL tension with a hook showing appropriate tension and a healed fracture. (B) Small and large arrows point to the suture ends from both anterolateral and anteromedial PushLock anchors from the suture bridge construct.

subsequent patients had complications related to the development of arthrofibrosis and required repeat surgery consisting of arthroscopic arthrolysis. This complication is not uncommon and has been reported in surgically treated tibial spine avulsions.[5] The loss of motion seen in our cohort may not be totally attributable to the novel suture bridge fixation of the eminence fracture but may have occurred simply because it is a known complication of surgical fixation of tibial eminence fractures and potentially also because of our conservative postoperative rehabilitation protocol. With the new biomechanical results by Sawyer et al.[1] showing the superior strength of the suture bridge technique, we believe that the patients who will be treated subsequently with suture bridge fixation of tibial eminence avulsion fractures can undergo a more aggressive rehabilitation protocol with unrestricted range of motion immediately postoperatively. Hopefully, this will diminish the incidence of arthrofibrosis while improving patient care. Interestingly, the repeat surgeries did allow us a chance for a second-look arthroscopy of the tibial eminence fixation. In both cases the tibial eminence was found to be reduced and healed in anatomic position and the ACL itself did not show signs of attenuation (Fig 1). We believe that further clinical studies will be required to prove improved surgical results with the suture bridge technique compared with the more conventional treatment methods for tibial eminence fractures before being universally accepted as a treatment method.

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Author's Reply

We thank Drs. Mann, Desy, and Martineau for their interest in our article and for sharing their clinical experience. The senior author (M.H.) has used the suture bridge fixation technique for pediatric and adult tibial eminence fractures since 2007. Since this technique was adopted by the surgeons in our pediatric orthopaedic service, we have collectively performed it in approximately 2 dozen pediatric cases. We have individualized the suture bridge construct to accommodate the specific fracture pattern, using 2 anterior anchors for a posterior hinged fracture, 3 anchors in a triangular configuration for simple fractures, and 4 anchors (2 anterior and 2 posterior) for larger and comminuted fracture patterns. We also have used the technique of suture passage through the anterior cruciate ligament fibers as needed to stabilize the displaced eminence fracture. We chose to perform biomechanical analysis of a 3-anchor suture bridge configuration because this represented the most minimalist fixation for a displaced tibial eminence fracture. We have not performed a biomechanical comparison of the 3- and 4-anchor suture bridge constructs. We use an immediate range-of-motion and weight-bearing rehabilitation program similar to an aggressive anterior cruciate ligament reconstruction protocol for more reliable patients. In this group we have not had any issues with fracture fixation failure or arthrofibrosis. Unfortunately, the pediatric patient population, by nature, is not compliant or reliable with postoperative restrictions. For these younger patients, we have immobilized the knee and used a more cautious range-of-motion and weight-bearing protocol. We have had one case of arthrofibrosis after repair and immobilization in a younger patient, necessitating subsequent arthroscopic debridement and manipulation. From a technical standpoint, we believe that it is important to avoid fat pad manipulation and debridement as much as possible to avoid arthrofibrosis. We routinely use a percutaneous traction suture placed around the transverse meniscus ligament to improve visualization of the tibial eminence fracture site.

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