



**Arthroscopic procedures for osteochondritis dissecans of the humeral capitellum in adolescents and young adults: clinical outcomes with a mean follow-up of 2.5 years**

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**Abstract:**

**Objective.** To evaluate functional outcomes and complications in a consecutive group of patients with elbow osteochondritis dissecans(OCD) treated with arthroscopic procedure.

**Methods.** Twenty-seven patients who had undergone arthroscopic procedure for elbow

osteochondritis dissecans (OCD) were recruited from May 2013 to July 2016. There were twenty males and seven females, aging from 15 to 35 years old. All of the twenty-seven patients had complained of pain and fifteen patients had mechanical symptoms, such as catching and locking. The patients positioned lateral decubitus under general anesthesia, proximal anterolateral, proximal anteromedial, midlateral (soft spot), straight posterior and posterolateral portals were used to explore and debride elbow joint, remove loose bodies and take microfracture procedures. Clinical assessment consist of elbow ROM, the Mayo Elbow Performance Score (MEPS). Postoperative complications were also assessed.

**Results.** All patients achieved primary healing. twenty-seven patients were followed up for 11 to 48 months (mean 34 months). twenty-four elbows (88.9%) had no pain or only mild pain and three patients (11.2%) had moderate pain at the last follow-up. Mechanical symptoms had disappeared in all fifteen patients. The flexion and extension ROM and the Mayo Elbow Performance Score (MEPS) had improved significantly ( $P < .05$ ) at the last follow-up. According to the Mayo Elbow Performance Score (MEPS), the result was excellent in twenty-one elbows, good in three elbows. The complications: transient injury of ulnar nerve in one patient.

**Conclusion.** In mid-term follow-up, arthroscopy is a reliable procedure for the elbow osteochondritis dissecans (OCD) that produce significant clinical functional improvements and without severe complications.

**Keywords :** Osteochondritis dissecans, Elbow joint, Arthroscopy, Debridement, microfracture

Elbow osteochondritis dissecans (OCD) is one of the most common injuries in young people, especially in adolescent overhead athletes and handicraftsmen<sup>[1-2]</sup>, and the capitulum humeri is the most common site affected. Because of the narrow joint space, complexity of the anatomy of elbow joint, abundant of the blood vessels and nerves. Elbow arthroscopy has always been considered as a quite highly technical demand procedure in orthopedics department. In recent years, with the development of arthroscopic techniques, elbow arthroscopy has gradually become a routine surgery. The purpose of this study was to evaluate the functional outcome and complications of a consecutive group of patients with elbow osteochondritis

dissecans(OCD) treated with arthroscopic procedure. Our hypothesis was that arthroscopic debridement, loose body removal and microfracture are a series of reliable procedures that produce significant functional improvement and without severe complications.

## **Materials and Methods**

Patients with elbow osteochondritis dissecans (OCD) who underwent arthroscopic procedure between May 2013 to July 2016 at Ningbo First Hospital were retrospectively identified. We received institutional review board approval before initiating this study. These patients, 20 males and 7 females, 8 left elbows (29.6%) and 19 right elbows (70.4%) were affected, for all 27 patients, the dominant side was involved. These patients ranged in age from 15 to 35 years old (mean age, 18.5 years). the median value of the duration from onset to surgery was 7.5 months ( ranged from 6 to 12). Occupation: 14 professional athletes, 5 soldiers, 4 students and 4 migrant workers. The median clinical follow-up for all patients was 34 months ( ranged from 11 to 48 months). The detailed demographic and clinical characteristics are shown in Table 1.

Patients were diagnosed with OCD based on physical examination findings, plain radiographs, three-dimensional CT scan and magnetic resonance imaging (Figure 1, Figure 2, Figure 3). All 27 patients had symptoms of elbow pain, 25 patients suffered from a limited range of motion of the elbow, 15 patients had mechanical symptoms, which defined as patient-reported locking, catching, clicking or crepitus. and 10 patients had definite history of trauma. Standard X-ray, three-dimensional CT scan and MRI were obtained in all patients. All patients who needed surgery were initially underwent strictly conservative treatment for at least six months. Clinical assessment consists of ROM of the elbow and the Mayo Elbow Performance Score(MEPS).

