



## Editorial at: “Passive anterior tibial subluxation in the setting of anterior cruciate ligament injuries: a comparative analysis of ligament-deficient states” published at *AJSM* by McDonald *et al.*

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McDonald *et al.* (1), identified patients treated for anterior cruciate ligament (ACL) injury from their institutional registry. Measurements to determine anterior tibial translation were performed, as described and validated by Iwaki *et al.* (2,3), determining the subluxation in the medial and lateral compartments.

Regarding the lateral compartment, in the acute ACL injury group, 16.2% of knees demonstrated subluxation  $\geq 6$  mm and no knees demonstrated subluxation  $\geq 10$  mm. In the chronic ACL injury group, 25% of knees demonstrated subluxation  $\geq 6$  mm and 7.5%  $\geq 10$  mm. In the failed ACLR group, 37.5% of knees demonstrated subluxation  $\geq 6$  mm, and 11.1% presented  $\geq 10$  mm. The mean value for an intact knee was 0.78 mm. Across all knee conditions, in knees with an intact anterolateral ligament (ALL), the maximum tibial subluxation was 9.4 mm with a mean value of 2.15 mm, while the ALL injured group showed a maximum tibial subluxation value of 15.1 mm and a mean subluxation of 3.75 mm ( $P=0.0046$ ), in the lateral compartment.

The medial compartment demonstrated a similar pattern and across all knee conditions, in the knees with an intact ALL, the maximum tibial subluxation was 5.6 mm with a mean value of 0.01 mm, while knees with an injured ALL demonstrated maximum subluxation of 10.3 mm and a mean subluxation of 1.08 ( $P=0.0438$ ). An intact knee had a mean subluxation of  $-0.92$  mm (posterior) and a max value of 3.2 mm, in the medial compartment.

The lateral compartment had a greater anterior tibial subluxation than the medial compartment across all ACL

states. Knees that failed previous ACLR were anteriorly subluxated more than acute ACL-deficient deficient knees ( $P=0.0006$ ).

Multivariate regression models with lateral and medial tibial subluxation as the outcome were performed. When all factors were held constant, a failed ACLR was predictive of a mean increase in tibial subluxation of 1.841 mm ( $P<0.0001$ ) and over 3 mm ( $P<0.0001$ ), for the medial and lateral compartments, respectively. The presence of combined medial and lateral chondral defects was also predictive for the medial compartment, and any ACL tear and combined medial and lateral meniscal tears were a predictive factor for the lateral compartment. Surprisingly, in both medial and lateral compartment models, an ALL injury was not an independent predictor of tibial subluxation.

A binary outcome throughout logistic regression modeling was evaluated, whether lateral compartment subluxation was  $\geq 6$  mm, which is required for a pivot shift to occur, according to a cadaveric study Bedi *et al.* (4) They concluded that both a failed ACLR ( $P=0.0042$ ) and combined medial and lateral meniscal tears ( $P=0.0121$ ) were associated with greater tibial subluxation. An injury to the ALL was not an independent predictor of increased lateral compartment subluxation  $\geq 6$  mm.

The authors state that the findings from this study suggest that progressive injuries to the secondary stabilizers including chondral surfaces and menisci, rather than having undergone ACLR, may play a dominant role in maintaining the normal tibio-femoral relationship in an unloaded ACL

deficient knee.

The ALL was visualized in 82.1% of the patients in their study, and ALL was injured in 78.2% of visualized knees and intact in 21.8% of knees. When the ALL was intact, only 7.9% of knees met the 6 mm minimum threshold of passive anterior tibial subluxation for a pivot shift to occur, and when the ALL was injured, 29.4% of knees were subluxated  $\geq 6$  mm in the resting position. When ALL was intact, no knees met the 10 mm minimum threshold of lateral subluxation. In addition, when ALL was injured, 7.4% of knees met this threshold.

This study, however, does not conclude that an ALL injury is an independent predictor of anterior tibial translation.

This interesting study highlights the importance of carefully evaluating the injury of the secondary stabilizers of the knee on the ACL injuries. They play an important role and not addressing them could explain higher rates of failure of ACL reconstruction (5-7).

Nevertheless, it is important to mention that all the measurements in the present study were based on an unloaded situation, in which the secondary stabilizers may assume a different importance on tibio-femoral anterior subluxation (8). In addition, the rotatory relationship between tibia and femur was not directly appreciated in the present study, which could be altered in situations such as the ALL injury on the resting position of the knee (9,10).

Also, the author mentions 6 and 10 mm of lateral compartment anterior subluxation for a positive pivot shift, based on the study of Bedi *et al.* (4). However, unfortunately, the clinical pivot shift on physical examination is not reported on the study, which would certainly be valuable to correlate with the measurements on the magnetic resonance imaging (MRI) and contribute to further understanding on the role of the secondary stabilizers.

As the author highlights, a failed ACL reconstruction is an independent predictive factor for a greater anterior tibial subluxation on the medial and lateral compartments. This interesting conclusion is aligned with the possible current indications for ALL reconstruction in ACL revision surgery, which may implicate directly on postoperative tibial subluxation on the resting position (5,9). One potential limitation we could highlight, regarding this specific group, is the lack of information on the anterior tibial subluxation previous to the failed ACL reconstruction.

We once again congratulate the authors and encourage all authors and readers to focus research in secondary knee stabilizers and ACL agonists in order to better understand

the anterior and anterolateral knee instability.

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We would like to thank the editorial board of *Annals of Joint* to the invitation to write this editorial. We read with great interest the article entitled “*Passive anterior tibial subluxation in the setting of anterior cruciate ligament injuries: a comparative analysis of ligament-deficient states*”. Authors evaluated 186 patients with various states of ACL deficiency and identified factors associated to static anterior tibial translation on MRI (1). We congratulate the authors for this very relevant, interesting and enlightening study.

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*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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