IN BRIEF

# Osteochondral Autograft Transplantation in the Elbow

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OSTEOCHONDRITIS DISSECANS (OCD) most commonly affects the elbow at the capitellum, and typically involves the area covered by the radial head at around 45° elbow flexion. Although the exact mechanism of injury is unclear, OCD is thought to result from repetitive microtrauma to a poorly vascularized capitellar chondroepiphysis. Unlike Panner disease, which most commonly occurs atraumatically in young boys,[1] OCD of the capitellum is seen in teenage boys and girls involved in sports that tend to generate high joint-reaction forces at the radiocapitellar joint (pitching, gymnastics, wrestling, etc).[2–4] An anteroposterior, lateral, and 45° flexion oblique view will often demonstrate focal radiolucency of the capitellum (Fig. 1). Magnetic resonance imaging can be helpful in assessing the status of the articular cartilage (Fig. 2) and identifying signs of fragment instability and/or loose bodies.

## TREATMENT STRATEGIES

For stable OCD lesions, a period of immobilization or activity modification is usually sufficient to heal most lesions, particularly if the patient is skeletally immature.[5] In unstable OCD lesions, in which the osteochondral fragment has separated from the adjacent healthy bone, allowing joint fluid to track beneath, nonsurgical management is unlikely to achieve healing. Surgical options include fixation of an intact osteochondral fragment, debridement of necrotic bone and cartilage with and without microfracture (MF), and, more recently, osteochondral autograft transplantation (OAT).

Proponents of MF argue that creating fresh bleeding over a cartilage defect stimulates the formation of fibrocartilage. Fibrocartilage is a suboptimal yet often sufficient replacement for articular hyaline cartilage, but is a worse substitute for subchondral bone. In cases in which the underlying subchondral bone is compromised or necrotic, however, replacement of the OCD lesion with healthy articular cartilage and subchondral bone may be preferred.

## SURGICAL TECHNIQUE

Surgery begins with a diagnostic arthroscopy to examine the joint and to remove any loose bodies. To visualize the capitellum, an inline series of portals are made along the posterolateral aspect of the elbow, ending most distally with the direct lateral (soft spot) portal. Placement of these portals as medial as the ulna will allow may facilitate visualization (Fig. 3). We prefer lateral decubitus or supine positioning, which allows for elbow arthroscopy, the anconeus-splitting open approach to the capitellum, and the lateral parapatellar knee arthrotomy without changing patient position. The anconeus split provides sufficient exposure for the OAT in most cases (Fig. 4), and is made by connecting the series of posterolateral arthroscopy portals with the soft spot portal. Detaching the collateral ligament origin from the humerus has been described[6] but is typically unnecessary. Full flexion of the elbow usually brings the OCD lesion into view. The risk of destabilizing the elbow is not worth the greater visualization. If necessary, a Kaplan (extensor communis–splitting) approach can be used to expose more anterior lesions without compromising the lateral ulnar collateral ligament.[7]

Using the recipient harvester (Osteochondral Autograft Transfer System [OATS]; Arthrex, Naples, FL), core out the lesion from the capitellum to a depth of at least 10 mm when possible. In the skeletally

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Received for publication April 13, 2013; accepted in revised form September 2, 2013.

D.A.Z. is a consultant for, and receives royalties from, Arthrex, Inc.

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0363-5023/13/■ A ■ -0001$36.00/0
http://dx.doi.org/10.1016/j.jhsa.2013.09.003

 

