Modern Osteochondral Allograft Transplantation: The "Gold Standard" for Femoral Condyle Cartilage Repair?

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INTRODUCTION

Repair of femoral condyle cartilage defects comprise the majority of cartilage repair procedures performed in the knee joint. Many techniques are used for femoral condyle cartilage repair with sustainable results¹⁻⁶. Fresh osteochondral allograft (OCA) transplantation surgical methods have evolved over the years; the dowel technique utilizing specific instrumentation and minimum amount of bone necessary for fixation has become the standard for treating large femoral condyle osteochondral lesions, whenever feasible⁷. Treatment options have evolved but there is still uncertainty regarding the efficacy of current surgical techniques. The purpose of this study was to evaluate the outcome of OCA transplantation utilizing dowel type grafts for the treatment of isolated femoral condyle cartilage lesions.

METHODS

This study comprised 187 patients (200 knees) who underwent OCA transplantation for isolated cartilage lesions on the femoral condyle between 1999 and 2014. Mean patient age was 31.1 ± 11.6 years, 62.5% were male, and the medial femoral condyle was affected in 69% of the knees (Table 1). For all cases, the dowel technique was used with commercially available surgical instruments utilizing the minimum amount of bone necessary for fixation (modern technique) (Figure 1). A single graft was used in 145 knees (72.5%) and, two grafts were used in 55 knees (27.5%). Average allograft area was 6.3 cm^2 (range, 2.3 to 13 cm²) and graft thickness was 6.5 ± 1.4 mm (cartilage and bone combined). All patients had a minimum follow-up of 2 years. Evaluation included International Knee Documentation Committee (IKDC) scores, Knee injury and Osteoarthritis Outcome Score (KOOS), and patient satisfaction. The frequency and type of further surgery was assessed. OCA failure was defined as a further surgery that involved removal of the allograft. An additional subgroup analysis on location comparing medial to lateral femoral condyle grafts was performed.

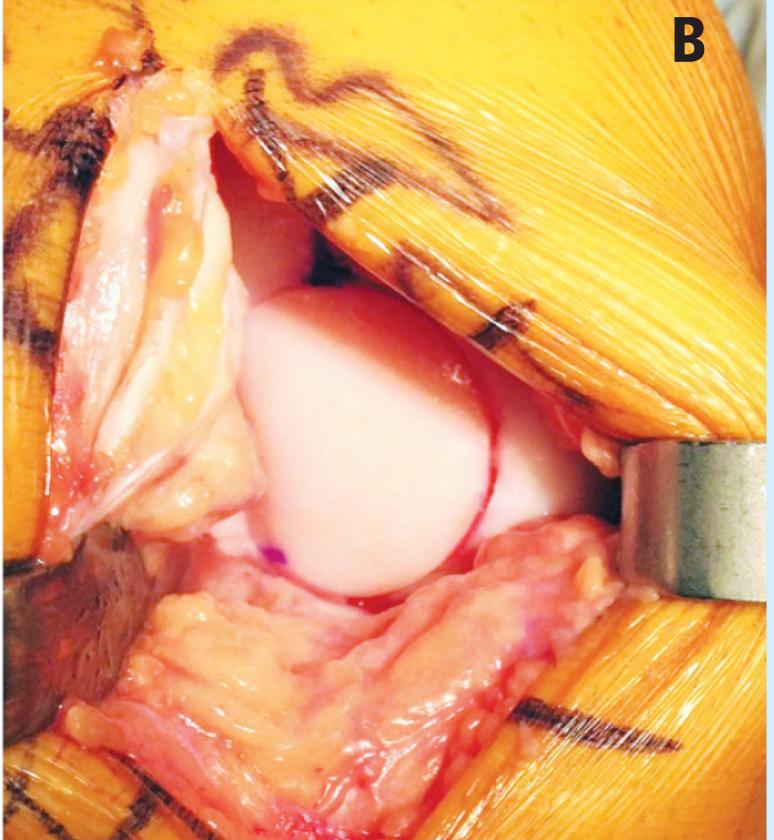




Age, y, mean ± sd (range)	31.1 ± 11.6 (11 – 67
Sex, No. (%)	
Male	125 (62.5%)
Female	75 (37.5%)
Body mass index, mean ± sd (range)	25.5 ± 4.9 (17 – 51
Diagnosis, No. (%)	
Osteochondritis dissecans	126 (63.0%)
Degenerative	46 (23.0%)
Traumatic	28 (14.0%)
Graft location, No. (%)	
Medial femoral condyle	138 (69.0%)
Lateral femoral condyle	62 (31.0%)
Previous surgery on affected joint	172 (86.0%)
Number of previous surgeries, median (range)	2.0 (1 – 13)
Number of grafts, No. (%)	
1	145 (72.5%)
2	55 (27.5%)
Total graft area, cm ² , mean ± sd (range)	6.3 ± 2.2 (2.3 – 13.0
Total graft thickness, mm, mean ± sd (range)	6.5 ± 1.4 (5-11)
Meniscal allograft, No. (%)	8 (4.0%)

