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Introduction

- Articular cartilage is vulnerable to injury and exhibits limited regenerative capacity.¹
- Full-thickness, focal, osteochondral defects are commonly treated with osteochondral allograft transplantation (OCA) or autologous chondrocyte implantation (ACI), which are associated with high levels of patient satisfaction and enhancement in functional performance.²
- Outcomes following OCA for revision of previously unsuccessful cartilage repairs are comparable to those observed in primary OCA. However, outcomes following OCA after failed ACI have been minimally reported in the current literature.^{3,4}
- Purpose:** To compare the clinical outcomes, reoperation rates, and failure rates of OCA following failed ACI with those of a matched cohort undergoing primary OCA.
- Hypothesis:** We hypothesized ACI revision with OCA would provide comparable outcomes and failure rates as primary OCA.

Methods

- A retrospective matched cohort analysis was conducted on twenty-two patients who underwent OCA following failed ACI between 2001 and 2021.
- Patients were matched based on lesion location, lesion size, age, sex, and BMI.
- Inclusion Criteria:** (1) Revision OCA after failed ACI and (2) Minimum 2-year follow-up.
- Exclusion Criteria:** (1) Less than 2 years follow-up and (2) The presence of inflammatory arthropathy.
- Reoperation:** Subsequent surgical intervention of the transplanted osteochondral allograft, including second-look arthroscopy for graft evaluation, debridement, and loose body removal.
- Failure:** Revision cartilage procedure, graft delamination on seconded-look arthroscopy, or conversion to unicompartmental or total knee arthroplasty

Table 1: Patient Demographics and Intraoperative Variables

Characteristic	Revision to OCA, n = 22	Primary OCA, n = 22
Sex		
Female	16 (73%)	11 (50%)
Male	6 (27%)	11 (50%)
Age (years)	31.2 ± 6.4	34.3 ± 7.5
BMI	26.7 ± 4.5	28.0 ± 3.5
Laterality		
Left	4 (18%)	9 (40%)
Right	18 (82%)	13 (60%)
Traumatic Etiology (% Yes)	9 (40%)	11 (50%)
Smoking status		
Current	2 (9%)	2 (9%)
Former	0 (0%)	1 (4.5%)
Never	20 (91%)	19 (86%)
Defect Location		
WC	4 (18%)	4 (18%)
MFC	7 (32%)	7 (32%)
LFC	6 (27%)	6 (27%)
Patella	9 (41%)	9 (41%)
Defect Area (mm ²)		
MFC	538 ± 477	381 ± 144
LFC	445 ± 148	352 ± 77.5
Patella	425 ± 236	484 ± 207
Follow-up (years)	5.72 ± 4.2	4.41 ± 1.8

Table 1: Demographics and intraoperative variables stratified by case and matched control groups. BMI, body mass index; LFC, lateral femoral condyle; MFC, medial femoral condyle; WC, worker's compensation status. * categorical variables listed as n (%); continuous variables listed as mean (SD)

Demographics

- 22 patients met inclusion criteria
- 73% (n = 16/22) female
- Mean age: 31.2 ± 6.4 years
- Mean follow-up: 5.72 ± 4.2 years (range: 2 - 14.0)
- Concomitant procedures performed in 37% (n = 8/22) of the revision OCA group and 50% (n = 11/22) of the primary OCA group.
- Both cohorts did not differ in patient demographics, intraoperative variables, number of previous surgeries, preoperative baseline patient-reported outcome measures (PROs), or types of concomitant procedures

Outcomes

- Both cohorts demonstrated statistically significant improvement for all postoperative PROs (P < 0.05).
 - No statistical difference between groups when comparing improvements in PROs, number of reoperations, and failure rates (P > 0.05).
- Reoperation Rate**

 - Revision to OCA: 10 patients (45%)
 - Primary OCA: 8 patients (36%)
- Failure Rate**

 - Revision to OCA: 4 patients (18%)
 - Primary OCA: 2 patients (9%)
- Four patients (18%) failed Revision OCA after failed ACI due to significant graft delamination at an average 2.4 ± 2.1 years.
 - Two patients required further revision OCA and two underwent significant chondral debridement.
 - All four patients were clinically asymptomatic at an average final follow-up of 5.9 years.

Discussion

- The primary finding of this study is that revision OCA after failed ACI has similar clinical outcomes, rates of reoperation, and failure compared to primary OCA at a minimum 2-year follow-up.
- Our study expands on prior findings that concluded revision OCA is a viable option for failed ACI. Merkely et al. reported data from 13 patients who underwent this procedure with similar results to the present study.⁴
- This data can help inform surgical decision-making for patients who have failed non-OCA cartilage repair for focal chondral lesions of the knee.
- Additional, long-term follow-up studies examining and graft survival following revision to OCA are warranted.

References

- Buckwalter J, Rosenberg L, Hunziker E. Articular cartilage: composition and structure. In: *Injury and Repair of the Musculoskeletal Soft Tissues*. 1988:405-425.
- Farr J, Cole B, Dhawan A, Kercher J, Sherman S. Clinical Cartilage Restoration: Evolution and Overview. *Clin Orthop*. 2011;469(10):2696-2705. doi:10.1007/s11999-010-1764-z
- Gracitelli GC, Meric G, Pulido PA, Götz S, De Young AJ, Bugbee WD. Fresh osteochondral allograft transplantation for isolated patellar cartilage injury. *Am J Sports Med*. 2015;43(4):879-884. doi:10.1177/0363546514564144
- Merkely G, Ogura T, Ackermann J, Barbieri Mestriner A, Gomoll AH. Clinical Outcomes after Revision of Autologous Chondrocyte Implantation to Osteochondral Allograft Transplantation for Large Chondral Defects: A Comparative Matched-Group Analysis. *Cartilage*. 2021;12(2):155-161. doi:10.1177/1947603519833136