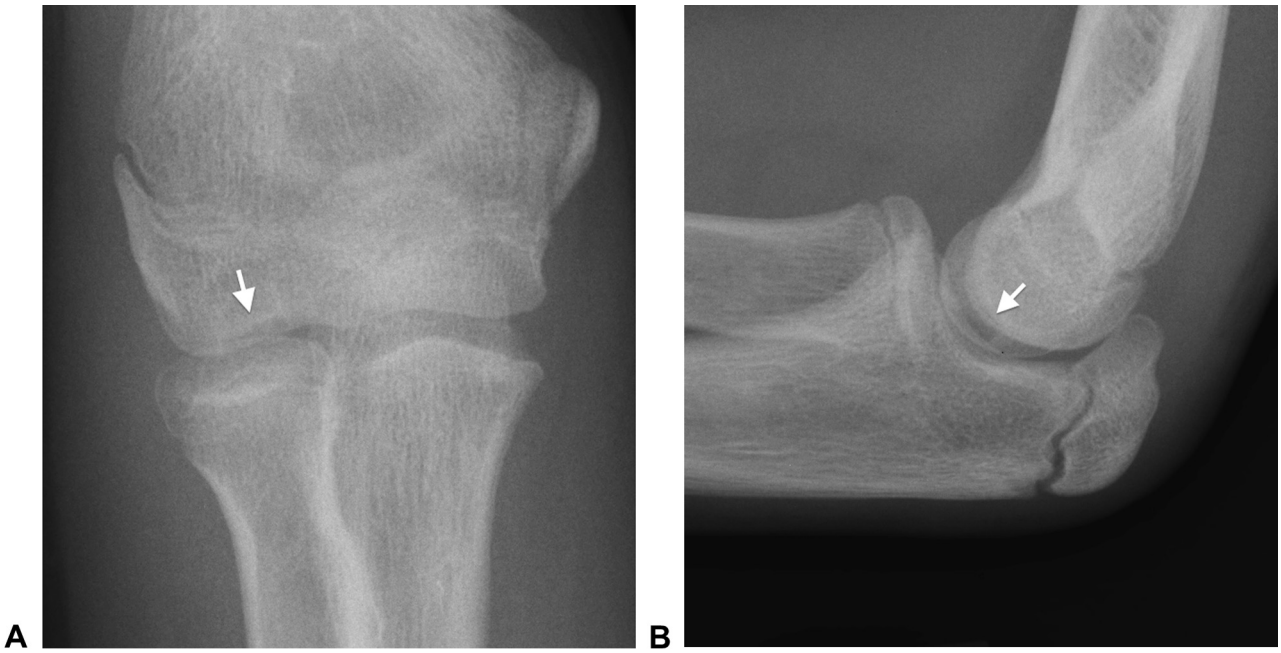


**FIGURE 1: A** Anteroposterior and **B** lateral radiographs demonstrate a focal radiolucency at the capitellum (white arrows) consistent with an osteochondritis dissecans lesion with bone loss. (Courtesy of Shriners Hospital for Children—Philadelphia.)

