

The final point to make is that we do not believe the concerns raised about overconstraint of the knee are valid if anatomic reconstruction is performed and the graft is fixed in full extension and neutral rotation.¹¹ In our published experience of 92 combined ACL and ALL reconstructions, with 2 years' follow-up, there has been no clinical evidence of overconstraint (no stiffness and no reoperations to cut a tight ALL). In addition, we report a very low ACL graft failure rate of only 1.1%.¹²

The best answer to this ongoing controversy is our clinical results, which are very promising on retrospective study. Such results strongly suggest that the ALL is not fiction and that there is an urgent need to start a prospective randomized study to confirm this.

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Authors' Reply



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We thank Sonnery-Cottet et al. for raising points in their letter to the editor, giving us the opportunity for much needed clarification of confusing statements for the reader of both journals—*Arthroscopy* and *Knee Surgery, Sports Traumatology, Arthroscopy*—regarding the anterolateral complex of the knee. The main points raised are consistent identification of the anterolateral ligament (ALL), the role of the anterolateral complex in restoring rotational knee stability, and overconstraint. We would also like to congratulate Sonnery-Cottet et al.¹ on their excellent study showing good outcomes of combined anterior cruciate ligament (ACL) and ALL reconstructions with only 9.2% residual pivot shift at 2 years' follow-up.

As editors of *Knee Surgery, Sports Traumatology, Arthroscopy*, we have seen an inflation of manuscripts appearing in the literature. There are an even higher number of submitted manuscripts with few identifiable scientific methods. In particular, a search of MEDLINE shows that more than 20 studies detailing the anatomic description of the anterolateral complex have been published since October 2013.²⁻²⁸ The findings and conclusions of these studies differ from one another with respect to origin, insertion, and course of the proposed ligament. We agree, however, with classic literature from Terry et al.,²⁹ Hughston et al.,³⁰ Müller,³¹ and other authors,³² who described meticulous dissections and reported their findings in

numerous detailed publications. Therefore, the editorial "Anterolateral ligament of the knee, fact or fiction?" was published in *Knee Surgery, Sports Traumatology, Arthroscopy* to provide clarification for the reader and caution against premature adoption of a surgical technique for a proposed anterolateral complex structure, on whose origin, insertion, and function experts cannot even agree.³³

We would like to thank Sonnery-Cottet et al. for a healthy debate regarding anatomic dissections and biomechanical studies. There have been more than 10 studies investigating the role of the anterolateral complex in controlling rotatory knee instability.^{8,12,19,34-43} However, none of these studies have demonstrated or clarified how dissection proceeds from layer 1 (iliotibial tract) to layer 3 (capsule). Only a few studies have shown a supportive role for the anterolateral complex in controlling rotatory knee instability.^{35,41,43} To add to the debate, there are several further studies published proposing biomechanical effects of the anterolateral complex, but lacking design or data to support their claims. To clarify the confusion about anatomy and biomechanics, we have since published a pictorial essay and rigorous biomechanical analyses⁴⁴ (also available online through VuMedi) detailing a step-by-step layered exposure and identification of the anterolateral capsule structures and their biomechanical function.⁴⁴⁻⁴⁸

For clarification regarding potential overconstraint of the lateral knee when using the iliotibial tract for purposes of tenodesis, the reader should take the following studies into consideration: The iliotibial band has almost 50% higher ultimate load, half the ultimate elongation, and almost 3 times higher stiffness compared with the anterolateral capsule.⁴⁸ Distinguishing the role of the ALL from the capsulo-osseous layer of the iliotibial tract, Kittl et al.³⁴ showed that the iliotibial tract controls rotatory knee stability whereas the ALL has almost no role. Thein et al.⁴⁰ showed that there is no need for ALL reconstruction in a well-functioning ACL-reconstructed knee due to a minimal role of the anterolateral complex in physiological ranges. Schon et al.⁴⁹ showed that anatomic ALL reconstruction cannot restore stability of the knee without significant overconstraint at any flexion angle.

Amis and colleagues^{50,51} at the Imperial College of London are a driving force of scientific research and helped elucidate many issues of rotatory knee instability over the past 20 years. For example, it was clear that rotatory knee instability is influenced by more than just the ACL when the concept of "envelope of motion" was introduced.⁵⁰ It is therefore both the anterolateral complex and the posteromedial corner that have a role in stabilizing the knee through a multitude of structures, most importantly the iliotibial tract on the lateral side and the posteromedial capsule and root on the medial

side.^{34,51} In clinical science, this has been shown by Marcacci and colleagues⁵²⁻⁵⁴ and Zaffagnini et al.,⁵⁵ who demonstrated that rotatory knee instability can be reduced by adding a lateral-plasty to ACL reconstruction and can continue, with good 10-year long-term results for patients. Most recently, Sonnery-Cottet et al.¹ were able to show that combined ACL and ALL reconstructions can also reduce rotatory knee instability.

A healthy scientific debate will encourage future research and expand our knowledge of orthopaedics. Controversies in our understanding of rotatory knee instability and the role of the anterolateral complex will continue to exist. We are grateful to Sonnery-Cottet et al. for giving us the opportunity to clarify some of the controversies and pointing out deficiencies in our clinical science. They deserve credit for publishing their 2-year clinical results. There is certainly a subgroup of patients whose ACL-related anterolateral rotatory knee instability might warrant surgery for the anterolateral complex in addition to anatomic ACL reconstruction. However, we currently do not know exactly who these patients are because rotatory knee instability is multifactorial. The factors influencing rotatory knee instability are patient aspects such as injury mechanism; timing from injury; injury to soft-tissue structures such as the collateral ligaments, menisci, meniscus roots, and capsule; ACL injury pattern including partial tears; bony factors such as coronal-plane and sagittal-plane alignment and notch width index; proprioceptive considerations such as neuromuscular control, knee abduction moments, and landing patterns; biodynamic factors such as functional joint space, muscle function, and altered joint contact path; and biological factors such as presence of proinflammatory cytokines, premature osteoarthritis, and altered genetic profiles. In summary, there is much to be learned about rotatory knee instability, and in addition, to basic science studies, there is a need for large-scale clinical studies.

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