



Fresh osteochondral allograft transplantation for osteochondritis dissecans of the capitellum in baseball players

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Background: Osteochondritis dissecans (OCD) of the capitellum is a rare yet debilitating injury seen in young athletes. This is the first report in the literature describing fresh osteochondral allograft transplantation (FOCAT) to treat OCD of the capitellum.

Methods: Nine male baseball players (mean age, 15.3; range, 14–18 years), with OCD of the capitellum were treated with FOCAT. There were 6 pitchers and 3 position players. A ligament-sparing, mini-open approach was used. A fresh femoral hemicondyle was used as a donor source. Of the 9 patients, 7 required 1 plug and 2 required 2 plugs. The average plug diameter was 11 mm (range, 8–18 mm). Five plugs were press fit, and 4 required additional fixation. Clinical outcomes were evaluated at a mean follow-up of 48.4 months (range, 11–90 months). Preoperative and postoperative outcome scores were calculated using the paired *t* test.

Results: The Mayo Elbow Performance score improved from an average 57.8 to 98.9 ($P < .01$). The Oxford Elbow Score improved from 22.4 to 44.8 ($P < .01$). The Disabilities of the Arm, Shoulder and Hand score improved from 35.2 to 5.4 ($P < .01$). The visual analog scale score improved from 7.8 to 0.5 ($P < .01$). The Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow score improved from 32.6 to 82.5 ($P < .01$). All patients returned to throwing and were still active in their sport or played at least 2 years of baseball before leaving the sport unrelated to the elbow.

Conclusions: FOCAT for OCD of the capitellum in properly selected cases is a viable treatment with significant functional improvement and pain reduction in throwers.

Level of evidence: Level IV; Case Series; Treatment Study

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Keywords: Osteochondritis dissecans; capitellum; osteochondral allograft transplantation; baseball; thrower; elbow

This study was approved the Kaiser Permanente Institutional Review Board (IRB Study Number 10427).

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Osteochondritis dissecans (OCD) of the humeral capitellum is a rare debilitating, painful disorder seen most often in young athletes, such as youth baseball players and gymnasts, who repetitively load their elbows. Proposed etiologies of the disease include hereditary, vascular, repetitive microtrauma, and a combination of these.²³ Common presenting symptoms include pain, swelling, crepitus, loss of extension,⁷ and the inability to perform overhead throwing sports. Initial treatment often starts

with nonoperative management with activity modification and anti-inflammatory measures, such as ice and nonsteroidal anti-inflammatory medications.

Different classification systems have been used in previous studies based on radiographic, magnetic resonance imaging (MRI), and arthroscopic findings.³ A recent study distinguished unstable vs. stable lesions, where stable lesions could effectively be treated nonoperatively, and fragment fixation or articular surface reconstruction led to better results in unstable lesions.³⁰ Previous studies have reported that nonoperative management of unstable lesions can lead to loose bodies, advanced degenerative joint disease, and functional impairment.^{28,31,32}

A wide range of operative options have been described, from open to arthroscopic débridement to joint preservation and reconstruction. Studies have shown arthroscopic débridement alone of unstable lesions that produce loose bodies is ineffective in consistently relieving symptoms and returning patients to their previous level of sport.^{7,23,30} Because the vascularity of the capitellum has been described as tenuous,³⁴ microfracture and transhumeral drilling have been described as methods to incite a healing response in the lesion.³³ These techniques do not restore hyaline articular surface, however, and many of these treated patients gave up their preferred sport and developed degenerative changes.^{3,7,9,33} Fixation of loose but nondisplaced lesions has also been described with a variety of methods, including Herbert screws, darts, and Kirschner wires.^{9,11,25} This method of treatment requires osteosynthesis, which can be less than robust in this condition with weakened subchondral support of the articular surface. To date, there are no clear data showing which technique is superior to other techniques.

