Editorial Commentary: Shedding Light on the Posterolateral Corner of the Knee: Can We Do it With the Scope? Is There a Real Benefit?

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Abstract: Historically described as the "dark side of the knee," the posterolateral corner of the knee has been a significant focus of anatomic, biomechanical, and clinical outcomes research due to poor treatment outcomes for these injuries before improvements over the past 2 decades. These research efforts have resulted in significant improvements in the understanding, diagnosis, and surgical treatment of these injuries. Perhaps most importantly, improved understanding of the anatomy and biomechanics has led to the development of anatomic-based reconstructions, which have been subsequently validated with both biomechanical and clinical outcomes. Due to the complex anatomy and proximity of neurovascular structures, reconstructions have historically used large "hockey stick" incisions to provide adequate visualization to identify the anatomic insertions of the static stabilizers and ensure adequate protection of neurovascular structures. These anatomic-based techniques have significantly improved the clinical and objective outcomes of the surgical treatment of posterolateral knee injuries. However, as techniques have evolved and the clinical outcomes have improved, clinicians have attempted to develop and employ less-invasive and arthroscopically assisted techniques. Specifically, given the steep learning curve, paucity of clinical outcomes, increased operative time, and the limited view of the anatomy, which may increase the risk of nonanatomic tunnel placement, and injuries to surrounding structures, we cannot support an arthroscopic approach at this time.

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We have read the recent biomechanical study by Liu, Gong, Zhang, and Ao[1] titled "Anatomical, All-Arthroscopic Reconstruction of Posterolateral Corner of the Knee: A Cadaveric Biomechanical Study" with great interest. We congratulate the authors on a well-designed robotic biomechanical investigation evaluating an all-arthroscopic approach for posterolateral corner (PLC) reconstruction of the knee using a semitendinosus autograft. The authors demonstrate that their fibular sling-based arthroscopic reconstruction restored varus, internal and external rotation, and posterior translational stability with respect to the intact knee. The authors point to the current requirements of a large lateral incision, significant subcutaneous dissection, splitting of the iliotibial band, and potentially long rehabilitation period as rationale for the potential development of this less-invasive approach.

Our preferred technique for PLC reconstruction involves the classically described lateral "hockey stick" incision, common peroneal nerve neurolysis, and individual reconstruction of the 3 primary static stabilizers of PLC including the popliteus tendon (PT), fibular collateral ligament (FCL), and popliteofibular ligament (PFL), which has been shown to be a reliable procedure.[2-6] Our approach and perspective is based on a large body of anatomic, biomechanical, and clinical outcomes research that has collectively improved the treatment of these injures through better understanding of the anatomy and greater sensitivity and accuracy of diagnostic techniques, and ultimately validated this anatomic-based reconstruction technique.[6-14] This approach recreates the anatomy of the PLC using the

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anatomic attachments of the FCL, PFL, and PT. Biomechanically, this reconstruction technique described by LaPrade et al.[7] restores the native varus and rotational stability. Furthermore, subsequent biomechanical research has emphasized the importance of a tibial-based PFL reconstruction, demonstrating better restoration of varus and internal rotational stability compared with an isolated FCL and PT reconstruction.[15]

The cadaver-based reconstruction technique presented by Liu et al.,[1] like most arthroscopically assisted PLC procedures, does not use a tibial-based reconstruction tunnel for the reconstruction of the PFL. Biomechanically, the authors note that internal rotation at 60° following reconstruction was not significantly improved relative to the PLC-sectioned state, echoing previously reported findings and emphasizing the importance of a tibial-based PFL reconstruction.[15] Given the proximity of the popliteal artery to the musculotendinous junction and the targeted aperture of the tibial PFL reconstruction tunnel, this is not a tunnel that we feel would be feasible to ream under arthroscopic and/or fluoroscopic visualization. Furthermore, the passage of the PT and PFL reconstruction grafts into the posterior aperture of the tibial tunnel is unlikely something that would be able to be accomplished through a less-invasive approach.

