

Editorial Commentary: Extension of Knowledge—and the Knee! New Biomechanical Study Suggests the Clinical Practice of Anterolateral Ligament Fixation Near Extension



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Abstract: The knee anterolateral ligament (ALL) is one of the most hotly debated topics in sports medicine in the last decade. Once one aspect of discussion regarding the ALL reaches a consensus, attention immediately turns to the next one. This has already happened with the existence of the ALL itself, its anatomic features, the ability to visualize the ALL with magnetic resonance imaging, and many other topics. In the end, the most important aspect must be clinical outcomes, and existing studies are trying to find the optimum surgical technique to best restore knee stability and reduce failure rates. It appears that, when doing an anatomic ALL reconstruction, fixation must be performed in full extension. The literature regarding ALL reconstruction shows promising results, with a strong tendency to present better knee stability, improved functional scores, and lower failure rates.

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Even though my career as a knee surgeon is not extremely long, I cannot remember a more controversial subject than the knee anterolateral ligament (ALL). The amount of knowledge produced in the last 6 years, after the early publications by Vincent et al.¹ and Claes et al.,² has been huge, and now we are starting to have consensus about the eventual need for ALL reconstruction.

It is interesting to note that each of the milestones in ALL research has been a matter of controversy, not only because this subject was in its infancy, but also because there were different viewpoints worldwide from highly respected surgeons.³ In these situations, it is hard to say that one perspective is completely right and the other is completely wrong. Controversy was found regarding anatomy,^{1,2,4-6} histology,⁷⁻⁹ biomechanics,¹⁰⁻¹³ radiological evaluation,¹⁴⁻²⁰ and reconstruction techniques.²¹⁻²⁵

Even though we have some data showing the benefits of ALL reconstruction,²⁶⁻³⁰ it is not an absolute truth for most knee surgeons. But, as pointed out recently by Rossi in an *Arthroscopy* editorial (and matching my personal opinion), “The story is not any more ‘if’ augmentation should be considered but ‘when’ and, maybe more important, ‘how’ to augment.”³¹

Considering all these points, I read with great interest the article entitled “Elongation Patterns of the Anterior and Posterior Borders of the Anterolateral Ligament of the Knee,” by Ahn, Koh, McGarry, Patel, Lin, and Lee.³² This cadaveric biomechanical study is important because it investigates ALL behavior during knee flexion-extension, internal-external rotation, anteroposterior translation, and varus-valgus angulation. Even though previous studies have attempted to investigate these characteristics, this study is novel in its attempt to determine whether the anterior and posterior borders of the ALL have similar or different behaviors. The authors concluded that the anterior border presented a slightly noncontinuous increase in elongation during knee flexion (almost isometric behavior, in my opinion), and the posterior border presented a continuous decrease in elongation pattern during range of motion from 0° to 90°. In this way, the authors

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suggest that “the graft fixation during ALL reconstructions should be performed at close to full extension of the knee.”

It is important to highlight some important facts about the study performed by Ahn et al.³² First of all, the dissection protocol was adequate, isolating the ALL from distal to proximal, similar to the technique described by Daggett et al.³³ in *Arthroscopy Techniques* in February 2016. In contrast, investigators performing dissection from proximal to distal are at greater risk for inadvertently removing some part of the ALL that passes above the lateral collateral ligament (LCL), and therefore fail to precisely define the femoral attachment. This is an important point to highlight because if the anatomy is incorrect, the biomechanics will be incorrect as well. A major issue with some previous studies that reported an increase in length with knee flexion is that the femoral attachment was considered to be anterior or distal to the LCL femoral attachment. In addition, some anatomic studies measured ALL behavior during flexion-extension without a strict rotational control, which may also have contributed to the controversy.