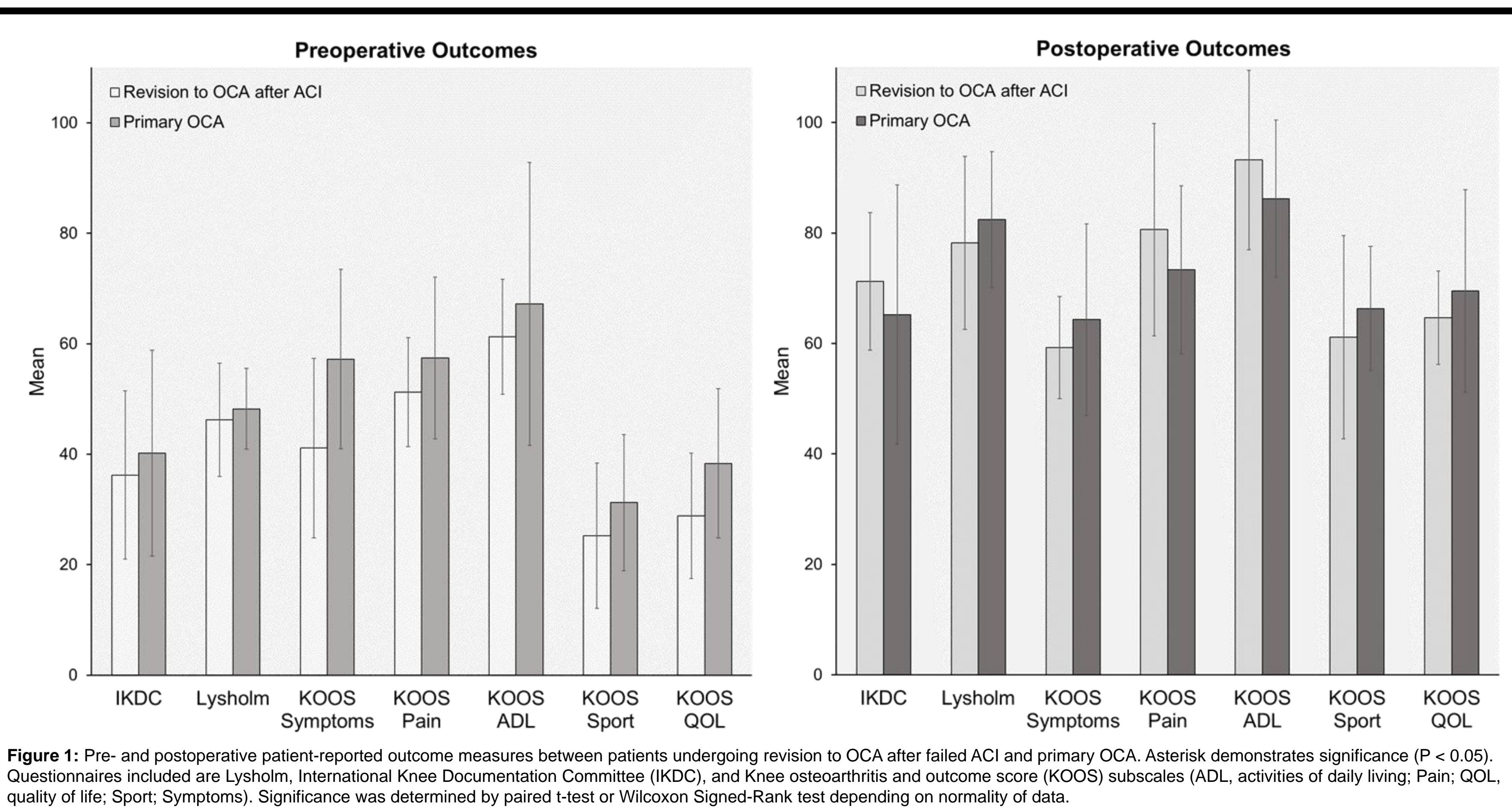


Figure 1: Pre- and postoperative patient-reported outcome measures between patients undergoing revision to OCA after failed ACI and primary OCA. Asterisk demonstrates significance (P < 0.05). Questionnaires included are Lysholm, International Knee Documentation Committee (IKDC), and Knee osteoarthritis and outcome score (KOOS) subscales (ADL, activities of daily living; Pain; QOL, quality of life; Sport; Symptoms). Significance was determined by paired t-test or Wilcoxon Signed-Rank test depending on normality of data.

Table 2: Major Concomitant Procedures

Variable	Revision OCA after Failed ACI	Primary OCA
LMAT	2 (9%)	3 (14%)
MMAT	2 (9%)	2 (9%)
Lateral Meniscal Repair	1 (4.5%)	0
HTO	0	2 (9%)
DFO	2 (9%)	0
AMZ	1 (4.5%)	3 (14%)
Separate site OCA	2 (9%)	6 (27%)
OAT	1 (4.5%)	0
BMAC	2 (9%)	0
PRP	2 (9%)	0

Table 2: Major concomitant procedure is defined as any of the listed procedures, apart from bone marrow aspirate concentrate (BMAC) or platelet-rich plasma (PRP). ACI, autologous chondrocyte implantation; ACLR, anterior cruciate ligament reconstruction; AMZ, anteromedialization with a tibial tubercle osteotomy; DFO, distal femoral osteotomy; HTO, high tibial osteotomy; LMAT, lateral meniscal transplantation; MMAT, medial meniscal transplantation. * categorical variables listed as n (%); continuous variables listed as mean (SD)