Although the authors report that the arthroscopic fibular sling-based technique restores the kinematics of the intact knee at time zero, we would emphasize the importance of objective clinical evaluation of these techniques, namely complication rates including clinical failure rates and varus stress radiographs. Outcomes following anatomic-based PLC reconstructions to date have demonstrated excellent outcomes and restoration of varus stability as indicated by stress radiographs.[5,6,16] This is also true for anatomic-based reconstructions of individual PLC structures such as isolated FCL tears.[17,18] In cases of multiligament injuries such as combined PLC and anterior cruciate ligament injuries, recreating the anatomy and restoring native stability may be even more important so as to not potentially jeopardize a concurrent anterior cruciate ligament reconstruction.[19] In our view, pilot trials and prospective studies of all-arthroscopic or arthroscopically assisted reconstructions would need to match these outcomes without significant increases in complications before these techniques become more widely applied. To date, other descriptions of arthroscopically assisted PLC reconstructions have been described, primarily in the form of technique articles with limited, if any, clinical outcomes.[20-23] Some of these studies note a steep learning curve, which in theory may result in increased operative time, excessive soft-tissue swelling, effusion, or, in rare cases, compartment syndrome.[20-23] It also should be taken into consideration that PLC injuries usually are associated with other injuries requiring concurrent procedures, which may result in significant fluid extravasation, and increased surgical time should be considered before adopting these less-invasive techniques clinically without further in vivo studies.

Overall, our primary concerns regarding the arthroscopic approach to the posterolateral corner are 2-fold, the first being concern for nonanatomic placement of reconstruction grafts secondary to limited exposure and reliance on palpation, small incisions, and arthroscopic visualization. It is our finding in our referral practices that the biggest source of failed PLC surgeries is nonanatomic tunnel placement, even when using an open surgical technique. If surgeons continue to pursue all-arthroscopic or arthroscopically assisted PLC reconstructive procedures, at the very least, previously described radiographic landmarks may be used to augment visualization and evaluate tunnel placement.[24] We have expressed similar concerns previously regarding FCL reconstructions and the importance of correctly identifying the anatomic attachments to restore the native stability and optimize clinical outcomes.[25]

Our second concern is the limited exposure and the potential risks to the neurovascular structures. Although the large lateral incision and extensive subcutaneous dissection requires a longer time relative to the small incisions and arthroscopic portals that the authors describe, it also affords the opportunity to perform a common peroneal nerve neurolysis to prevent a foot drop that may result from swelling in the postoperative period. In many of these injuries, the common peroneal nerve is malpositioned due to the injury and this may not be possible to recognize, even on the preoperative magnetic resonance imaging scan, without an open surgical approach. In addition, this also allows us to both visualize and palpate the posteromedial aspect of the fibula and posterior aspect of the tibia when drilling our fibular and tibial reconstruction tunnels to ensure protection of the popliteal artery during tunnel reaming while ensuring that the reconstruction tunnel is positioned anatomically.

In conclusion, we congratulate the authors on a well-designed robotic study and continuing to push the evolution of the understanding of PLC injuries and their surgical treatment. We would contend that the significant improvements in the diagnosis and treatment of PLC injuries in the last 20 years are rooted in the foundation of an improved anatomic understanding, and future progress must continue to emphasize the anatomy, including both the recreation of the injured anatomy, while protecting the vulnerable surrounding neurovascular anatomy. Historically, nonanatomic repairs and reconstructions of the PLC have had an unacceptable failure rate. In contrast, current anatomic-based posterolateral knee reconstructions have been validated to significantly restore both subjective and

objective clinical outcomes in the peer-reviewed literature. In moving forward, additional evolutions and improvements must not neglect the importance of the anatomy in the interest of improving surgical efficiency and minimizing invasiveness. We again applaud the authors on their efforts but caution early adopters of an arthroscopic approach, given the steep learning curve, paucity of clinical outcomes, increased operative time, and the limited view of the anatomy, which may increase the risk of nonanatomic tunnel placement and injuries to surrounding structures.

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