

Biologic Knee Reconstruction Demonstrates Clinically Significant Outcome Achievement at 5-Year Minimum Follow-Up

Kyle R Wagner, Nolan B Condron, Allen Ali Yazdi, Jarod Moyer, Yusuf Nomaan Mufti, Derrick Knapik, Eric J Cotter, Adam Blair Yanke¹, Brian J Cole²

¹Rush University Med Ctr, ²Rush University Medical Center

INTRODUCTION:

Osteochondral allograft transplantation (OCA), meniscal allograft transplantation (MAT), and osteotomies have demonstrated durable outcomes independently. Recent advancements allow these procedures to be performed simultaneously, but studies examining the combined use of OCA, MAT, and osteotomy are limited. The objective of this study is to analyze clinically significant outcome achievement, reoperations, and failures at midterm follow-up in patients who underwent concomitant primary OCA, MAT, and osteotomy.

METHODS: Patients undergoing combined primary OCA, MAT, and osteotomy from 1999-2018 were prospectively followed. Inclusion criteria consisted of patients with minimum 5-year follow-up. Those undergoing revision procedures were excluded. Patients were evaluated for reoperation, failure, and achievement of clinically significant outcomes (CSOs) for International Knee Documentation Committee subjective form, Lysholm, and Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales. Minimal clinically important difference (MCID) was determined by a distribution method, while patient acceptable symptomatic state (PASS) and substantial clinical benefit were determined with an anchor-based method. Reoperation was defined as subsequent surgical intervention of the transplanted osteochondral or meniscal allograft, including second-look arthroscopy for graft evaluation, debridement, loose body removal, or meniscectomy. Failure was defined as structural failure of allograft seen on magnetic resonance imaging or second-look arthroscopy, revision of the primary OCA or MAT, or conversion to arthroplasty.

RESULTS: Nineteen patients (N = 11/19 were female, 58%) with a mean patient age of 30.2 ± 9.9 year (range: 15.0 – 49.2) and follow-up of 7.8 ± 2.3 years (range: 5.0 – 13.9) were analyzed (Table 1). The most common combined procedure performed was OCA of the lateral femoral condyle, lateral meniscus transplantation, and distal femoral osteotomy (N = 11/19, 58%). The mean intraoperative varus and valgus corrections were 8.1 ± 1.8 and 6.6 ± 1.4 degrees, respectively. PASS was achieved by a majority of patients for all patient-reported outcome measures, with the exception of KOOS Sport. Seven (N = 7/19, 37%) patients underwent subsequent reoperation at a mean 1.0 ± 0.8 years (range: 0.5 – 2.8). Hardware removal and articular cartilage debridement were the most common procedures performed (N = 4/19, 21%), followed by lysis of adhesions (N = 2/19, 10%). Two patients (N = 2/19, 10%) met criteria for failure at a mean 1.0 ± 0.4 years (range: 0.7 – 1.3). One patient underwent total knee arthroplasty, while the other underwent revision OCA and MAT.

DISCUSSION AND CONCLUSION: In appropriately selected patients, combined OCA, MAT, and osteotomy can result in clinically significant results at midterm follow-up. While reoperation rates following this procedure are high, rates of conversion to arthroplasty or revision procedures are low.

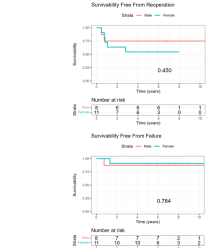


Figure 1: Kaplan-Meier survival plot showing the percentage of patients achieving clinically significant outcomes (CSOs) over time. The plot shows two curves: one for 'All patients' (n=19) and one for 'Patients achieving CSOs' (n=12). The 'All patients' curve starts at 100% and drops to approximately 63% at 5 years. The 'Patients achieving CSOs' curve starts at 100% and drops to approximately 63% at 5 years. The p-value is 0.400.

Table 1: Demographics and Intraoperative Variables

Variable	Female, N = 11 ^a	Male, N = 8 ^a	P-value
Age (years)	28.3 ± 8.4	30.0 ± 11.7	0.309
BOI	20.84 ± 3.15	20.42 ± 3.71	0.807
Laterality			<0.001
LFT	5 (95%)	4 (50%)	
Right	0 (0%)	4 (50%)	
Smoking status	0 (0%)	0 (0%)	<0.001
WC	1.0 (5%)	1 (12%)	<0.001
Pre-reoperation	5.0 ± 1.00	3.2 ± 0.80	0.002
Symptom duration (years)	5.8 ± 4.6	4.3 ± 3.6	0.301
IMTs	9 (82%)	3 (38%)	0.034
MMTs	7 (64%)	5 (63%)	0.974
HTC	5 (45%)	5 (63%)	0.480
DFO	8 (73%)	3 (38%)	0.330
Distal width (mm)	18.68 ± 2.34	19.57 ± 2.57	0.603

^aContinuous variables listed as n (%), categorical variables listed as mean (SD)

Demographics and intraoperative variables of patients who underwent concomitant MAT, OCA, and osteotomy. BOI, body mass index; OCA, osteochondral allograft transplantation; IMTs, lateral meniscus transplantation; MMTs, medial meniscus transplantation; HTC, hook transposition; DFO, distal femoral osteotomy.

Table 2: Baseline and 5-year Minimum Patient-Reported Outcomes

Variable	Baseline ^a	Postoperative ^b	P-value
IKDC	43.2 ± 9.4	65.3 ± 16.6	0.001
Lysholm	56.5 ± 14.4	77.9 ± 11.7	0.006
KOOS Subtotal			
Pain	59.3 ± 15.7	80.1 ± 12.2	0.001
Symptoms	55.7 ± 17.8	85.5 ± 14.4	0.001
Quality of life	37.7 ± 16.1	73.4 ± 18.8	0.007
ADL	75.1 ± 20.8	95.8 ± 14.5	0.007
QOL	28.8 ± 11.0	63.7 ± 20.4	0.001

^aContinuous variables listed as mean (SD), categorical variables listed as n (%).

^bContinuous variables listed as mean (SD), categorical variables listed as n (%).

IKDC, International Knee Documentation Committee; KOOS, Knee Injury and Osteoarthritis Outcome Score; QOL, quality of life.

Table 3: Achievement of Clinically Significant Outcomes at 5-Year Follow-Up

Outcome	Patients achieving CSOs
IKDC	4/7 (57%)
Lysholm	4/7 (57%)
KOOS	4/7 (57%)
Pain	4/7 (57%)
Symptoms	4/7 (57%)
Quality of life	4/7 (57%)
ADL	4/7 (57%)
QOL	4/7 (57%)

CSOs, clinically significant outcomes; IKDC, International Knee Documentation Committee; KOOS, Knee Injury and Osteoarthritis Outcome Score; QOL, quality of life; ADL, activities of daily living.