### **Surgical techniques**

All surgical procedures were performed by one of the two senior authors (Jia or Zhu) in the lateral decubitus position with tourniquet blood control under general anesthesia. Important anatomical structures were marked on the skin before the surgery. Firstly, the arthroscope was introduced from a proximal anteromedial portal, and an anterolateral portal was created using the outside-in technique. Routine diagnostic arthroscopic surgery was carried out in the anterior compartment, and synovial debridement and removal of loose bodies were performed if present, Loose bodies are commonly found in the radial fossa, coronoid fossa, and in the

olecranon fossa. (Figure 4). Secondly, a posterolateral portal was established in the lateral side of the soft spot, which was in the posterior radiocapitellar joint, followed by the establishment of a midlateral (soft spot) portal, which was located at the superomedial corner of the soft spot, all unstable cartilage of the capitellum lesion were removed to create a stable bed, we create microfractures in the lesion bed until bleeding was detected from the bone marrow using these 2 portals (Figure 5). Then, the arthroscope was introduced to the posterior compartment through the lateral gutter, and another one or two posterior portals were created in the olecranon fossa, loose body was removed and synovial debridement was performed. Osteophytes were resected, if there was impingement signs of the olecranon.

### **Postoperative management**

Postoperatively, an arm sling was used for 2 weeks, careful attention should be paid to the swelling of the elbow joint, sensation and blood supply of the upper extremity. Isometric muscle contraction was started right after surgery. and then physical therapy to resume elbow ROM and correct scapular dyskinesis was initiated after the pain and swelling relieved, All patients were allowed to use their arm for activities of daily living after the stitch removal.

### **Clinical Evaluation**

Patients were preoperatively and postoperatively evaluated with flexion and extension ROM and the Mayo Elbow Performance Score(MEPS), 90-100 points of the Mayo Elbow Performance Score(MEPS) demonstrated excellent; 75-89 points demonstrated good; 60-74 points demonstrated fair; less than 60 points demonstrated poor.

### **Statistical Analysis**

Statistical analyses were conducted using IBM SPSS statistics for Windows (version 20.0, IBM, USA), Descriptive statistics with mean values  $\pm$ standard deviation(SD) and median values and quartile range were used for continuous variables. For categorical variables, frequency were calculated as the percentage of patients [ ( n% ) ] . The paired t test was used for comparison of pre- operative and post-operative Mayo Elbow Performance Score(MEPS) and ROM. We considered a 2-sided P Value of<.05 statistically significant.

### **Results**

All seventeen patients achieved primary healing. The mean follow-up was 34 months (range from 11 to 48 months). Pain completely disappeared or only slight pain in twenty-four

patients (88.9%) at the last follow-up, and another three patients (11.2%) had moderate pain. Mechanical locking symptoms completely disappeared in all 15 patients postoperatively. The ROM of elbow joint, flexion ROM and extension ROM, MEPS scores were significantly improved compared with preoperative values ( $P < 0.05$ ). The scores of MEPS were excellent in 21 patients, good in 3 patients, and fair in 3 patients, and the excellent and good rate was 88.9% (Table 2). Postoperative complications: no severe complications were encountered, only one patient got temporary paralysis of the ulnar nerve.

## **Discussion**

Elbow osteochondritis dissecans (OCD) is a notable injury in children and adolescents who participate in sports involving repetitive compression forces and valgus torque at the elbow, such as baseball, tennis, badminton and gymnastics[1] [2] [3] . This disease involves a specific lesion of articular surface including cartilage and subchondral bone, the separation of the cartilage always is the source of loose body in joint space [4]. Repetitive micro-trauma and poor blood supply have been considered as the causes of this kind of disorder[5] [6] [7] [8]. Conservative treatment is usually indicated for some stable lesions with an open capitellar growth plate, and many studies have showed good outcomes after non-operative treatment[1] [9] [10]. Surgical procedure is necessary for patients with ineffective conservative treatment and indicated for unstable lesions with a range of motion (ROM) loss of  $>20$  degrees, a closed capitellar growth plate, and high intensity in the capitellum on T2-weighted MRI[2]. There are a large variety of surgical procedures for unstable OCD[11] [12], including fragment resection by open procedures, fragment fixation with screws, and osteochondral grafting, etc. In 1994, Uribe et al[13] first reported arthroscopic debridement procedures for 21 competitive sports athletes with OCD, and the excellent and good rate was 75%. Uribe considered that the key point of the procedure is debridement of cartilage lesion in skeletally immature athletes. In previous studies, both functional and radiographic outcomes after arthroscopic fragment resection were excellent in small or large OCD lesions. And also in this study, the mid-term clinical outcome of 27 patients was satisfactory with an excellent and good rate of 88.9%.

