Osteochondral Allograft Transplant of the Patella Using Femoral Condylar Allografts: Response

Authors' Response:

We thank Huddleston et al for their letter to the editor regarding our study entitled "Osteochondral Allograft Transplant of the Patella Using Femoral Condylar Allografts: Magnetic Resonance Imaging and Clinical Outcomes at Minimum 2-Year Follow-up." This is a timely topic for discussion, as patellar osteochondral allograft (OCA) transplantation is an increasingly popular cartilage restoration procedure for joint preservation. Unfortunately, the supply has been unable to meet the high demand, and there is a scarcity of patellar OCA compared to femoral condylar allografts. While we agree that topographic matching should be a primary objective for this procedure, the paucity of grafts can often lead to significant delays in treatment, which may be detrimental to successful clinical outcomes. Untreated full-thickness cartilage defects have been associated with increased progression of cartilage damage,[6,7] and have also been associated with increased progression to total knee arthroplasty (TKA).[5] In this study, we described the use of femoral OCA for focal patellar defects, with good short-term MRI and clinical outcomes. The senior authors have extensive experience utilizing nonorthoptic OCA grafts and have published proof-of-concept studies that have been validated with clinical studies demonstrating successful clinical outcomes following nonorthoptic femoral OCA transplantation at midterm follow-up.[4,9,10] Ultimately, this practice has become well accepted given the benefits of timely surgical care. To our knowledge, this is the first report investigating clinical outcomes after the use of nonorthotopic grafts for the treatment of focal cartilage defects of the patella.

The authors of the letter raise concerns related to 2 important components of graft fit: congruity and topography. Congruity relates to the symmetry of the graft-host interface at the periphery (ie, how proud or sunken the graft is). Topography relates to the overall surface shape of the reconstructed articular surface, and its match to the native contour. These are indeed integral aspects for OCA transplantation. Prior literature has described the importance of congruity, as it is known that even 0.5 mm of osteochondral graft elevation can substantially increase contact pressure.[1-3,8] In theory, this may lead to more rapid clinical failure, likely through edge loading at the proud borders of the donor plug, although the current studies describing surface incongruity are laboratory based, cadaveric studies. In our study of nonorthotopic patellar OCA, excellent border congruity was attained, based on our routine clinical practice and postoperative MRI scoring by a fellowship-trained musculoskeletal radiologist.

Maintenance of native topography, or surface contour, is undoubtedly important for any type of articular cartilage restoration procedure. The goal should be to restore the articular surface as closely as possible to the native articulation of any joint. Use of nonorthotopic grafts, even when perfectly congruous (with no surface step-off), will likely lead to alterations in topography, of varying degrees depending on the graft type/location used and the size of the lesion (surface area of the mismatch area). This is emphasized in the discussion section of our article and is a topic that deserves further study. Unlike border congruity, there is no simple or established quantitative measurement for change in topography. Whereas for congruity there are established thresholds (such as plug elevation of 0.5 mm leading to up to 48% increased contact pressure[8]), there are no such thresholds for topography mismatch, and the effects of any alterations following OCA transplantation remain very unclear.

The authors of the letter raise the point of total patellar thickness in relation to overstuffing, particularly in the setting of TKA. This is an important phenomenon to be aware of; however, it is not relevant to patellar OCA transplantation. At the time of complete patellar resurfacing in TKA, the entire patellar thickness is changed, over its entire surface area, as is the thickness and shape of the trochlea. Additionally, the entire patellar surface topography is altered to a spherical button (although more anatomic implants now exist), removing both facets and changing the depth of the midline ridge. This is a complete shape change, which is clearly the extreme of topography mismatch. Use of a caliper prior to making the patella cut provides one point of reference for restoring height, as the entire surface is removed. In the case of patellar OCA, the lesion is typically focal rather than over the entirety of the patella. When preparing and implanting the graft, there is a direct 360° visual reference for any changes in congruity, thickness, and topography, which is the surrounding articular surface. While for very large grafts the patellofemoral space may become overstuffed, for small focal lesions, which we studied, this effect is likely much less pronounced. Regardless, this is an important point to discuss, although further study in the setting of patellar OCA grafting is required to draw conclusions. As Huddleston et al have stated, there is much room for improvement in donor graft matching for patellar grafts.

Another important point that the authors mention is the thickness of the patellar cartilage in relation to that of condylar cartilage. Patellar cartilage is significantly thicker. Thus, to achieve proper overall graft height and minimize surface incongruity at the graft-host junction, there may be incongruity of the depth of the subchondral plate. Huddleston et al

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propose that the difference in cartilage thickness leads to overstuffing the patellofemoral joint, resulting in stiffness; however, because overall height is maintained and the area of topography mismatch is small, overstuffing should be minimized. The incongruity of the subchondral plate however, regardless of topography match, may in itself lead to altered healing biology and ability of the deep cartilage layer to handle load. Further study is required to elucidate this phenomenon.

Our study was written to objectively quantify the experience of nonorthotopic OCA grafting of the patella, which remains a novel concept. While in theory topography differences undoubtedly change the articulation and focal contact pressures, in the clinical setting, good short-term outcomes were observed. Further study will be useful to establish longer term follow up and to assess the effect of lesion and donor location and size, as these factors influence overall topography match. Additionally, laboratory studies are necessary to establish models and thresholds for quantifying topography. There is no doubt that improved matching will be of use in osteochondral grafting of the patella; however, it is known that untreated full-thickness lesions lead to progression of cartilage damage and progression to TKA.[5-7] The theoretical changes in contact pressures imparted by a small nonorthotopic graft to the patella must be weighed against the other treatment options on a case-by-case basis, including waiting for an orthotopic graft, continued nonoperative treatment, cell-based therapies, or patellofemoral arthroplasty in properly indicated patients. Results from all phases of research—laboratory, cadaveric, and clinical—must be reported objectively and carefully appraised.

This is a nuanced clinical problem with many currently unanswered questions. Although we always strive to achieve exact matching for osteochondral allograft transplantation, in this first report of nonorthotopic grafts for patellar OCA (given the rarity of orthotopic patellar grafts), we observed encouraging clinical and MRI results. We appreciate the points brought forward by Huddleston et al, as it is important to critically appraise our current techniques in order to improve our understanding and establish boundaries and frameworks for clinical practice.

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