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Reduced tibial eminence size is substantial risk factor for ACL injury: Is there more to find?

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Dear Editor,

We read with great interest the paper entitled “Knee Morphological Risk Factors for Anterior Cruciate Ligament Injury: A Systematic Review” published online in Jan 21, 2020, in J Bone Joint Surg Am. Bayer et al. concluded that reduced tibial eminence size and intercondylar notch stenosis are substantial risk factors for ACL injury (1). This systematic review is a valuable study with great interest, and give us some very important inspiration about ACL injury, which we would like to address for the authors.

We all know that the anterior cruciate ligament (ACL) is the most important structure located in the intercondylar notch and is very important for the stability of knee joint. ACL injury is common and many factors may influence the occurrence probability of it. Among them, the morphological characteristics of the intercondylar femoral notch and the tibial plateau have been shown to be related to the injury of ACL, which to be more exactly, are the shape and volume of intercondylar notch and the size of the tibial eminence, just like the article’s conclusion. Usually there is a inverse correlation between the shape and size of tibial eminence and the volume of intercondylar notch. That is the larger the tibial eminence, the smaller the volume of intercondylar notch. For ACL closely contacts with the tibial eminence, when the tibial eminence become bigger or hyperplasia, it will certainly decrease the volume of intercondylar notch, squeeze and bend the ACL.

Hyperplasia and osteophyte of tibia eminence is often seen in osteoarthritis of knee, which is considered as one of the feature. It is very common in arthroscopic surgery, especially the old patients with osteoarthritis and degeneration of ACL. In these patient tibial eminence is getting bigger or hyperplasia, then the

distance between tibial eminence and femur condylar become more narrow, even more they can directly contact or collide with each other. We consider this phenomenon a compensatory response of human body to the degeneration of the joint and failure of ACL and instabilities, so as to restore the stability and function of knee joint to a certain extent. For the hyperplasia of tibial eminence may increase the length and tension of ACL and decrease the volume of intercondylar notch. So we suppose that the hyperplasia and osteophyte of tibia eminence can increase the tension of ACL, decrease the volume of intercondylar notch and increase the stability of joint. We will proceed further research to confirm this hypothesis, to examine whether the size of tibial eminence can change or how to change the length and tension of ACL and the volume of intercondylar notch, and to what extent, whether it is a self protective mechanism for the gradually loss of ACL function and instability of knee joint.

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Conflict of interest
The authors declare that they have no conflict of interest.
Ethical approval
This article does not contain any studies with human participants or animals performed by any of the authors.

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Article Author Response

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Article Author(s) to Letter Writer(s)

Bony morphological risk factors for anterior cruciate ligament (ACL) injury continues to draw much interest and a plethora of studies have investigated various factors. We thank the readers, Yu and colleagues, for their interest in our study (1,2). The systematic review identified three studies that investigated the tibial eminences, all of which concluded reduced size is a risk factor for ACL injury (3, 4, 5). Yu and colleagues theorize that increased tibial eminence size may increase the tension on the ACL

and may provide increased rotatory knee stability. To the authors' knowledge, the relationship between tibial eminence size and tension on the ACL has not been reported in the literature and the proposed mechanism would need to be investigated as proposed by Yu and colleagues.

Sturnick et al performed volumetric assessment of the tibial eminences from MRI of both ACL-injured and non-injured patients (5). Reduced medial tibial eminence volume was associated with ACL injury in male patients. Tibial eminence height, width, or length individually were not predictive of ACL injury. Both Uhorchak et al and Xiao et al reported on tibial eminence width on plain radiographs, and reported decreased tibial eminence width was associated with ACL injury (3, 4). Yu and colleagues also conjecture on the relationship of the tibial eminence and intercondylar notch, noting that increased tibial eminence size may decrease the intercondylar notch size. The systematic review did not discover any studies reporting on that relationship, although decreased intercondylar notch size is clearly one of the strong associations with ACL injury risk (1).

Yu and colleagues also discuss the increase in size of the tibial eminences with osteoarthritis and propose this is a compensatory mechanism in the setting of chronic ACL degeneration with aging (2). Although this does not appear to have been studied in the literature to date, it is worth noting the Parson's knob, or tuberculum intercondylare tibiae tertium. The presence of this bony prominence anterior to the medial tibial eminence was reported to be a risk factor for ACL injury (6). It was theorized to form in response to a chronic traction load on the ACL, and thus was found with increasing incidence in ACL-injured patients.

We are thankful that our study has inspired further theories and potential investigation from Yu and colleagues. Further research is necessary to truly understand the variations in bony morphology and the role in rotatory knee stability. Our improved understanding of the anatomy should be considered in the individualized anatomic ACL reconstruction to optimize outcomes.

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