There are several tips and pearls for elbow arthroscopic procedures. 1) the patient's position is quite important for elbow arthroscopic procedure, there were supine position, prone position and the lateral decubitus position available, each has the advantages and disadvantages[14]. In

the lateral decubitus position, the upper extremity does not need any additional traction, and it is easy to transform to the open operation when necessary. All twenty-seven patients were treated with lateral decubitus position, and all patients have satisfactory clinical function results and good reproducibility. 2) More than ten portals[15] have been reported for elbow arthroscopic surgery. In this case-series study, we choose the proximal anterolateral portal, the proximal anteromedial portal, midlateral(soft spot), the posterior portal and posterolateral portal for this kind of procedure. the proximal anteromedial portal and anterolateral portal can be used to observe the anterior and lateral structure of the elbow joint. At the same time, the distance from proximal anteromedial portal to the ulnar nerve and the radial nerve is 15.8mm, 14.1mm respectively when elbow flex to 90 degrees[15] [16]. The midlateral portal combined with posterolateral portal can be used to observe the posterior compartment of the elbow. The midlateral portal is located in the space of capitulum radii, capitulum humeri and the olecranon, it is commonly known as "soft point". 3) Elbow osteochondritis dissecans (OCD) is often seen in overhead young athletes, The patients are often combined with "valgus extension overload syndrome"[17], Before the operation, the stability of the elbow joint, the ulnar nerve injury and the impingement of the elbow should be carefully evaluated. During the operation, it is necessary to observe pathology dynamically, remove the osteophyte and reconstruct medial collateral ligament when necessary. 4) Cartilage repair is the key point for the treatment of OCD. However, cartilage repair is still a big challenge nowadays, a series of procedures have been introduced[12] [18] [19]. Microfracture is still the main strategy for cartilage defects, it causes the release of multi-potent mesenchymal stem cells from the bone marrow, and the cells enhance tissue healing. The elbow is different from the knee and other lower extremity weight-bearing joints, the elbow pain and mechanical symptoms can be significantly improved, only need to maintain the smooth surface of the cartilage defect.5)Transposition of the ulnar nerve, severe elbow joint stiffness, ectopic ossification and the local infection are all regarded as the absolute contraindication for elbow arthroscopy[20]. 6) Nerve and vascular injuries are the most concerned complications of elbow arthroscopic procedure, One of the most common complications is temporary paralysis of the nerve[21]including the injury of ulnar nerve, the anterior branch of the radial nerve, the median nerve, and the anterior interosseous nerve. And forearm osteofascial compartment syndrome were also have ever been reported[22] [23].

There were several limitations in this study. firstly, it was a retrospective case-series study. Secondly, the mean follow-up may not have been longer enough for the assessment of clinical

outcomes. Thirdly, we haven't compare our results with those different procedures such as microfracture or osteochondral grafting. We tried to reduce this bias by recruiting more patients and design a comparative study in the future.

## **Conclusions**

Both functional outcomes and ROM of the elbow were excellent in elbows with OCD lesion after arthroscopic procedures in midterm follow-up. Arthroscopic debridement, loose body removal and microfracture can be a series of reliable procedures that produce significant functional improvement and without severe complications in the treatment of elbow OCD.

## **Figure Legends**

Figure 1. Capitellar osteochondritis dissecans lesion on sagittal CT scan. (A) Preoperative sagittal CT scan showing a separated fragment and irregular margin of the capitellum. (B) loose body showed in the olecranon fossa.

Figure 2. Capitellar osteochondritis dissecans lesion on three-dimensional CT scan. (A) anterior aspect of 3D CT imaging showing a defect area of the capitellum. (B) posterior aspect imaging shows loose body in the olecranon fossa.

