

Bone Marrow Aspirate Concentrate is Associated with Greater Improvements in Functional Outcomes in Patients with Chondrolabral Junction Breakdown: A Case-Control Study

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INTRODUCTION: In the setting of femoroacetabular impingement (FAI), the importance of chondrolabral junction preservation during arthroscopic labral repair has been increasingly emphasized to reconstitute the physiologic suction seal of the hip. However, the unique histology and variable presentation of breakdown in this region creates an added challenge for surgeons, as the accompanying chondral injury may not always be amenable to microfracture or other variations of cartilage restoration. At the time of hip arthroscopy, preliminary evidence has suggested that augmentation with bone marrow aspirate concentrate (BMAC) may provide functional benefit to patients with moderate cartilage damage. However, to date, no literature has specifically investigated clinical outcomes following BMAC augmentation in patients with chondrolabral junction breakdown and associated chondral injury (i.e., delamination, partial defects, or full-thickness flaps). Thus, the purpose of the present study was to assess 12-month functional outcomes following arthroscopic acetabular labral repair in the presence of chondrolabral junction breakdown and concomitant chondral injury to compare patients receiving a standardized method of BMAC application versus a historical control cohort that did not receive BMAC.

METHODS: A retrospective review was performed to identify patients (age ≥ 18 years) who underwent arthroscopic acetabular labral repair with minimum 12-month follow up, by a single surgeon employing a uniform surgical technique. Operative notes and arthroscopy images were queried to identify patients with labral tears and arthroscopic evidence of chondrolabral junction damage (Beck Transition Zone Cartilage Injury Classification 2 or 3) and concomitant chondral delamination (i.e., “wave” or “carpet” sign), partial-thickness chondral injuries, or exposed subchondral bone with an overlying full-thickness chondral flap. Clinical outcomes were assessed using patient-reported outcome measures (PROMs) to compare patients who received BMAC augmentation between December 2016 to June 2021 to a control cohort of patients that did not receive BMAC between March 2007 to November 2016. Exclusion criteria consisted of labral debridement or incomplete PROMs (International Hip Outcome Tool–33 [iHOT-33], Hip Outcome Score–Activities of Daily Living [HOS-ADL], Hip Outcome Score–Sports Subscale [HOS-SS], modified Harris Hip Score [mHHS], and visual analog scale [VAS] for pain) at enrollment and 24-month follow up. Descriptive data and intraoperative findings were collected and compared between cohorts using t-tests or Chi-square/Fisher’s exact tests, as appropriate, while comparisons of outcome scores between cohorts at 3-, 6-, 12-, and 24-month follow up were made using linear mixed-effects models. Additionally, clinical thresholds were assessed at 12- and 24-month follow up.

RESULTS: Fifty-five hips treated with BMAC were compared to forty-two control hips with no significant preoperative differences identified in terms of mean age (33.8 vs. 37.2 years, $p=.142$), sex (61.8% vs. 61.9% male, $p=.775$), body mass index (25.0 vs. 25.6 kg/m², $p=.454$), radiographic Tönnis grade ($p=.087$), Tönnis angle (6.6 vs. 5.5 degrees, $p=.329$), or alpha angle (61.6 vs. 57.8 degrees, $p=.295$; **TABLE 1**). However, the BMAC cohort was found to have a significantly higher preoperative lateral center edge angle (37.9 vs. 35.3 degrees, $p=.050$) with a higher distribution of patients with mixed-type FAI ($p=.002$) that subsequently received a higher frequency of combined femoral acetabuloplasty ($p=.002$; **TABLE 1**). Additionally, the BMAC cohort encompassed a higher distribution of patients with more severe chondrolabral junction breakdown (Beck Transition Zone Classification, $p<.001$) and cartilage damage (Outerbridge grade, $p<.001$; **TABLE 1**). Notably, no significant differences were identified in terms of labral tear quality (Beck Labral Tear Classification, $p=.094$). In terms of functional outcomes, no differences were identified at baseline between cohorts. However, at 12-month follow up, the BMAC reported significantly higher functional scores assessed via the iHOT-33, HOS-ADL, mHHS, and VAS pain scale. These findings remained consistent through 24-month follow up for all outcomes, except HOS-ADL (**TABLE 2**). Importantly, both cohorts exhibited significant interval improvement in all PROMs across the study period, however the BMAC cohort achieved clinical thresholds at similar or greater rates across all outcome measures at 12- and 24-month follow up (**TABLE 3**).

DISCUSSION AND CONCLUSION: BMAC application in patients with evidence of chondrolabral junction breakdown and concomitant chondral injury experienced greater improvements in functional outcomes scores at minimum 12-month follow up compared to a control cohort that did not receive biologic augmentation. These findings add to the preliminary evidence supporting the use of BMAC during hip arthroscopy, but further higher-power, randomized studies will be needed to corroborate these findings.

