# Cartilage Defect of Lunate Facet of Distal Radius After Fracture Treated With Osteochondral Autograft From Knee

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## Abstract

We describe using an osteochondral autograft from the lateral femoral condyle of the knee to treat a symptomatic die-punch lesion of the lunate facet of the distal radius.

An 18-year-old woman who sustained a distal radius fracture remained symptomatic after nonoperative treatment and diagnostic wrist arthroscopy with microfracture. We used a commercial harvesting system to transfer an osteochondral plug into a cartilage defect involving the lunate facet of the distal radius. At final follow-up, 34 months after surgery, the patient was assessed with a visual analog scale (VAS) and Disabilities of the Arm, Shoulder, and Hand (DASH) scores and with a comprehensive physical examination. Magnetic resonance arthrogram was used to assess articular cartilage status.

VAS pain score improved from 7 before surgery to 0.5 after surgery. Postoperative DASH score was 0. The patient was asymptomatic and had satisfactory wrist motion without mechanical symptoms. Magnetic resonance arthrogram showed the transferred osteochondral autograft incorporated in excellent position.


Symptomatic intra-articular joint-depression fractures are technically challenging to treat in the acute setting and even more difficult when treatment is delayed. Osteochondral autografts have been used for years to treat full-thickness cartilage defects in the knee. More recently, investigators have reported using osteochondral autografts in the small joints of the hand,[1-3] in the scaphoid,[4] and in the distal radius.[5,6] In these cases, however, atypical graft donor sites were used for very large defects involving the majority of the scaphoid or the lunate facet.

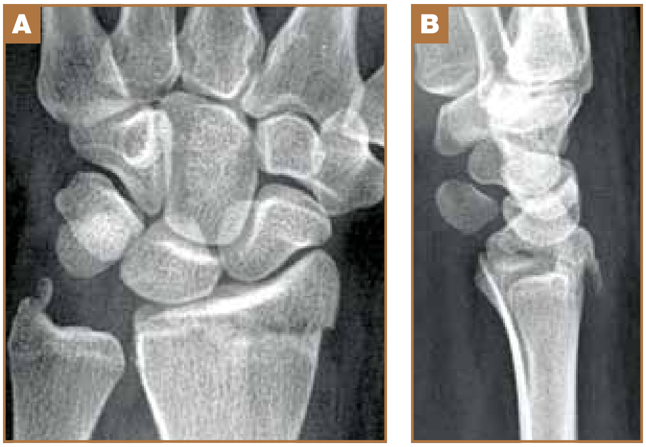


Figure 1. Posteroanterior (A) and lateral (B) radiographs of initial injury show fracture of distal radius extending into lunate fossa, without radial shortening or angulation. Fracture through base of ulnar styloid is also present.

We report the case of a patient with wrist pain and a cartilage deficit treated with osteochondral autograft transfer from the lateral femoral condyle to the lunate fossa of the distal radius.

The patient provided written informed consent for print and electronic publication of this case report.

## Case Report

An 18-year-old right-hand–dominant woman sustained an intra-articular left distal radius and ulnar styloid fracture in a motor vehicle collision. She was initially evaluated 4 days after the injury, with radiographs showing a transverse distal radius fracture extending into the lunate facet, and slight dorsal displacement of the distal fracture fragment (**Figures 1A, 1B**). Volar angulation of the distal radius was normal, with mild negative ulnar variance and no radial shortening. The patient was seen 1, 2, 4, and 7 weeks after injury, each time with unchanged radiographic alignment. Five months after injury, she continued to complain of constant, aching wrist pain and occasional sharp pain in the dorsal central wrist. She also reported occasional mechanical symptoms with clicking, pop-

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ping, and catching. Radiographs showed that the fracture had healed with mild depression of the lunate facet of the distal radius (**Figure 2**).

Magnetic resonance arthrogram confirmed a healed distal radius fracture, with die-punch depression of the subchondral plate of the lunate facet (**Figures 3A, 3B**). There was a 4-mm-in-diameter lesion of cartilage loss, with a matching cartilage irregularity of the proximal surface of the lunate. The triangular fibrocartilage complex (TFCC) was thinned, but no discrete tear was identified. The patient was referred to Hand Service for further evaluation and treatment.

Physical examination revealed wrist flexion/extension of 40°/50° on the affected left side and 60°/80° on the right side. There was no significant swelling about the wrist or hand. Grip strength was reduced, at 50% of the contralateral side. There was central, dorsal wrist tenderness without instability. Ulnocarpal impaction testing was negative. No mechanical symptoms were detected during examination.

A lengthy discussion with the patient concerned the implications of a die-punch fracture and early radiolunate arthrosis. Wrist arthroscopy was performed to directly evaluate the die-punch lesion and TFCC. We arthroscopically debrided mild joint synovitis, revealing significant scarring of the central lunate facet and a 7×8-mm loss of cartilage, a defect larger than predicted by the magnetic resonance arthrogram. The cartilage loss on the distal radius was full-thickness (**Figure 4**), precluding osteotomy/elevation of the depressed fragment. Mild lunate chondrosis was noted.

