

# Editorial Commentary: Meniscal Root Repairs: Let the Biology Help You!



Jorge Chahla, M.D., Ph.D., Editorial Board

**Abstract:** Meniscal root tears are increasingly being recognized as important entities by the orthopaedic community. This is probably due to the catastrophic consequences of not identifying or addressing a root tear in a timely fashion, leading to the need for a total meniscectomy. The majority of the studies on root tears have been focused on natural history, diagnosis, biomechanical consequences, and fixation techniques. Conversely, rehabilitation concepts have been extrapolated from those applied after other meniscal tears/repairs, even though root tears probably constitute a completely different pathology from biological and biomechanical standpoints. Time zero studies are important to determine the effect of certain loads on the repaired structure without taking into consideration the healing process. This allows for examination of the effects that an accelerated protocol would have in the immediate postoperative phase after a root repair. As with any repaired structure, allowing time for the repaired tissue to heal is vital because failing to do so might lead to unrecoverable failure of the root fixation.

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**M**eniscal root tears constitute a very specific type of meniscal injury, which has gained increased attention over the past years, as surgeons have become more aware of the biomechanical consequences that can occur when such an injury is left untreated.<sup>1</sup> Root tears are reported to constitute up to 20% of all meniscal tears, affecting nearly 100,000 patients annually.<sup>2-4</sup> For this reason, it is believed that the majority of these injuries were previously ignored, leaving them to their natural progression and putting patients at significantly increased risk for morbidity (e.g., articular cartilage degeneration, subchondral insufficiency fractures, and progressive osteoarthritis) without treatment.<sup>5-9</sup> Early detection of root tears is crucial because knee joint loading can be restored to a near native state if the lesion is properly diagnosed and treated promptly<sup>10</sup>; in addition, the progression of osteoarthritis can be significantly slowed.<sup>11,12</sup>

Despite a remarkable upsurge of research on meniscal root tears in the last 5 years, the majority of the literature has focused on natural history, diagnosis, biomechanical

characteristics, and fixation techniques. However, rehabilitation concepts have been extrapolated from those used in association with other meniscal tears/repairs. In their article, titled “Loosening of Transtibial Pull-Out Meniscal Root Repairs Due to Simulated Rehabilitation Is Unrecoverable: A Biomechanical Study,” Steineman, LaPrade, and Haut Donahue<sup>13</sup> have attempted to demonstrate the importance of healing before loading for meniscal root repairs. The authors performed a transtibial pull-out repair of the posteromedial meniscal root in 16 cadaveric ovine knees. Transtibial root repairs in which the 2-simple-suture technique was used were cyclically loaded, allowed to rest, and loaded in tension again. Then paired differences in displacement with rest were recorded to evaluate recoverability. The authors found that there was a significant, unrecoverable loosening after meniscal root repairs when the repairs were subjected to cyclic loading. Root repairs were also gradually displaced with continued loading, which is relevant because the healing of the root of the meniscus has been reported to take at least 6 months; therefore, displacement of the repair might not plateau, and consequently, the repair construct could become progressively looser.<sup>14</sup>

As stated by the authors, although it was previously reported that displacement accumulates with loading of root repairs,<sup>15,16</sup> in previous studies investigators were unable to determine whether this displacement is due to viscoelastic creep of the meniscal root or permanent,

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unrecoverable loosening of the repair. This information is of utmost importance when more aggressive protocols of rehabilitation are being considered because the repair could be significantly compromised and lead to unrecoverable changes if proper healing times are not allowed. Of note, this loosening amounted to 1.59 mm, which was statistically significant but might not be clinically relevant because the exact amount of loosening that would translate into clinically significant findings is not defined in the literature. Additionally, the thickness and structure of the meniscus in an ovine model might not completely replicate the human anatomy, but the model had its own control, and thus, a valid point was made.

The natural history of root tears treated conservatively has yielded less than desirable outcomes. Krych et al.<sup>17</sup> report poor clinical outcomes, worsening of osteoarthritis, and a 31% incidence of conversion to arthroplasty in 52 patients treated conservatively for posterior root tears at a mean follow-up of 5 years. Conversely, evidence to support root repairs is exponentially growing. One key factor for success here is restoration of the anatomy. As my mentor, Dr. LaPrade says, "You have to put it back where it belongs," because it has been shown that attaching the roots in a different position compromises the final results. Results of biomechanical studies have revealed that a 3-mm nonanatomic displacement significantly alters meniscal function by failing to restore joint loading and contact areas.<sup>18,19</sup> Chung et al.<sup>20</sup> report that medial meniscal root repairs slow the progression of intraarticular arthritic changes compared with partial meniscectomy.<sup>20</sup> In addition to the overall difference in arthritic changes, Chung et al.<sup>20</sup> report that 35% of the patients who had undergone a meniscectomy to treat a meniscal root tear required conversion to total knee arthroplasty by 5-year follow-up, whereas none of the patients who had undergone a meniscal root repair required conversion to total knee arthroplasty. In a recent systematic review of the outcomes of posterior medial meniscal root repairs, magnetic resonance imaging findings demonstrated that medial meniscus extrusion was reduced in only 56% of the patients. In addition, second-look arthroscopy demonstrated that the healing status was complete in 62% of patients, partial in 34%, and failed in 3%.<sup>11</sup> LaPrade et al.<sup>21</sup> performed a comparative study on meniscal root repairs in patients older and younger than 50 years old. The authors reported comparable improvement in patient-reported outcomes (Lysholm Score, International Knee Documentation Committee, Western Ontario McMaster Osteoarthritis Index) for both groups when an anatomic 2-tunnel transtibial pull-out technique was used.<sup>21</sup>

Finally, as previously stated, rehabilitation for meniscal root repairs is usually designed based on rehabilitation associated with other meniscal repairs, with a linear periodization protocol based on

progressive loading of the repair.<sup>22</sup> The first 6 weeks are focused on non-weight-bearing protection and are followed by 2 to 3 weeks of gradually progressive weight bearing. This provides sufficient protection to allow the root to partially heal while avoiding arthrofibrosis. After this partial healing has been achieved, the final 3 phases consist of muscle endurance, strength, and power/return to sports training. This protocol is the most widely used now; however, more research is needed to determine the real effect of different protocols in vivo.

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