When One Stage Is Enough: Symptom Improvement After Arthroscopic Evaluation for MACI

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INTRODUCTION: Matrix-Induced Autologous Chondrocyte Implantation (MACI) is a two-stage surgical approach designed to address full-thickness articular cartilage defects in the knee. While this technique has demonstrated favorable outcomes in appropriately selected patients, the pathway to MACI often begins with diagnostic arthroscopy and cartilage biopsy. Notably, many patients do not proceed to the second-stage implantation following this initial procedure, raising the question of whether some individuals derive sufficient therapeutic benefit from arthroscopic intervention alone. Despite the growing use of MACI, there remains a limited understanding of the clinical factors that influence patient progression to implantation and whether arthroscopic biopsy with debridement itself may lead to symptom improvement. This study aims to (1) quantify how often patients initially considered for MACI do not proceed with the second-stage procedure and (2) evaluate clinical and intraoperative factors associated with that decision.

METHODS: A retrospective chart review was conducted of 254 patients who underwent arthroscopic cartilage biopsy between 2017 and 2022 as part of a potential MACI workup. This population included patients undergoing arthroscopy either with the intent to proceed to MACI pending findings or those who had biopsy added during therapeutic arthroscopic debridement as a precautionary measure. Patients were categorized into two groups: those who ultimately received MACI (n=80) and those who did not (n=174). Demographic characteristics (age, sex, BMI), clinical parameters (preoperative pain scores, concomitant injuries), and intra-operative findings (cartilage defect size, defect location) were collected. Additionally, surgical planning documentation was reviewed to capture the initial intent of the procedure. Stepwise binary logistic regression was used to identify variables significantly associated with progression to MACI.

RESULTS: The study cohort consisted of 142 male and 112 female patients, with an average age of 27.7 ± 9.2 years and BMI of 27.9 ± 5.3 kg/m². Among all patients who underwent cartilage biopsy, only 31.5% (80/254) proceeded to MACI. Binary logistic regression analysis identified two significant predictors of progression to the second-stage procedure: larger intra-operative cartilage defect size (OR = 0.130, $p = 0.011$) and a documented preoperative plan to proceed with MACI ($p < 0.001$). No significant associations were observed for age, sex, BMI, or baseline pain levels. For the majority of patients who did not undergo implantation (68.5%), documented reasons included symptom resolution, improved function with conservative management, or a shared decision to defer further intervention after arthroscopic debridement.

DISCUSSION AND CONCLUSION:

This study challenges the traditional assumption that all patients evaluated for MACI necessarily require progression to the second-stage implantation. With only 31.5% of patients ultimately undergoing MACI, the data suggest that a substantial number of individuals experience sufficient symptom improvement from the initial arthroscopic procedure alone. Documented reasons for not proceeding with MACI included decreased symptoms, improved function, and shared decision-making in favor of conservative management, highlighting the potential therapeutic value of debridement even in the setting of significant chondral pathology.

These findings indicate that larger cartilage defect size and a preoperative plan to proceed with MACI were the strongest predictors of undergoing implantation, while factors such as age, BMI, and pain level did not significantly influence this decision. These results underscore the importance of surgical intent and objective intra-operative findings in treatment planning. However, the role of subjective improvement following debridement cannot be overlooked, as nearly 70% of patients did not require further intervention.

These insights support a more nuanced and individualized approach to cartilage restoration. By recognizing that some patients may achieve acceptable clinical outcomes without full cartilage implantation, surgeons can better tailor interventions, avoid unnecessary procedures, and align treatment with patient goals. Future prospective studies are warranted to validate these findings and develop predictive tools that incorporate both objective variables and patient-reported outcomes to guide shared decision-making in cartilage repair.