Figure 2. Posteroanterior examination of wrist after fracture healing shows die-punch depression (arrow) of distal articular surface in lunate fossa.

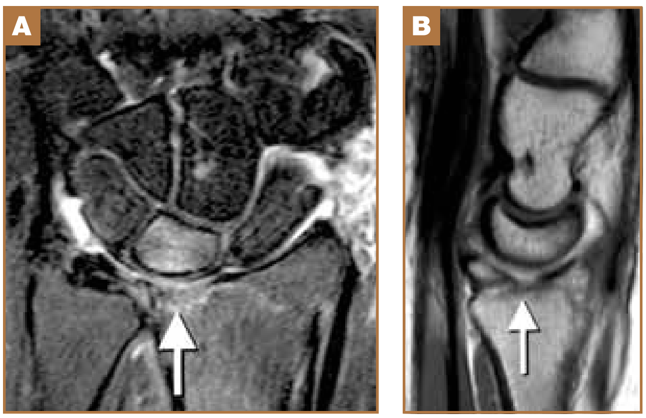


Figure 3. Coronal $T_2$-weighted (A) and sagittal $T_1$-weighted (B) magnetic resonance arthrograms show full-thickness chondral defect in lunate fossa (arrows). $T_2$-weighted arthrogram shows subchondral bone marrow edema underlying chondral defects.

A multidisciplinary sports medicine and hand consultation was held to discuss treatment options, including nonoperative care. Given the patient's young age and the central location of the lesion, we recommended an osteochondral autograft transfer from the knee. Two months later, we performed the procedure through a dorsal approach to the wrist and the third dorsal compartment. A posterior interosseous nerve neurectomy was performed, and the capsule was opened longitudinally. We detached the dorsal capsule to allow for adequate exposure with wrist flexion. The lesion, confined to a 7-mm area, was debrided. An osteochondral autograft transfer system (OATS; Arthrex Inc, Naples, Florida) was used to prepare the site for the osteocartilaginous graft. We entered the knee through a standard lateral parapatellar approach and harvested an essentially flat 7-mm osteochondral plug from the lateral femoral condyle above the sulcus terminalis. The OATS instrumentation was used to harvest the graft, and the graft was press-fit into the prepared site of the lunate facet of the distal radius. The graft provided excellent fill, with a smooth surface transition from the graft to the surrounding articular cartilage and minimal disruption of the overall joint surface contour. Passive wrist range of motion (ROM) was smooth, without catching or impingement.

Two weeks after surgery, the patient returned for initial follow-up and began wrist ROM exercises. Three months after surgery, she had excellent motion with no symptoms, and a radiographically healed autograft, and was released to full activity. At final follow-up, 34 months after surgery, she reported minimal discomfort. Visual analog scale (VAS) pain scores[7] had improved from 7 before surgery to 0.5 at final follow-up. Disabilities of the Arm, Shoulder, and Hand score[8] was 0. Wrist ROM, 60° extension and 55° flexion, was slightly limited compared with 60°/80° contralaterally. Wrist radial and ulnar deviation, and forearm pronation and supination were symmetric. Grip strength was slightly reduced on the left (18 kg) compared with the contralateral side (24 kg); pinch strength was 7 kg on the left and 8 kg on the right. Physical examination revealed no tenderness and no mechanical symptoms with ROM.

Radiographs showed osteochondral graft incorporation with no significant arthrosis (**Figures 5A, 5B**). As the autograft and the native lunate fossa differed in cartilage thickness, the subchondral bone of the osteochondral plug appeared depressed compared with that of the distal radius. Magnetic resonance arthrogram of the radiolunate joint showed near complete filling of the articular cartilage defect and a flush articular surface (**Figures 6A–6C**).

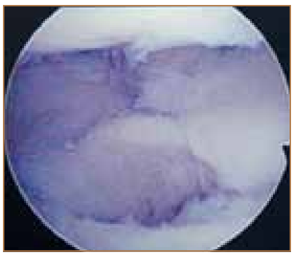

Figure 4. Arthroscopic images from initial diagnostic arthroscopy show articular incongruity of lunate facet of distal radius before microfracture, and grade II cartilage damage to lunate (superior aspect of picture).

## Discussion

Upper extremity osteochondral autograft transfer has been reported most commonly in the elbow and to a limited extent in other joints, such as the proximal interphalangeal joint.[1,9] There are 2 reports of osteochondral autograft in the wrist, and both involved nonstandard grafts for large articular defects.[5,6] In 1 of these 2 cases, a fibular facet of the proximal tibiofibular joint autograft was utilized for reconstruction without direct evaluation of cartilage health at follow-up.[6] In the other case, the vascularized base of the third metatarsal was used to correct a malunion.[5] In the present report, we have evaluated a more common, somewhat smaller lesion treated with a standard osteochondral autograft transfer harvested from the lateral aspect of the distal femur. This graft source, familiar to most sports surgeons, allows the use of commercial graft harvesting and implantation instruments.