Figure 3. Capitellar osteochondritis dissecans lesion on Sagittal T2-weighted magnetic resonance imaging. (A) preoperative MRI demonstrate a high-to-mixed signal intensity area in anterior aspect of the capitellum, edema showed in the bone marrow. (B) loose body and fluid demonstrated in the olecranon fossa.

Figure 4. (A) synovitis and loose body detected in the anterior compartment of the elbow. (B) Loose body removed in the anterior compartment. (C) several loose bodies taken out from the elbow joint.

Figure 5. (A) Posterior view of the radiocapitellar joint after debridement of a large capitellar osteochondritis dissecans lesion. (B) microfractures in the lesion bed and bleeding was detected from the bone marrow.

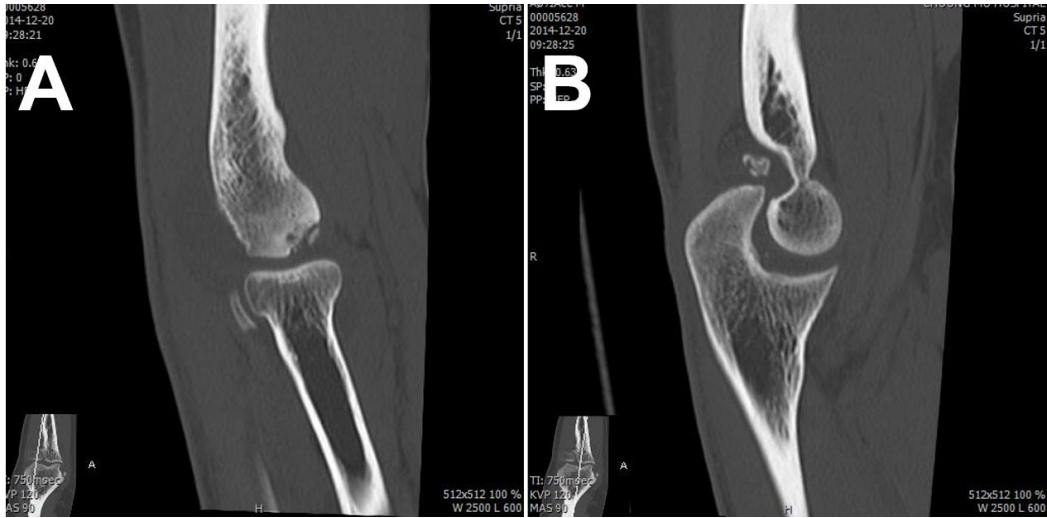


Figure 1

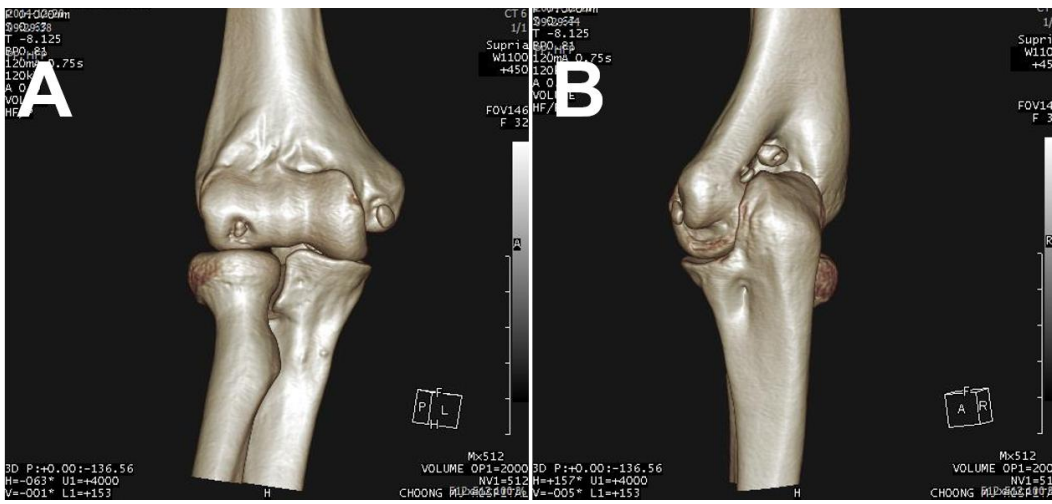
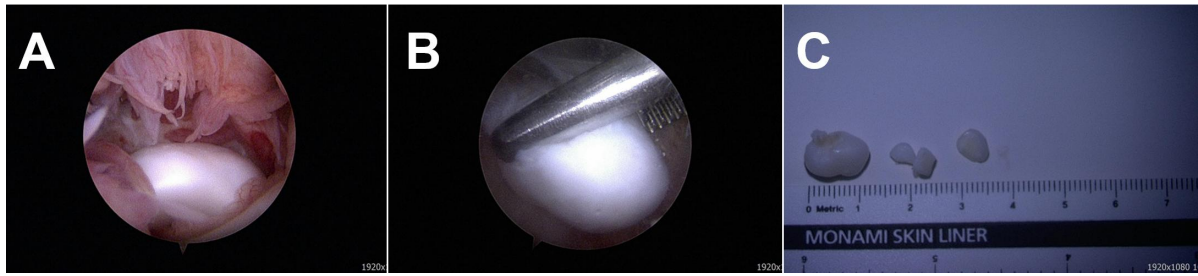


