Mechanical loading induces ACL hypertrophy

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Video Abstract

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Abstract

Can athletes' ACLs be "trained" to resist injury? A new study published in The American Journal of Sports Medicine suggests that it's possible. Studies on animals have shown that exercise during growth periods like puberty can "bulk up" the ACL, increasing its size and improving its mechanical properties. However, evidence of so-called "ACL hypertrophy" in human athletes is scarce. To address this gap, researchers examined the knees of 52 athletes who had been skating or diving since before puberty or since puberty onset. These types of athletes always land or jump up using the same leg, which the researchers labeled as the "dominant leg," and thus habitually load one knee more than the other while training for their sport. Specifically, the team compared ACL and patellar tendon dimensions and knee strength between the left and right knees. They also examined how differences in ACL dimensions between knees correlated with age at training onset and with the number of years of training. MRI revealed that both the ACL cross-sectional area and the patellar tendon diameter were nearly 5% larger in the dominant leg than in the opposite leg. This finding suggests that mechanical loading can increase the size and perhaps the robustness of important structures in the knee. However, the difference in ACL cross-sectional area between legs was not related to the specific age at which training started or to the number of years of training. In addition, dynamometry revealed that the isometric flexion strength of the knee joint was almost 15% greater in the dominant leg than in the nondominant leg. This result is consistent with the presumably higher forces applied to the dominant leg during training. While the loading difference between knees was not quantified, it was assumed to exist given the techniques used in figure skating and springboard diving as well as the observed difference in patellar tendon diameter between knees. A matched control group was not included, and the subjects were primarily female. Lastly, because the study was cross-sectional, cause-and-effect relationships and temporal patterns could not be definitively established. Despite its limitations, this study indicates that long-term mechanical loading may help fortify key knee structures such as the ACL by inducing hypertrophy. If applied strategically during periods of growth, such structural "training" could help reduce the risk of ACL injury in athletes.