

Sex-Mismatched Osteochondral Allografts for Transplantation in the Knee Do Not Adversely Affect Cumulative Graft Survival Rates

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DISCLOSURES: J. Williams: None. K. Rucinski: None. J. Pridemore: None. A. Stoker: 1; MTF. C. Crececius: None. C. Nuelle: 2; Vericel, Arthrex. 3B; Guidepoint Consulting. 6; AO Foundation, Arthroscopy. 7B; Arthroscopy. 8; Arthroscopy. 9; AAOS, AOSSM, AANA. J. Stannard: 3B; Arthrex, DePuy, A Johnson & Johnson Company, Orthopedic Designs North America, Smith & Nephew. 5; Arthrex, NIH, US DOD. 7B; Thieme. 8; J of Knee Surgery. 9; AOA, AOF, AO NA, MAOA. J.L. Cook: 1; Arthrex, MTF. 2; Arthrex. 3B; Arthrex, Bioventus, Collagen Matrix Inc, Trupanion. 5; Arthrex, AO Trauma, Collagen Matrix Inc, Cellularity, MTF, NIH, Organogenesis, Purina, Regenosine, SITES Medical. 7B; Thieme. 8; J of Knee Surgery. 9; MTN, MTF.

INTRODUCTION: For more than 40 years, osteochondral allograft (OCA) transplantations have been used to treat symptomatic articular cartilage defects in young and active patients. The number of these surgeries being performed is growing as allograft availability, quality, and storage duration continue to increase. While improvements to surgical technique and graft preservation methods have led to improved outcomes after OCA transplantation, functional graft survival rates are still lower than desired. In a 2022 study, Merkely et al. reported that patients receiving donor-recipient sex-mismatched grafts for OCA transplantation in the knee had a significantly lower 5-year cumulative survival rate compared to patients receiving sex-matched OCAs.¹ However, based on limitations to that study, we sought to validate these findings at our high-volume OCA transplant center prior to making any shift in practice that would markedly affect patient care. Therefore, this study was designed to test the null hypothesis that donor-recipient sex-mismatched OCAs for transplantation in the knee would not be associated with significantly different cumulative graft survival rates when compared to sex-matched OCAs.

METHODS: With IRB approval and documented informed consent, patients seeking OCA transplantation to treat symptomatic articular cartilage defects in the knee were enrolled in a life-long outcomes registry prior to surgical intervention. Donor age and sex were collected from respective organ procurement organizations and tissue banks. A Kaplan-Meier Survival Analysis was performed to compare cumulative survival rates between cohorts over an 85-month time frame. Functional graft survival time was defined as the time between surgical intervention and OCA treatment failure or the most recent follow-up with documented absence of failure. OCA treatment failure was defined as any need for a revision OCA surgery or conversion to any form of knee arthroplasty. A Cox-Hazard multivariate analysis was used to determine if patient BMI, patient age, patient sex, or donor age significantly contributed to cumulative survival rates. Significance for all tests was set at $p < 0.05$.

RESULTS: A total of 162 patient-donor pairs were included in this study with 57 (35%) sex-mismatched. A total of 38 OCA treatment failures (23%) were documented, with 12 (32%) of the failures occurring in donor-recipient sex-mismatched transplants. Kaplan-Meier analysis revealed that sex-mismatched OCA transplants were not associated with a significantly different cumulative graft survival rate when compared to sex-matched OCA transplants ($p = 0.25$). Cox-Hazard multivariate analysis revealed no statistically significant effects for patient BMI, patient age, patient sex, or donor age covariates ($p = 0.46$, $p = 0.06$, $p = 0.62$, and $p = 0.96$ respectively) on cumulative graft survival rates.

DISCUSSION: Our findings indicate that use of donor-recipient sex-mismatched osteochondral allografts does not adversely affect cumulative treatment failure rates in this population of patients undergoing OCA transplantation in the knee. These data contradict the findings of Merkely et al., which may reflect differences in patient populations, graft types, storage methods, pre-implantation treatments, surgical techniques, and/or patient management strategies. Further clinical research designed to delineate these variables is needed in order to ensure maximal OCA quality and availability, optimize use of donated tissues, and continue to improve patient outcomes. In our study, 86% of donors were male while only 59% of patients were male. A shift in practice requiring a donor-recipient sex-matched OCAs could significantly increase the time that patients are required to wait for joint-preserving OCA transplantation. This requirement would be associated with prolonged knee dysfunction and diminished quality of life, as well as increased direct and indirect healthcare costs.

SIGNIFICANCE/CLINICAL RELEVANCE: The results of the present study support current protocols for OCA transplantation, which do not require donor-patient sex-matching. Ongoing studies at our joint preservation center are aimed at further defining modifiable variables that significantly influence outcomes after OCA transplantation.

REFERENCES: [1] Merkely G, Farina EM, Leite CBG, Ackermann J, Görtz S, Lattermann C, Gomoll AH. Association of Sex Mismatch Between Donor and Recipient With Graft Survivorship at 5 Years After Osteochondral Allograft Transplantation. *Am J Sports Med.* 2022 Mar;50(3):681-688. doi: 10.1177/03635465211068872. Epub 2022 Jan 19. PMID: 35044257.

IMAGES AND TABLES:

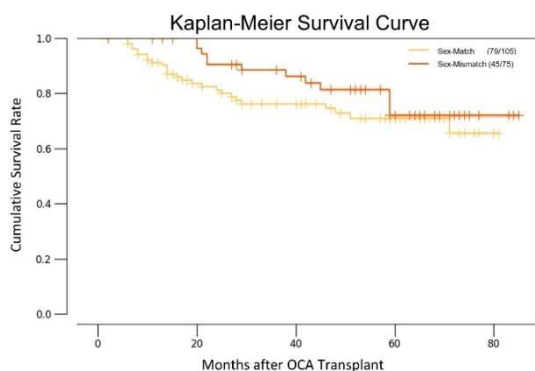


Figure 1) Kaplan-Meier survival analysis. No significant difference was found between the patient cohort receiving sex-mismatched grafts and the cohort receiving sex-matched grafts ($p = 0.2521$)

Multivariate Cox Hazard Analysis of the Influence of Donor-Recipient Sex-Mismatch on OCA Survival Rates

	Coefficient	P value	Hazard Ratio	95% CI
Patient Age	0.03	0.06	1.85	0.00 - 0.05
Patient Sex	0.24	0.62	0.49	-0.73 - 1.22
Patient BMI	0.02	0.46	0.74	-0.04 - 0.09
Donor Age	0.00	0.96	0.05	-0.06 - 0.06
Sex Mismatch	-0.51	0.31	-1.02	-1.49 - 0.47

Table 1) Cox-Hazard multivariate analysis. No significant effect was found from the covariates patient BMI, patient age, patient sex, donor age, or sex-mismatch on OCA survival rates. This finding agrees with the Kaplan-Meier survival analysis, even when considering the effects of additional variables.