Another interesting point of this study regards the isolation of proximal and distal structures that behave differently, showing the complexity of the anatomy in this region. The ALL as we know it today is the superficial structure (running from the femur to the tibia, superficial to the LCL), and the anterolateral capsular thickening (known previously as the mid-third anterolateral capsular ligament) is the deep structure, as colleagues and I pointed out in a recent study with cadavers.³⁴ The superficial structure we described behaved like the ALL described by Ahn et al.³² Unfortunately, the deep structure was found in only 3 of 8 specimens, and its behavior was not studied in detail. In the end, these findings by Ahn et al.³² are in line with a very interesting biomechanical study performed by Inderhaug et al.³⁵ that concluded, “The ALL procedure restored normal laxities only when fixation occurred in full extension.”

Considering all the ALL research so far, most of the major research centers in knee surgery around the world have probably published something on the subject. Apart from some remaining controversy, the ALL is currently accepted as a true ligament in the anterolateral portion of the knee with a femoral attachment posterior and proximal to the lateral epicondyle³⁶ and an antero-inferior path to the periphery of the lateral meniscus³⁷ and to the anterolateral tibia,³⁸ between Gerdy’s tubercle and the fibular head. A recent systematic review by de Lima et al.³⁹ and 2 consensus papers led by Getgood et al.⁴⁰ (hosted by Al Getgood and Charlie Brown Jr. in London, 2017) and Sonnery-Cottet et al.⁴¹ (hosted by Bertrand Sonnery-Cottet and Steven Claes in Lyon, France, 2015) clearly pointed this

out. Biomechanical studies still show some controversy, but it is now accepted that if there is a combined lesion of the ACL and the anterolateral structures, ACL reconstruction alone does not reestablish normal knee kinematics, as shown again by Inderhaug et al.⁴² and the Imperial College group and also by Geeslin et al.⁴³ from LaPrade’s group in Colorado.

Some questions are still in debate, such as: How frequently do we injure the ALL? Does the ALL heal? Does ALL reconstruction lead to lateral arthrosis? The rate of ALL lesion varied among studies, with most of them showing a rate of approximately 50%^{15,18-20} in adults and 60%⁴⁴ in adolescents. However, anterolateral exploration studies done by Ferretti, Monaco, and colleagues in Rome,^{45,46} ultrasound studies done by Cavaignac et al.,⁴⁷ and a 3-dimensional magnetic resonance imaging study done by Muramatsu et al.⁴⁸ have shown higher injury rates in acutely ACL injured knees, reaching close to 90% in some series. Healing studies are ongoing, and long-term follow-up studies regarding combined extra- and intra-articular reconstructions have not shown an increased rate of lateral compartment degenerative changes,⁴⁹⁻⁵¹ although it is worth mentioning that this calculation was not done specifically for the ALL.

Apart from all this information, in the end, what really matters for the patient and for surgeons is the clinical result. One could argue that clinical results regarding ALL reconstruction are still lacking, but studies that compared ALL reconstruction and control groups showed irrefutable benefits for the combined reconstruction.²⁶⁻³⁰ Sonnery-Cottet has led some important clinical research and showed a lower rerupture rate, less meniscal repair failure, and low complication rates when performing ALL reconstruction.^{26,28,30} A clinical study evaluating chronic ACL tear performed by my group also showed benefits for the ALL group.²⁷ It is important to mention that Sonnery-Cottet advocated performing ALL fixation in full extension for a while,²³ even before the biomechanical knowledge regarding ALL behavior we have today, as was recently described by Saithna et al.⁵² in *Journal of Bone and Joint Surgery: Essential Surgical Techniques*. The study by Ahn et al.³² is one more that confirms this initial theory.

Undoubtedly, there is still a long way to go regarding ALL research, but our eagerness for knowledge cannot stop. As pointed out by Lubowitz et al.⁵³ in an editorial for *Arthroscopy* in 2016, “we should be open to the possibility that lateral augmentation of ACL reconstruction could be of benefit in some patients.” In a world with a strong social media presence, Dr. Peter Millett recently posted on Twitter a quote from an anonymous author: “A doctor is a student till he dies. Once he considers himself not a student anymore, the doctor himself dies.” I hope we can all continue to study this fascinating subject, and I hope results can convince

us that ALL reconstruction is a good option (as I personally already believe it is).

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