Articular Cartilage Integrity Influences Outcomes of Medial Meniscus Posterior Root Tear Repair

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INTRODUCTION: Meniscal root tears alter joint biomechanics and accelerate osteoarthritis. The coexistence of preexisting articular cartilage damage with medial meniscus posterior root tears (MMPRT) presents a multifaceted challenge for orthopedic surgeons, potentially hindering surgical success due to compromised structural integrity of the knee joint and worsened biomechanical alterations. However, there is a paucity of literature addressing the specific impact of articular cartilage lesions on the efficacy of MMPRT repair. Therefore, this study aimed to investigate the impact of articular cartilage status at the time of MMPRT repair on patient outcomes. The authors hypothesized that patients with severe cartilage damage would experience inferior outcomes compared to those with less severe chondropathy.

METHODS:

Patients aged 18 or older who underwent primary isolated MMPRT repair with documented International Cartilage Research Society (ICRS) grading and at least 2-year follow-up were included. Exclusion criteria were revision MMPRT repair, concomitant ligament or meniscus procedures, ipsilateral knee surgery history, Kellgren-Lawrence (KL) grade 4, and incomplete patient-reported outcome measures (PROM) at baseline or minimum 2-year follow-up. Data collected included demographics, medical history, x-ray and MRI data, subsequent surgery rates and PROMs such as the Knee Injury and Osteoarthritis Outcome Score, Joint Replacement (KOOS Jr.), International Knee Documentation Committee (IKDC) score, and Veterans RAND 12 Item Health Survey Score (VR-12). Injuries were categorized as acute (symptoms <12 weeks) or chronic (≥12 weeks). Patients were stratified by cartilage damage severity on the medial tibial plateau (MTP) or medial femoral condyle (MFC) using the ICRS grading scale: low grade (Grades 0, I, or II) and high grade (Grades III or IV). Descriptive statistics summarized baseline characteristics. Bivariate analysis was conducted using Fisher's exact test for categorical variables and unequal variances t-test for continuous data. Six generalized linear models with a binomial distribution and a logit link function were created. The models included covariates such as age, sex, BMI, race, preoperative joint space, pre-operative KL Grade, pre-operative meniscal extrusion, mechanical alignment of the knee, and tear chronicity. Results were reported as odds ratios with 90% confidence intervals. Hypothesis testing was two-sided, with statistical significance set at $p < 0.05$.

RESULTS:

A total of 85 patients were included (mean age 56.5 ± 9.2 years, BMI 32.9 ± 6.1 kg/m², follow-up 41.5 ± 17.6 months). The low-grade damage group (ICRS Grades 0-II) had 54 patients (63.5%) and the high-grade damage group (ICRS Grades III-IV) had 31 patients (36.5%). Females comprised 76.5% of the cohort, with chronic injuries in 52.9%. Follow-up times were comparable (41.4 ± 17.8 vs 41.6 ± 17.5 months, $p = 0.968$). The only significant differences in baseline characteristics were that meniscal extrusion was lower in the low-grade damage group (3.7 ± 1.0 mm vs 4.4 ± 1.0 mm, $p = 0.005$), and chronic tears were more common in the high-grade damage group (67.1% vs 44.4%, $p = 0.044$). No significant differences in preoperative PROMs were observed. Postoperatively, the low-grade damage group showed higher IKDC scores (70.7 ± 19.5 vs 58.9 ± 25.2, $p = 0.028$) and greater improvement in IKDC scores from preoperative to final follow-up (33.8 ± 20.9 vs 24.6 ± 19.8, $p = 0.048$). The low-grade damage group had a higher PASS achievement rate for IKDC (66.7% vs 41.9%, $p = 0.046$). Subsequent surgery rates were similar (12.9% vs 6.5%, $p = 0.476$). Males were 75% [95% CI: 26%, 91%] less likely to achieve MCID for the VR-12 Physical score ($p = 0.031$). Patients with chronic tears were 61% [95% CI: 26%, 89%] less likely to achieve MCID and 67% [95% CI: 20%, 87%] less likely to achieve PASS for the VR-12 Physical score ($p = 0.031$ and $p = 0.041$, respectively).

DISCUSSION AND CONCLUSION: The severity of cartilage damage at the time of medial meniscus root tear repair significantly impacts outcomes, with a greater degree of chondropathy associated with inferior clinically significant outcomes. These findings underscore the importance of cartilage integrity in successful MMPRT repair and suggest that severe cartilage damage may require more comprehensive management strategies for optimal outcomes.