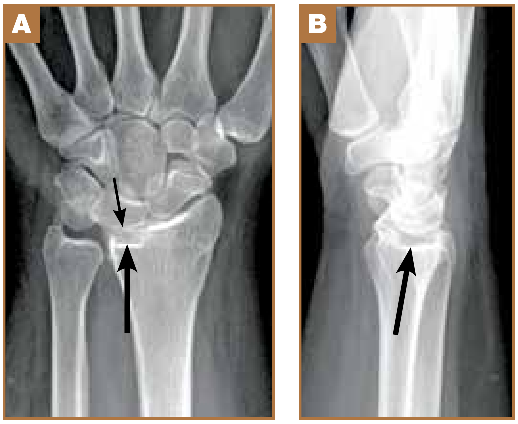


Figure 5. Postoperative (A) and lateral (B) radiographs show cortical surface of osteochondral plug (large arrows) depressed compared with distal radial articular surface. Note narrowed radiolunate joint space (small arrow).

Depressed articular surface fragments of the distal radius are difficult to visualize radiographically[10] and may not be appreciated until the patient returns with a symptomatic malunion. A study using computed tomography found that intra-articular joint-depression fractures were responsible for 75% of incongruous joints, 91% of which went on to develop radiographic evidence of arthritis at a mean follow-up of 6.7 years.[10] Intra-articular malunions of the distal radius are typically addressed with osteotomy if there is a marked step or gap deformity. However, this technique may be less useful for smaller, centrally located lesions.[11] In patients with a central depressed fracture fragment (die-punch fragment), osteochondral autograft potentially offers a more appropriate solution.

Osteochondral autograft transfer has been used most commonly in the knee and ankle to treat full-thickness cartilage lesions. Recent reports have indicated excellent outcomes in other joints.[1-3,12,13] However, there are several concerns about using osteochondral autografts.[14] Chondral contact pressures are normalized when the graft sits flush or slightly recessed with the opposing cartilage,[15] making transfer from a donor site with a similar radius of curvature ideal. In the present case, cartilage with a slightly convex surface—taken from the lateral border of the knee—was used to fill a defect on the lunate facet of the distal radius, which has a slightly concave surface. However, the plug was harvested from the flattest portion of the lateral aspect of the lateral condyle, and the recipient site was in the central ulnar aspect of the lunate facet, an area with minimal curvature. No incongruity was seen on visual inspection, and none was felt with wrist motion. The other 2 reports of osteochondral grafting to the distal radius used more complex graft sites in an attempt to recreate the shape of the lunate face[5,6]; our patient's graft fit well and has demonstrated good survival despite not anatomically matching the curvature of the lunate facet.

The lateral condyle of the knee has been the site of osteochondral graft harvest for many years and may represent a less morbid, faster, and easier graft harvest site compared with other options. Our patient had minimal knee complaints at her first postoperative visit and no pain or dysfunction at final follow-up. A recent study of donor-site morbidity confirmed the low risk for pain or functional deficits: Mean VAS pain score was 0.8 at 1 month after surgery and 0 at 6 months, and mean Lysholm knee score[16] was 96.3 at 3 months, with no deterioration at 2 years.[17]

For our patient's symptomatic cartilage defect, osteochondral autograft transfer from the knee to the distal radius yielded a satisfactory outcome, with resolution of mechanical symptoms and pain. At the time of initial fracture in any patient, we attempt anatomical restoration of the distal radius articular surface. We consider this technique in younger patients with an isolated area of cartilage loss of the distal radius articular surface measuring at least 5 mm in diameter. We only consider this technique if other surgical options, such as osteotomy, are not ideal.

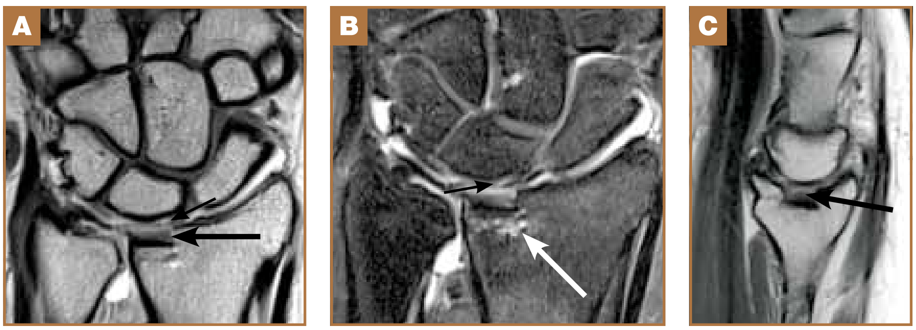


Figure 6. Postoperative coronal $T_1$-weighted (A), coronal $T_2$-weighted (B), and sagittal $T_1$-weighted (C) magnetic resonance arthrograms show intermediate signal-intensity reparative cartilage (large black arrows) filling majority of surface defect and nearly flush with distal radial articular surface. Small bone cysts (large white arrow) are present at base of bone plug. Cartilage lesion in proximal lunate (small black arrows) is slightly increased in size.

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