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Published on: 01 Mar 2014 - American Journal of Sports Medicine (SAGE PublicationsSage CA: Los Angeles, CA)

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Biomechanical Consequences of a Complete Radial Tear Adjacent to the Medial Meniscus Posterior Root Attachment Site

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Objectives: Complete radial tears near the medial meniscus posterior root attachment site disrupt the circumferential integrity of the meniscus (*similar to a posterior root avulsion*). These tears can compromise the circumferential integrity and have been reported in biomechanical studies to simulate the meniscectomized state. The purpose of the study was to quantify the tibiofemoral contact load and contact area changes that occur in cadaveric knees from complete posterior horn radial tears and subsequent repairs of the medial meniscus adjacent to the posterior root attachment site.

Methods: Six non-paired fresh-frozen human cadaveric knees each underwent 45 different testing conditions: 9 medial meniscus conditions (intact, root avulsion, root repair, serial radial tear and in-situ 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 contact area and pressure in the medial and lateral compartments.

Results: The medial meniscus root avulsion and all radial tear conditions resulted in significantly decreased contact area and increased mean contact pressure compared with the intact state for knee flexion angles beyond 0° ($P < .05$). **Medial Compartment Contact Area** Individual comparisons of meniscus conditions for results at 30°, 45°, 60° and 90° of flexion demonstrated the following. At each angle, the root avulsion and 3, 6 and 9 mm radial tears resulted in a significant reduction (range 33%-45% decrease) in medial compartment contact area. **Medial Compartment Contact Pressure** Individual comparisons of meniscus conditions were performed at 30°, 45°, 60° and 90° of flexion. At each angle, the root avulsion and all radial tears resulted in a significant increase in average contact pressure (range 46%-110%) when compared to the intact meniscus. **Root Repair and In-situ Repairs** The root repair and in-situ repairs restored contact area and pressure to levels statistically indistinguishable from the intact meniscus, and increased contact area and decreased contact pressure when compared to the corresponding tear conditions (**Figure**).

Conclusion: Posterior horn radial tears adjacent to the medial meniscus root that extend to the meniscocapsular junction can lead to derangement of the loading profiles of the medial compartment that are similar to a root avulsion. Repair of these radial tears with an in-situ pullout technique restored joint mechanics to the intact state.

Clinical Relevance Complete radial tears of the posterior horn of the medial meniscus, are biomechanically equivalent to root avulsions and could potentially lead to medial compartment arthrosis. An in-situ repair offers an alternative treatment to meniscectomy and can reestablish the posterior anchor point, thus improving load distribution in the medial compartment.

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The Orthopaedic Journal of Sports Medicine, 2(3)(suppl 1)

DOI: 10.1177/2325967114S00004

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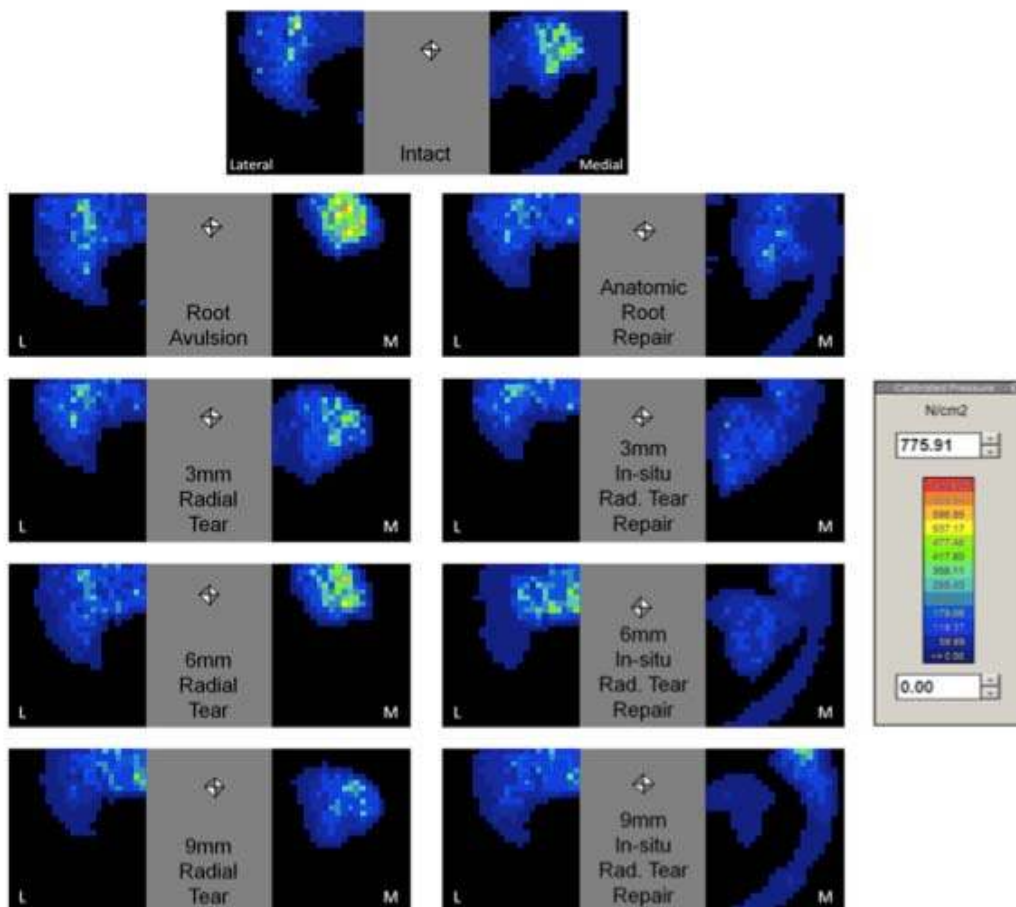


Figure. Representative Tekscan contact area and pressure maps of the medial and lateral compartments of a specimen at 30° of flexion undergoing the 9 medial meniscus conditions (right knee).