Figure 2

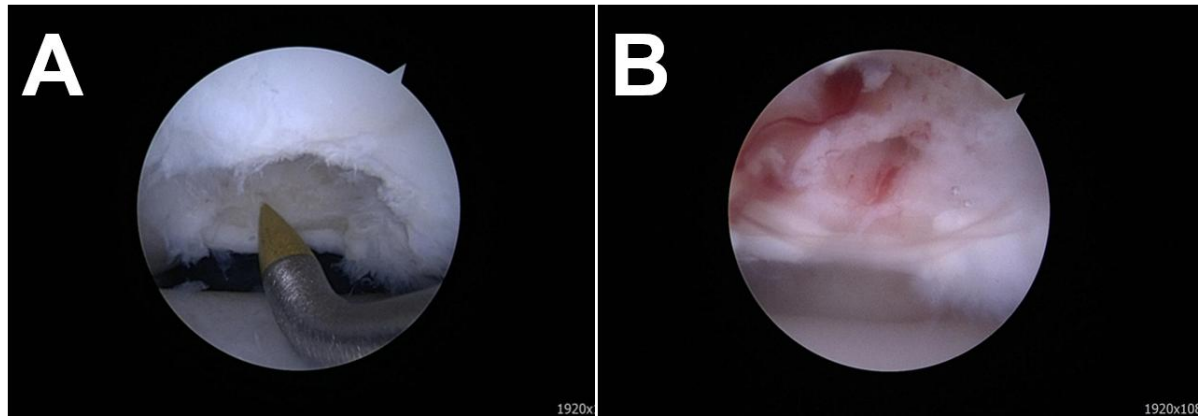


Figure 3.





**Figure 4**



**Figure 5**

**Table 1. Preoperative Demographic and Clinical Features of the 27 Patients with OCD**

Characteristic		Number (%)
gender	male	20 (74.1)
	female	7 (25.9)
Age(years)		18.5±4.2
Time to surgery(month)		7.5 (6-12)
Affected side	left	8 (29.6)
	right	19 (70.4)
Traumatic event	Yes	10 (37.0)
	No	17 (63.0)
Occupation	professional athletes	14 (51.9)
	Soldiers	5 (18.5)
	Students	4 (14.8)

Characteristic		Number (%)
	migrant workers	4 (14.8)
Dominant side	Yes	27 (100)
	No	0 (0)
Range of motion	No limited	2 (7.4)
	ROM restricted	25 (92.6)
pain	Positive	27 (100)
	Negative	0 (0)
Mechanical symptoms	Yes	15 (55.6)
	No	12 (44.4)

**Table 2. Comparison of pre- and post-operative clinical functional datas in 27 patients with osteochondritis dissecans (X±S)**

	Total ROM	Flexion ROM	Extension ROM	MEPS
Pre-operative	97.3±9.8	108.9±7.9	18.6±4.3	58.7±5.4
Post-operative	125.8±12.5	130.5±10.2	4.7±2.9	91.7±9.7
t	7.403	6.901	11.067	12.313
P-value	P<0.05	P<0.05	P<0.05	P<0.05

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