

Osteochondral Allograft Transplant of the Patella Using Femoral Condylar Allografts: Letter to the Editor

Dear Editor:

Osteochondral allograft (OCA) transplantations are a useful treatment for International Cartilage Repair Society (ICRS) grade 3 to 4 focal chondral defects (FCD) of the knee. Prior case series have demonstrated high success rates after this procedure. Despite having slightly inferior outcomes compared to their tibiofemoral counterpart, patellar OCA transplantations can significantly improve patient-reported outcomes (PROs), with 10- and 15-year survivorships of 78.1% and 55.8%, respectively.^{5,6} For this reason, patellar OCAs are becoming increasingly popular as a joint preservation option, but grafts remain more scarce than distal femoral condyle grafts.

We congratulate Lin et al¹⁰ on their recent study entitled "Osteochondral Allograft Transplant of the Patella Using Femoral Condylar Allografts: Magnetic Resonance Imaging and Clinical Outcomes at Minimum 2-Year Follow-up." In this case series, minimum 2-year follow-up PROs and minimum 6-month postoperative magnetic resonance imaging (MRI) findings were assessed in 25 and 20 patients, respectively, who underwent OCA to the patella or patella and trochlea using a femoral condyle allograft (FCA). The rationale for this approach is based on the scarcity of patellar grafts compared to that of the femoral condyle. Along with this, many lateral femoral condyles are wasted because transplants in that compartment are less common. Therefore, the use of FCA for patellar OCA might improve the ability to treat patients in a timely manner. In the study, patients demonstrated significant improvements in both pain- and function-related PROs, with differences in IKDC and Knee Outcomes Survey-Activities of Daily Living scores above the previously defined minimal clinically important difference values. In addition, MRI analysis demonstrated that the mean total Osteochondral Allograft MRI Scoring System (OCAMRISS) score was 9.1 (range of 7-11), with the majority of grafts having 76%-100% cartilage fill and osseous integration. These imaging findings provide insightful and promising results on the post-operative status of the graft, perhaps even more so than PROs, which are a blunter instrument of operative success. The Lin et al article adds to the limited literature on patellar OCA transplantation and suggests short-term patient success.

Although the results of this study are promising, we have some reservations for orthopaedic surgeons who are

considering the viability of the approach described. The use of a nonorthotopic graft may result in a significantly altered patellar surface topography with poor graft-articular surface congruity because of the different radius of curvatures between the patella and femoral condyle. Prior studies in the tibiofemoral joint have described how proud or sunken osteochondral allografts significantly alter joint biomechanics. Koh et al⁷ performed a study on the effect of 0.5- or 1.0-mm sunken or proud femoral grafts on contact pressures when an 80-N load was applied, and the authors demonstrated that plug elevation of even 0.5 mm can increase the contact pressure by 48% compared to the intact state. This change was less pronounced with sunken grafts, with a pressure increase of 8% and 11% observed for defects that were sunk 0.5 and 1.0 mm, respectively. The threshold of 0.5 mm of incongruity resulting in significantly increased contact pressures has been supported in other cadaveric studies.^{3,4} These studies demonstrate the importance of ensuring that the osteochondral allograft is flush with the surrounding articular surface; one of the main issues that leads to graft incongruity is differences between donor and recipient radius of curvature.

Maintenance of native surface topography is equally important in the patella, and the differences in radius of curvature between the patella and femoral condyle are much greater than any differences between femoral condyles. In the study by Lin et al,¹⁰ the authors reported that the graft was always harvested at the same location, the trochlear-condylar junction, and although no explanation was provided as to why this graft harvest location was selected, we surmise that this location was chosen in an effort to match patellar topography. The authors likely had a variety of locations on the patella which required grafting, and we question whether the radius of curvature differences can be reliably matched using this harvest site. Pidioriano et al,¹³ for example, reported on 36 patients who demonstrated 4 main locations of patellar defects, with distal and lateral defects being most common. The surface topography of the distal aspect and lateral facet of the patella is variable among patients, and we discourage utilization of identical grafts for each of these locations. When using a patellar donor, for example, the graft is harvested from the corresponding location of the defect; it is not always harvested from the lateral facet.

As mentioned in the article's discussion section, the femoral condyle often has thinner cartilage than the patella, which raises concerns for the graft's longevity.¹⁴ The thinner femoral condylar cartilage may not be able to withstand the long-term contact pressures of the patellofemoral joint. In addition, as the authors alluded, subchondral incongruity may also contribute to graft failure. Despite the thinner cartilage on the FCA, chondral and subchondral graft mismatch may result in increased overall patellar thickness in the sagittal plane owing to graft proudness, particularly in large grafts. This increased patellar thickness may cause overstuffing of the patellofemoral joint, resulting in stiffness.

Other parallels can be drawn to the biomechanics and kinematics of patellar resurfacing in arthroplasty. Multiple studies have demonstrated that domed patellar prostheses significantly increase the mean contact pressure, while decreasing contact pressure area in the patellofemoral joint.⁹ Alterations in patellar articular shape can make a significant impact on patellar tracking, congruity, and stability of the patellofemoral joint.⁸ This has been well documented in the arthroplasty literature and has spurred research in finding the ideal patellar component. An FCA may result in an excessive dome on the patella, as suggested by the intraoperative picture in Figure 2, while removing the patellar ridge. Similar to a patellar component, this alteration in patellar morphology could increase patellofemoral joint pressures while altering patellar kinematics because of the disruption to the patellar ridge and morphology of the facets. Furthermore, many patients who undergo patellofemoral OCA transplantation have related pathoanatomical aberrancies, such as trochlear dysplasia.^{1,11} Therefore, extra effort should be taken to maintain native patellofemoral anatomy in these patients; creating an aberrant patellar articular surface topography may increase the risk of maltracking, especially in patients with concomitant trochlear dysplasia.

The study by Lin et al¹⁰ strives to solve an underlying problem plaguing this procedure: the lack of patellar graft availability. The larger concern that this paper raises is the paucity of literature describing how to appropriately match donor grafts and what is the ultimate clinical effect of cartilage and/or osseous mismatch. Also, how do we ensure that we re-create native patellar morphology and provide graft-articular surface congruity? Unfortunately, these questions remain largely unanswered and are complicated by large variances in patellar morphology for the population.² Industry often determines graft matches based on proximal tibial width. This approach is very limited, and it is unclear if this improves patellar graft matching. Patel et al¹² provided some insight on this topic. They reported that patellar morphology matching based on Wiberg type can significantly minimize the overall surface topography mismatch by 0.14 mm.¹⁵ However, the clinical significance of this remains unclear and further research is needed to provide more robust matching guidelines. An additional question remains as to where on the patella to harvest the graft. The current dogma is to harvest it from the same anatomic location, but this approach may only make sense in a graft that is well matched to its recipient. When this is not the case, as in the present study, how do we determine the harvest location? There is a lot of room for improvement in osteochondral allograft matching, and we all strive toward the balance of improving graft availability while not sacrificing patient outcomes. This study helps push us to evaluate where these boundaries lie.

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