FIGURE 1. INTRAOPERATIVE PHOTOGRAPH OF A) OSTEOCHONDRAL DEFECT IN THE MEDIAL FEMORAL CONDYLE AND B) OSTEOCHONDRAL ALLOGRAFT TRANSPLANTATION UTILIZING A DOWEL TECHNIQUE AND PRESS-FIT FIXATION





RESULTS

The average follow-up time was 6.7 years (range, 1.9 to 16.5 years). Outcome scores In this study, we report our results with modern OCA transplantation for the treatment of improved from preoperatively to latest follow-up on all measures (Table 2). At latest the most common cartilage lesion in the knee. According to Harris et al.,⁸ femoral condyle follow-up, outcome scores did not differ by location on the femoral condyle. The majority cartilage defects account for 75% of the cartilage repair procedures performed in the knee of patients (89%) reported satisfaction with the results of the OCA transplantation joint, and OCAs have been successfully and extensively used for the treatment of these (responding either extremely satisfied or satisfied). Further surgery was required in 52 lesions⁶. As OCA surgical technique evolved through the years, the dowel technique using knees (26%), of which 16 knees (8% of entire cohort) were defined as OCA failures specific instrumentation became the standard for the treatment of femoral condyle cartilage (4 OCA revisions, 1 arthrosurface, 6 unicompartmental knee arthroplasties, and 5 total knee lesions, whenever feasible⁹. Another modern concept in dowel OCA is making the graft as thin arthroplasties). The median time to failure was 4.9 years (range, 0.3 to 16.1 years). Survivoras possible. Immune response is a factor that may lead to failure of the OCA, so graft thickness ship of the OCA was 95.6% at 5 years and 91.2% at 10 years (Figure 2). must be kept to the minimum amount of bone necessary for fixation in order to decrease the immunogenic marrow elements from the osseous portion of the graft. In this study, mean graft thickness was 6.5 mm and it was never greater than 11 mm. To our knowledge, this is the largest long-term follow-up cohort of modern OCA dowel technique for isolated femoral condyle cartilage defects. This cohort had an extremely low failure rate (8%) and a high 5-year and 10-year survivorship of 95.6% and 91.2%, respectively.

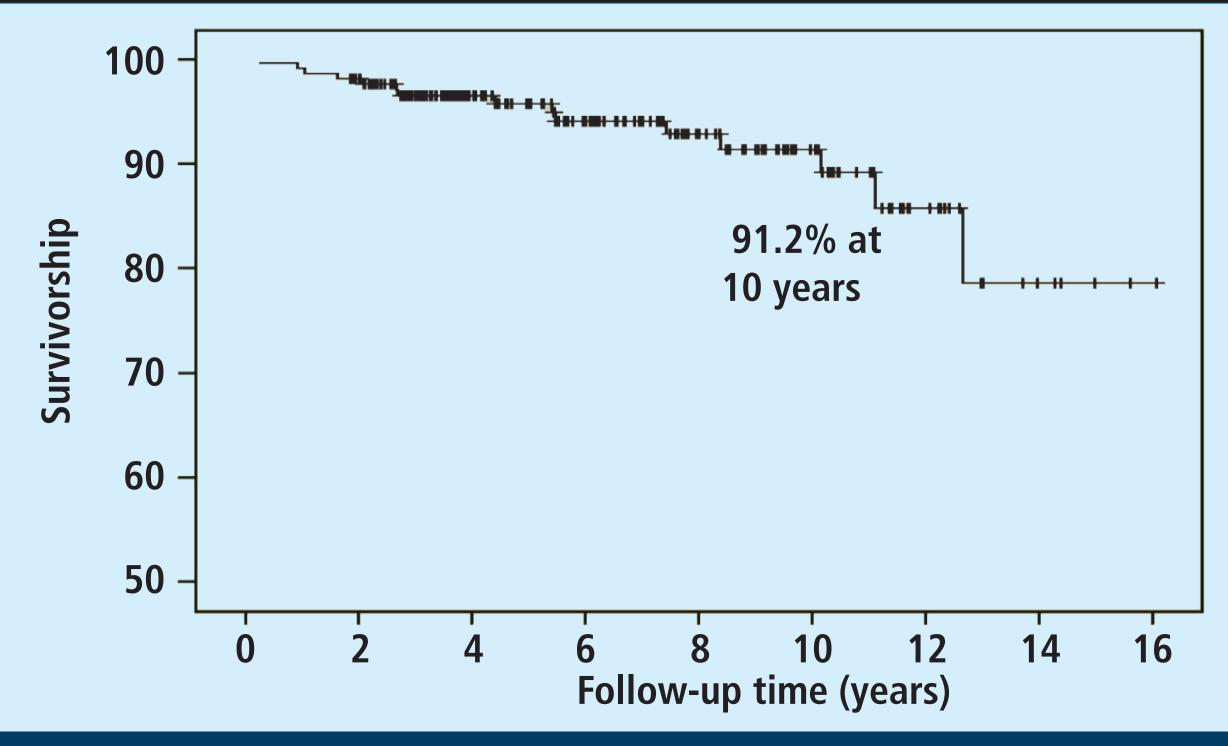
TABLE 2. OUTCOMES AMONG 184 KNEES WITH GRAFTS IN SITU AT LATEST FOLLOW-UP					
	All knees	Medial	Lateral		
Measure	N=184	N=125	N=59	p-value*	
IKDC					
Pain	2.7 ± 2.4	2.6 ± 2.4	3.1 ± 2.5	0.176	
Function	7.3 ± 2.2	7.4 ± 2.2	7.2 ± 2.2	0.364	
Total	76.2 ± 18.7	76.9 ± 19.2	74.8 ± 17.5	0.312	
KOOS					
Symptoms	82.5 ± 15.5	84.0 ± 14.5	79.7 ± 17.2	0.251	
Pain	85.3 ± 16.3	86.9 ± 15.6	82.5 ± 17.3	0.103	
Activities of daily living	91.1 ± 14.7	91.8 ± 14.0	89.8 ± 16.0	0.535	
Sports / recreation	70.2 ± 26.4	73.6 ± 24.0	64.9 ± 29.4	0.199	
Quality of life	62.1 ± 24.3	64.5 ± 24.9	57.7 ± 22.6	0.113	
Satisfaction				0.260	
Extremely satisfied	67.7%	70.5%	61.5%		
Satisfied	21.3%	19.6%	25.0%		
Somewhat satisfied	5.5%	4.5%	7.7%		
Somewhat dissatisfied	3.0%	1.8%	5.8%		
Dissatisfied	2.4%	3.6%	0.0%		