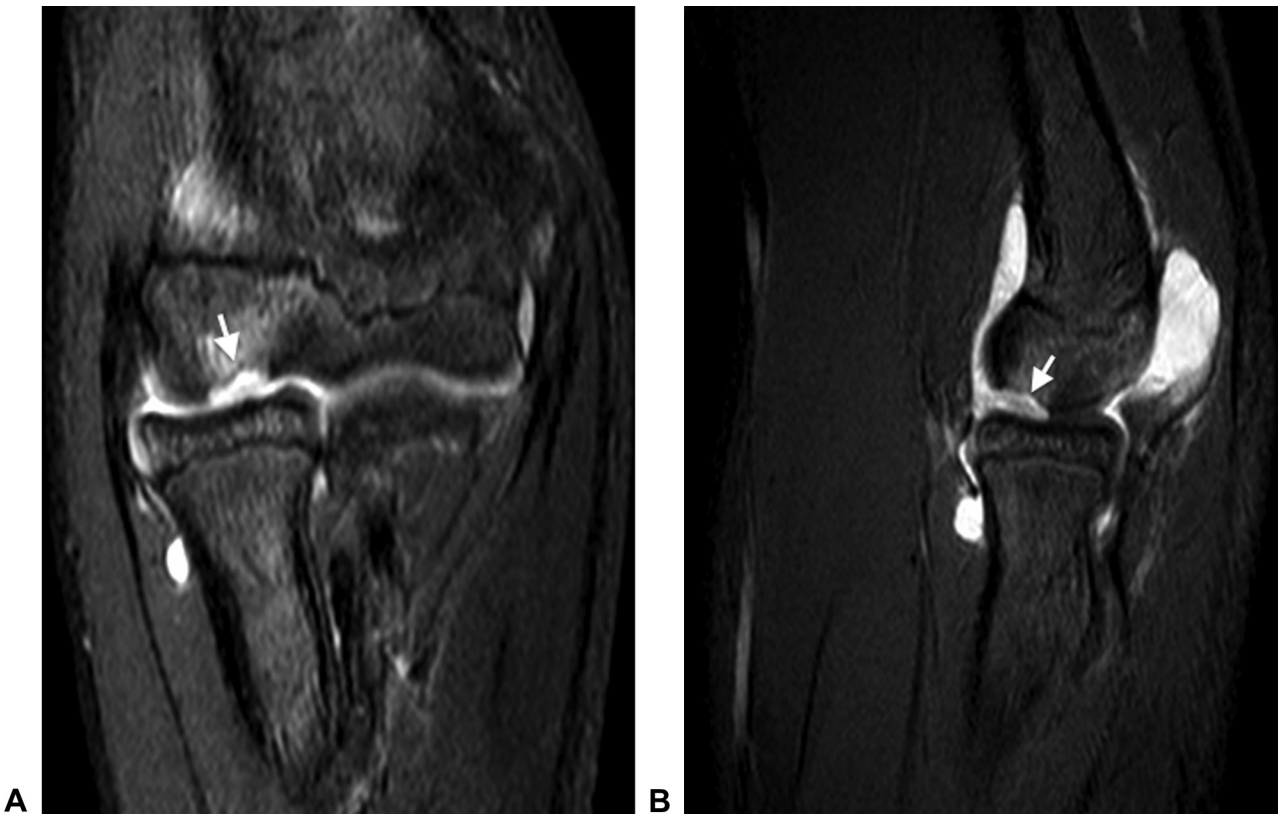


**FIGURE 2: A** Coronal and **B** sagittal magnetic resonance imaging of the same patient better defines the degree of bone and cartilage loss (white arrows). (Courtesy of Shriners Hospital for Children—Philadelphia.)

immature patient, shallower depths may have to be accepted to not violate the distal humeral physis. The maximal depth can be determined on preoperative magnetic resonance imaging and confirmed on intraoperative fluoroscopy. We prefer to harvest 1 large plug up to 10 mm in diameter rather than

