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Paper #42

The Effect of Meniscocapsular and Meniscotibial Based Lesions in ACL Deficient and ACL Reconstructed Knees: A Biomechanical Study

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Summary:
Meniscocapsular and meniscotibial lesions of the posterior horn of the medial meniscus increased knee anterior tibial translation, internal and external rotation, and the pivot shift in ACL deficient knees.

Abstract:

Background

Ramp lesions were initially defined as a tear of the peripheral attachment of the posterior horn of the medial meniscus at the meniscocapsular junction. The separate biomechanical roles of the meniscocapsular and meniscotibial attachments of the posterior medial meniscus have not been fully delineated.

Purpose

To evaluate the biomechanical effects of meniscocapsular and meniscotibial based lesions of the posterior medial meniscus in ACL deficient and reconstructed knees and the effect of repair of ramp lesions.

Methods

Twelve matched pairs of human cadaveric knees were evaluated with a 6 degree-of-freedom robotic system. All knees were subjected to an 88 N anterior tibial load, internal and external rotation torques of 5 N-m, and a simulated pivot shift test of 10 N valgus force coupled with 5 N-m internal rotation. The paired knees were randomized to either cutting the meniscocapsular or meniscotibial attachments following ACL reconstruction (ACLR). Eight comparisons of interest were chosen prior to conducting the data analysis. The intact state data was compared to the subsequent states data. The following states were tested 1) intact (n=24), 2) ACL-deficient (n=24), 3) ACL deficient with a meniscocapsular lesion (n=12), 4) ACL deficient with a meniscotibial lesion (n=12), 5) ACL deficient with both meniscocapsular and meniscotibial lesions (n=24), 6) ACLR with both meniscocapsular and meniscotibial lesions (n=16), 7) ACLR with repair of both meniscocapsular and meniscotibial lesions (n=16). All states were compared to the previous states. For the repair and the reconstruction states, only the specimens that underwent repair were compared to their intact and sectioned states, thus excluding the specimens that did not undergo repair.

Results

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Cutting the meniscocapsular and meniscotibial attachments of the posterior horn of the medial meniscus significantly increased ATT in ACL deficient knees at 30 (p 0.020) and 90 (p<0.005). Cutting both the meniscocapsular and meniscotibial attachments increased both tibial internal (all p>0.004) and external rotation (all p<0.001) at all flexion angles in ACL reconstructed knees. Reconstruction of the ACL in the presence of meniscocapsular and meniscotibial tears restored ATT (p>0.053), but did not restore internal rotation (p<0.002), external rotation (p<0.002) and the pivot shift (p<0.05). To restore the pivot shift, both an ACL reconstruction, and a concurrent repair of the meniscocapsular and meniscotibial lesions was necessary. Repairing the meniscocapsular and meniscotibial lesions after ACLR did not restore internal rotation and external rotation at angles >30.

Conclusion

Meniscocapsular and meniscotibial lesions of the posterior horn of the medial meniscus increased knee anterior tibial translation, internal and external rotation, and the pivot shift in ACL deficient knees. The pivot shift was not restored with an isolated ACL reconstruction but was restored when performed concomitantly with a meniscocapsular and meniscotibial repair. Patients with high-grade Lachman and pivot shift tests in the presence of an ACL tear, and those with persistent instability after an ACL reconstruction, should be evaluated for a potential ramp lesion of the posterior horn of the medial meniscus. Future research should evaluate different repair techniques that can further restore rotational stability at higher flexion angles.