Results are shown as mean \pm standard deviation or percentage.

IKDC, International Knee Documentation Committee; KOOS, Knee injury and Osteoarthritis Outcome Score

*P-value for comparison of medial vs lateral

FIGURE 2. SURVIVORSHIP WITH REVISION OF THE ALLOGRAFT OR CONVERSION TO ATHROPLASTY AS THE ENDPOINT



DISCUSSION

CONCLUSION

OCA transplantation utilizing a modern technique is a valuable procedure for the treatment of femoral condyle cartilage lesions, resulting in significant improvement in clinical scores, high patient satisfaction, and low reoperation and clinical failure rates. These results are similar or better than any other cartilage repair procedure for isolated femoral condyle lesions.

REFERENCES

- 1. Zak L, Albrecht C, Wondrasch B, et al. Results 2 Years After Matrix-Associated Autologous Chondrocyte Transplantation Using the Novocart 3D Scaffold: An Analysis of Clinical and Radiological Data. The American journal of sports medicine. 2014; 42: 1618-27.
- Minas T, Von Keudell A, Bryant T and Gomoll AH. The John Insall Award: A minimum 10-year outcome study of autologous chondrocyte implantation. Clinical orthopaedics and related research. 2014; 472: 41-51.
- 3. Steadman JR, Rodkey WG and Briggs KK. Microfracture: Its History and Experience of the Developing Surgeon. Cartilage. 2010; 1: 78-86.
- Gudas R, Gudaite A, Pocius A, et al. Ten-year follow-up of a prospective, randomized clinical study of mosaic osteochondral autologous transplantation versus microfracture for the treatment of osteochondral defects in the knee joint of athletes. The American journal of sports medicine. 2012; 40: 2499-508.
- 5. Gille J, Schuseil E, Wimmer J, Gellissen J, Schulz AP and Behrens P. Mid-term results of Autologous Matrix-Induced Chondrogenesis for treatment of focal cartilage defects in the knee. Knee surgery, sports traumatology, arthroscopy : official journal of the ESSKA. 2010; 18: 1456-64.
- 6. Levy YD, Görtz S, Pulido PA, McCauley JC and Bugbee WD. Do fresh osteochondral allografts successfully treat femoral condyle lesions? Clin Orthop Relat Res. 2013; 471: 231-7.
- 7. Garrett JC. Fresh osteochondral allografts for treatment of articular defects in osteochondritis dissecans of the lateral femoral condyle in adults. Clinical orthopaedics and related research. 1994: 33-7.
- 8. Harris JD, Brophy RH, Siston RA and Flanigan DC. Treatment of chondral defects in the athlete's knee. Arthroscopy : the journal of arthroscopic & related surgery: official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2010; 26: 841-52.
- 9. Görtz S and Bugbee WD. Allografts in articular cartilage repair. The Journal of bone and joint surgery American volume. 2006; 88: 1374-84.