A durable load-bearing joint surface is requisite for patients to resume their previous level of sport and function, especially in overhead athletes where the lateral, radiocapitellar joint is repetitively loaded in compression at high forces. Several authors have described joint reconstruction with osteochondral autografting to restore a healthy subchondral foundation with an overlying hyaline cartilage surface to the capitellum.^{16,25,28,30,35}

Encouraging results of mosaicplasty with multiple osteochondral plug grafts from nonweight-bearing portions from the distal femur have been reported at 2 to 3 years, with evidence of graft remodeling.²⁸ However, donor site morbidity has been reported.^{14,24} Cylindrical costal osteochondral autograft has also been reported as another source to reconstruct larger unstable lesions and lesions with extension over the lateral aspect of the capitellum.^{17,22,25,26} These series reported no significant donor site morbidity of the ribs; however, 1 patient sustained a pneumothorax resulting in chest tube placement, and all patients had temporary donor site pain.²⁷

Fresh osteochondral allograft transplantation (FOCAT) has been well reported in the treatment of large chondral and osteochondral defects of the knee.^{15,16,20} Recent studies have shown graft survival of 90% at 10 years in a pediatric and adolescent population²⁰ and 82% at 10 years in adults.¹⁵ However, no series have reported outcomes of FOCAT for

the treatment of capitellar OCD. These grafts are suitable for the treatment of capitellar OCD lesions because they restore a hyaline articular surface with the supporting subchondral structure, without the morbidity associated with previously described autograft harvesting from the knee. The goal of this study was to evaluate the outcome in a case series of baseball players who underwent FOCAT of OCD lesions of the capitellum performed by a single surgeon (R.M.).

Materials and methods

A retrospective record review was performed of all patients who underwent FOCAT for OCD of the elbow. The indication for FOCAT was an OCD lesion on plain radiograph or MRI, or both, that failed nonoperative management, including rest/shutting down from throwing, followed by a throwing program. The patients were referred to the senior author (R.M.) from various centers that had multiple different therapy programs.

Preoperative and postoperative Mayo Elbow Scores, Disabilities of Arm, Shoulder and Hand (DASH) scores, visual analog scale (VAS), Oxford Elbow Score, and Kerlan-Jobe Orthopaedic Clinic (KJOC) Shoulder and Elbow score were used to clinically evaluate the patients, and a paired *t* test was used to compare the preoperative and postoperative scores across all patients. The KJOC score is a validated scoring system that is more sensitive in detecting subtle performance changes in high-performance overhead throwing athletes because it avoids a "ceiling effect."^{1,10} When this series was started, KJOC scores had not been published. However, at the time of follow-up, patients were asked to fill out a KJOC questionnaire based on their best recollection of preoperative symptoms.

Classification

The lesions were classified by the senior author (R.M.) based on plain radiographs, MRI, and intraoperative findings. The Minami classification uses plain radiographs to classify lesions into 3 grades.¹⁹ Elbows with a grade I lesion have a translucent cystic shadow seen in the lateral or middle parts of the capitellum. Grade II lesions have a clear zone or "split line" between the lesion and the adjacent subchondral bone. Grade III lesions are those where a fragment has separated from its bony floor and become a loose body.

The Itsubo classification was used to classify the lesions based on MRI.¹² In stage 1, a normally shaped capitellum has several spotted areas with high signal intensity that is lower than that of cartilage. In stage 2, there are several spotted areas of higher intensity than that of cartilage. In stage 3, there is a discontinuity of the chondral surface signal and noncircular outer contour of the capitellum in coronal and sagittal sections. No high signal interface is apparent between the lesion and the floor. In stage 4, the capitellar lesion is separated by a high intensity line in comparison with the cartilage, regardless of whether the outer contour of the capitellum is circular or not. In stage 5, the capitellar lesion is displaced from the floor of the bone marrow or defect of the capitellar lesion is seen. Stages 3, 4, and 5 are considered unstable.

The International Cartilage Repair Society grading system⁸ was used to classify the lesions based on arthroscopic findings. In grade I, the lesion is softened, covered by intact cartilage, and is in continuity with surrounding normal cartilage. In grade II, there is partial discontinuity of the cartilage, and the lesion is stable on probing. In

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