BMAC Augmentation of Allograft Anterior Cruciate Ligament Reconstruction Improves Patient Reported Outcomes in the Presence of Intra-Articular Pathology

Brian Forsythe[1], Elyse Jordan Berlinberg[2], Camden J Bohn[3], Catherine Maria Hand[3], Daanish Hussain Khazi-Syed, Joshua Chang, Ophelie Lavoie-Gagne[4], Jorge A Chahla, Adam Blair Yanke[5], Nikhil N Verma[6], Brian J Cole[3]
[1]Midwest Orthopaedics At Rush, [2]Massachusetts General Hospital, [3]Rush University Medical Center, [4]Massachusetts General Hospital, Harvard Medical Sc, [5]Rush University Med Ctr, [6]Midwest Orhtopedics At Rush

INTRODUCTION: A randomized control trial demonstrated evidence of earlier graft remodeling and improved 9-month International Knee Documentation Committee (IKDC) scores when anterior cruciate ligament reconstruction (ACLR) with bone-tendon-bone allograft was augmented with an intra-graft injection of bone marrow aspirate concentrate (BMAC). While these results are promising, the mechanism by which BMAC may affect patient reported outcome measures (PROMs) following ACLR is unclear.

METHODS: This was a sub-analysis of patients enrolled to date in an IRB-approved, double-blinded, randomized control trial comparing patients undergoing ACLR with BTB allograft ± BMAC. Only patients who had completed at least 9 months follow-up were included. Patients were stratified by 1) treatment arm (BMAC versus control) and 2) presence of concurrent meniscus or cartilage pathology, as noted on diagnostic arthroscopy). The primary outcome was the Tegner activity scale and International Knee Documentation Committee (IKDC) at 9 months. A secondary sub-analysis assessed differences in MRI characteristics (signal intensity ratio [SIR], graft volume) by group.

RESULTS: The final study cohort included 44 BMAC patients – 19 (43%) without and 25 (57%) with concurrent cartilage or meniscus pathology – and 39 control group patients - 16 (41%) without and 23 (59%) with concurrent cartilage or meniscus pathology. 24 patients in the BMAC group had a meniscus lesion, 13 of which were treated via meniscectomy (54%) and 11 by meniscus repair (46%). By comparison, 21 patients in the control group had a meniscus lesion (P=0.57), 11 who were treated with meniscectomy (52%, P=0.88) and 11 who had a meniscus repair (P=1.00). 5 patients with BMAC (20%) and 6 control patients (25%) had a cartilage injury noted intraoperatively (P=0.94); chondroplasty was performed in 2 patients in the BMAC group (8.0%) and 4 patients in the control group (16.7%). Tegner score at 9 months did not differ by BMAC treatment or presence of concurrent meniscus/cartilage pathology (P=0.816). If a patient had a concurrent meniscus and/or cartilage lesion, the group treated with BMAC had a greater mean IKDC at 9 months (81.7 [SD=10.2] vs. 74.3 [SD=14.6], P=0.039). If a patient had no concurrent pathology, there was no difference in IKDC scores by treatment group (P=0.80). Change in Tegner (P=0.99) and IKDC (P=0.31) did not differ by groups. At 3 months, patients with BMAC and concurrent pathology had the highest mean SIR in the inferior 1/3 of the graft (3.00), followed by patients with BMAC but no concurrent pathology (2.60), controls without concurrent pathology (1.95), and controls with concurrent pathology (1.83, P=0.041). There were no significant differences in SIR at 9 months or graft volume, in this comparative cohort study.

DISCUSSION AND CONCLUSION: Amongst patients with concurrent meniscus and/or cartilage lesions, patients with BMAC had an 8-point higher mean IKDC score than controls at 9 months postoperatively. However, there was no difference in mean IKDC score between BMAC and control groups if no concurrent pathology was present. Thus, improved IKDC amongst patients with BMAC may be mediated by improved healing of repaired tissue or through an undefined anti-inflammatory or nociceptive pathway. Further investigation will be required to delineate a physiologic mechanism of action associated with BMAC during the recovery process when utilized at the time of ACL allograft reconstruction.