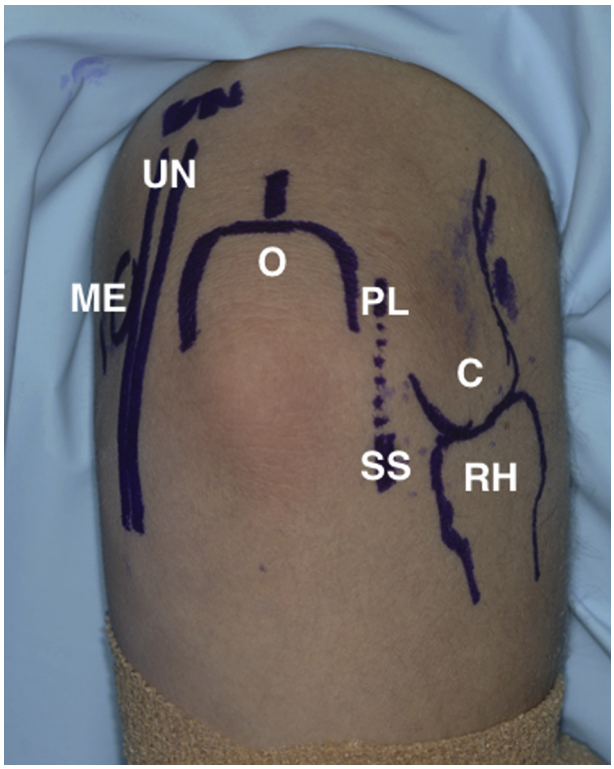


**FIGURE 3:** Clinical photograph of a right arm at the time of elbow arthroscopy. The patient is in a lateral decubitus position with the arm on an arm holder. The skin is marked to identify the medial epicondyle (ME), ulnar nerve (UN), olecranon (O), soft spot portal (SS), capitellum (C), and radial head (RH). Connecting the posterolateral portal (PL) with the soft spot portal (dotted line) exposes the OCD lesion in most patients when the elbow is fully flexed. (Courtesy of Shriners Hospital for Children—Philadelphia.)

multiple smaller plugs when the lesion permits. Occasionally, sclerotic bone within the capitellum prevents removal of bone with the harvester device. Alternatively, the recipient defect can be created with the cannulated drill provided in the OATS set.

For autologous osteochondral graft harvest, we favor a mini-open incision on the lateral knee (Fig. 5). The superolateral corner of the femoral condyle is easily palpable in most adolescents, just lateral to the superior half of the patella. In skeletally immature patients, the site of planned osteochondral graft harvest will not violate the distal femoral physis as long as the graft is not harvested in a proximal direction. If there is doubt, the physis can be well visualized on a lateral fluoroscopic image.

The donor site is chosen to match the contour of the recipient site and harvested using the donor harvester tool (OATS; Arthrex). The harvesting system is designed to deliver a donor plug that is just 1 mm larger in diameter than the recipient defect. The recommendation from the manufacturer is also to size the donor at 2 mm deeper than the recipient defect. We have found the extra depth to be difficult to compress with the impaction device, resulting in graft prominence; therefore, we make our donor plug the same depth as the defect. For postoperative pain control, fill the donor defect(s) with Gelfoam (Pfizer, Inc, New York, NY) infused with bupivacaine and epinephrine. Alternatively, the donor defects may be filled with bone graft or substitutes or just left empty.

The donor osteochondral plug is carefully inserted and press-fit into the recipient defect with the collared pin on the harvester device, obviating the need for additional supplemental fixation. Care is taken to match the contour and profile of the capitellum. Graft prominence should be avoided. If the graft is prominent, gently mallet the graft down using the impaction device included in the OATS set that is at least 1 mm larger in diameter than the core diameter. If gentle persuasion is insufficient, use a threaded 0.035-inch (1.4-mm) Kirschner wire drilled into the center of the plug to extract the plug. Remove as much bone from the deep portion of the plug as the graft was prominent, and then reinsert the plug. If the plug is inserted too deeply, remove the plug, add cancellous bone graft from the knee to the base of the defect, and then reinsert the plug. Direct inspection, palpation, and elbow range of motion will confirm appropriate fit and stability.

Both the elbow and knee wounds are closed in layers. Early elbow range of motion is advocated, and patients may weight bear as tolerated on the lower limb immediately postoperatively. A knee immobilizer is used for 2 weeks and deep knee bends are allowed at 4 weeks. Upper limb weight-bearing and repetitive overhead activities (eg, baseball pitching, tumbling) are restricted for 6 months postoperatively.

