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Paper #67

Biomechanical Consequences of a Complete Radial Tear Near the Medial Meniscus Posterior Root Attachment Site: In-Situ Pullout Repair Restores Derangement of Joint Mechanics

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Summary:
This biomechanical model has demonstrated that in-situ pullout repairs of complete radial tears of the posterior horn of the medial meniscus restore medial compartment joint loading profiles to the intact state in spite of shortening the functional circumferential length of the meniscus.

Abstract:
Background:
Complete radial tears near the posterior root attachment of the medial meniscus can disrupt the circumferential integrity of the meniscus in a manner similar to a posterior root avulsion. Side-to-side anatomic repair of these types of lesions can be problematic and these injuries are often treated with partial meniscectomy.

Hypothesis:
In-situ pullout repair of posterior horn radial tears through transosseus drill holes at incremental distances from the root will result in decreased tibiofemoral contact pressure with increased contact area versus the avulsed state, and increased contact pressure with decreased contact area versus the intact state.

Study Design:
Controlled laboratory study

Methods:
Six non-paired fresh-frozen human cadaveric knees each underwent 45 different testing conditions – 9 medial meniscus conditions (intact, posterior root avulsion, posterior root repair, serial radial tear and in-situ pullout repair at 3, 6, and 9 mm from the root attachment site) at 5 flexion angles (0°, 30°, 45°, 60° and 90°) – under a 1000-N axial load. Tekscan sensors were used to measure mean contact area and mean contact pressure.

Results:
The root avulsion and all radial tear conditions resulted in significantly (P ? .05) decreased contact area and increased mean contact pressure compared with the intact state for knee flexion angles of 30°, 45°, 60° and 90° (except for 6 mm repair at 30° and 45°). For root repair and all in-situ repair conditions, contact mechanics were not statistically (P ? .05) different than that of the intact state for all knee flexion angles. Mean total load did not show any statistically significant (P ? .05) change compared to the intact state throughout testing.

Conclusion:

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Posterior horn radial tears near the root of the medial meniscus that extend from the inner rim to the meniscocapsular junction can lead to derangement of the loading profiles of the medial compartment that are similar to root avulsion. Repair of these radial tears with an in-situ pullout technique restored joint mechanics to the intact state in spite of shortening the functional circumferential length of the medial meniscus.

Clinical Relevance:
Complete radial tears of the posterior horn of the medial meniscus are equivalent to root avulsions and could potentially lead to rapid arthrosis. In-situ repair offers an alternative treatment to meniscectomy and may offer a better healing environment than end-to-end repair.