## RESULTS

Transplantation of an autologous osteochondral plug or plugs from the non—weight-bearing surfaces of the knee has been demonstrated superior to other methods of cartilage resurfacing, such as MF and debridement, for focal chondral defects in weight-bearing regions of the knee. A recent prospective randomized study of 136 patients undergoing anterior cruciate ligament reconstructions found that the results of OAT were significantly better than either MF or debridement at 3-year follow-up.[8] Another prospective randomized study in young athletes (15—40 y of age) with 10-year follow-up found similarly better results in knee scores and in return to sports after OAT compared with MF.[9]

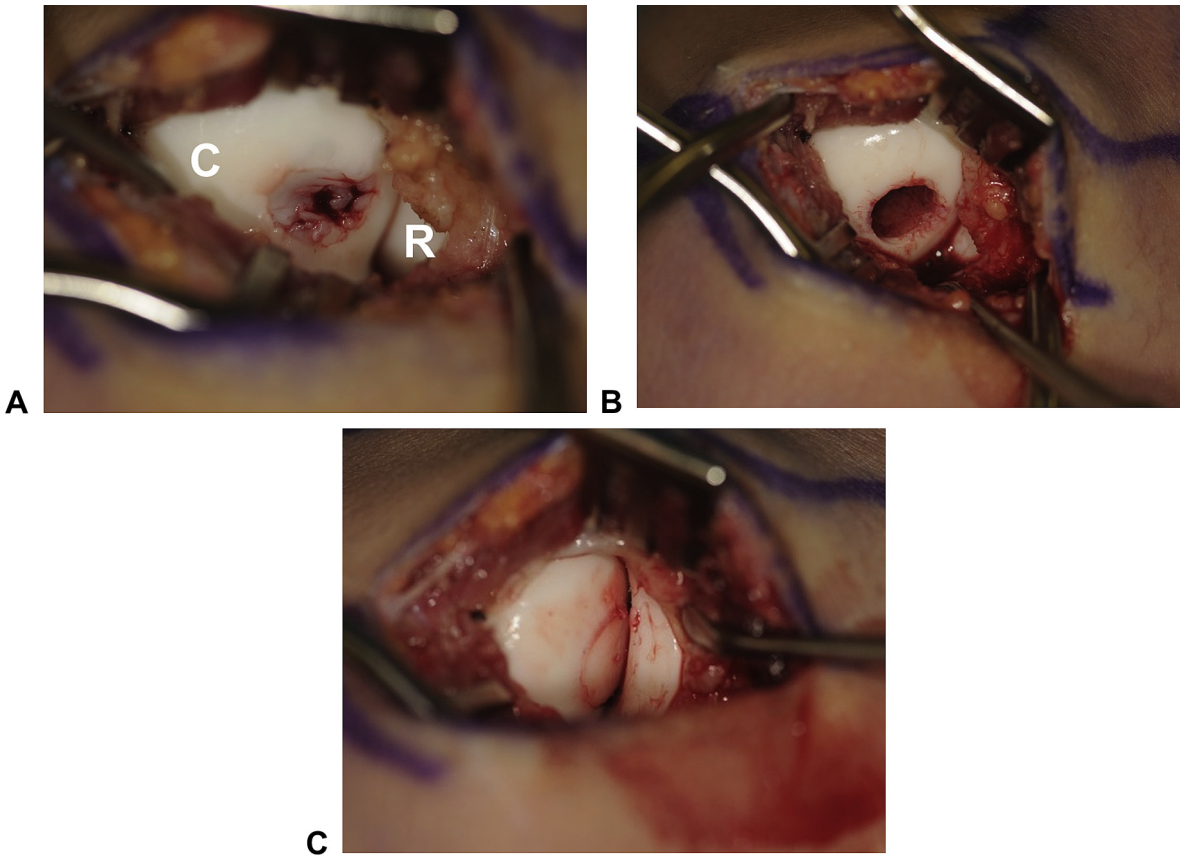


**FIGURE 4:** **A** Clinical photographs of the capitellum (C) as seen via an anconeus split approach demonstrates the lesion involving not only the cartilage, but also the subchondral bone. **B** The lesion is removed along with a cylinder of bone, which is then filled with a size- and shape-matched osteochondral plug from **C** the knee. The radial head (R) can be seen articulating with the resurfaced capitellum. (Courtesy of Shriners Hospital for Children—Philadelphia.)

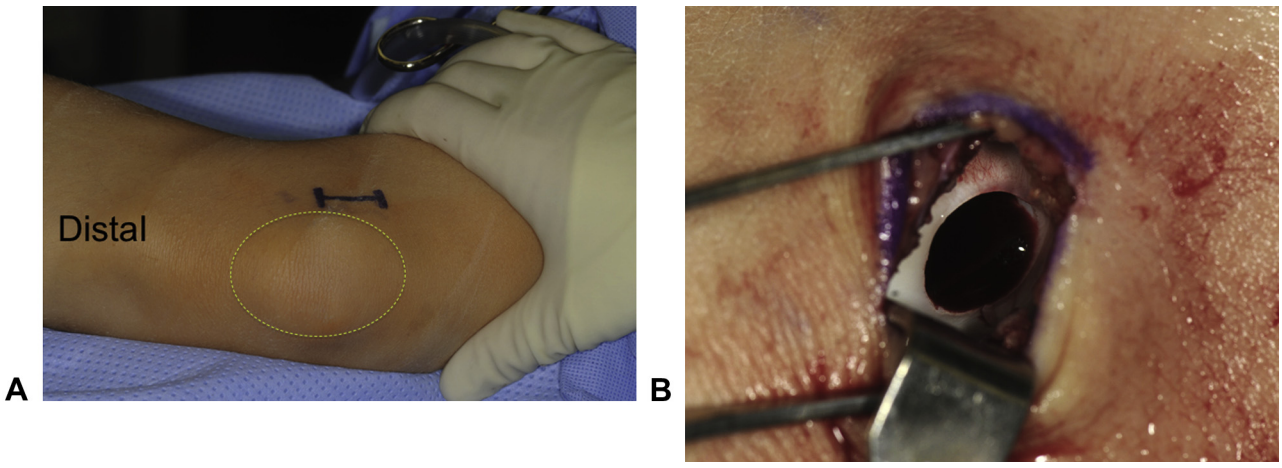


**FIGURE 5:** **A** The harvest site at the superolateral corner of the lateral femoral condyle can be palpated directly lateral to the superior half of the patella (oval). **B** A 1.5-cm mini-open incision is sufficient to extract the osteochondral autograft. This clinical photograph demonstrates an 8-mm plug harvest. (Courtesy of Shriners Hospital for Children—Philadelphia.)

Costal[10] and knee-derived OAT have both been described as a treatment for capitellar OCD. The advantages of the knee as a donor site are that there is minimal morbidity from the harvest of a small number of plugs,[11–17] the approach is simple and reproducible, and the graft obtained has a convex surface similar in contour to the capitellar defect in most cases. Cartilage depth at the superolateral

femoral condyle has been shown to be around 2.0 mm in thickness, just 0.5 mm thicker than at the lateral capitellum.[18] By comparison, the costal osteochondral plug has a much larger hyaline cartilage cap that must be trimmed to match the capitellar defect. The costal grafts therefore lack a lamina splendens, the most superficial layer of articular cartilage, which has a horizontal fiber arrangement that resists the high tensile and shear forces generated in the joint and blocks entry of degradative enzymes into the cartilage matrix.

Short-term results for knee-derived OAT procedures in the elbow have been universally favorable, although the number of patients combined is small. Combining the available retrospective studies, just over 80% of patients were completely pain free and back to their sport with about 2-year follow-up.[7,11–16] Medium-term results have also been promising. With a minimum follow-up of 7 years, Vogt et al[17] showed complete or near complete pain relief with return to sports in all 8 patients. There was no harvest site morbidity in any patient.

Although there is no prospective randomized trial comparing MF and OAT, the available evidence suggests that in cases of bone loss at the capitellum, the OAT procedure may be more reliable at relieving pain and returning young athletes to high-level sports. The procedure can be difficult to perform and requires exacting attention to detail, but in our experience the additional effort has been rewarded with better results than had been possible previously. Donor site morbidity at the knee has been minimal even in competitive athletes.

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