

Internal Fixation of Unstable Cahill Type-2C Osteochondritis Dissecans Lesions of the Knee in Teenage Patients

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abstract

The treatment of osteochondritis dissecans (OCD) lesions remains controversial. We present a case series of 12 teenage patients with average 6 year follow-up after compression screw fixation of unstable Cahill Type-2C OCD lesions. Postoperatively, patients were evaluated with several functional tests and scoring systems, including Lysholm, IKDC, and KOOS. All lesions healed, and no clinical or radiographic evidence of degenerative disease was noted. No significant differences in thigh girth, range of motion, stability, or single-leg-hop distance was observed when compared to the unaffected, contralateral extremity. We conclude that this technique is appropriate and efficacious for the treatment of unstable OCD lesions.

tial for healing and should therefore be treated surgically, preferably by fixation of the fragment in its original bed.² Several authors have reported on their experience with compression screw fixation of unstable OCD lesions.^{6,8,12} These reports mostly consisted of small case series with comparatively short follow-up, but reported >80% good and excellent results with this technique.

We present a case series of 12 teenage patients that were treated with internal fixation of unstable OCD lesions of the knee. Patients were observed with clinical and radiographic examination for ≥ 2 years.

The specific pathophysiology of osteochondritis dissecans (OCD) remains controversial. Originally thought to be an inflammatory phenomenon, various investigations point to vascular insufficiency,¹¹ repetitive microtrauma,¹⁰ and genetic factors⁹ as playing a role in the etiology of this disease. Prognosis and treatment recommendations are primarily determined by the patient's bone age, and secondarily by characteristics of the lesion (ie, location, fragmentation and stability).⁴ Osteochondritis dissecans lesions of the knee have an incidence that is estimated between 0.02% and 1.2%,^{1,7} are more common in boy than girls by a factor of 2, and typically manifest between

10 and 15 years of age. Both knees should be routinely imaged as bilateral presentation occurs in 15%-30% of cases.⁵

A large, controlled trials has not been conducted to investigate different treatment modalities for OCD lesions. Therefore, treatment recommendations often are based on smaller case series and personal experiences of treating physicians. However, there appears to be a consensus that nondisplaced, smaller lesions (<2 cm), in the classic location on the lateral aspect of the medial femoral condyle have a better prognosis—especially in children with open growth plates.⁵ Conversely, unstable or displaced lesions after physeal closure have little poten-

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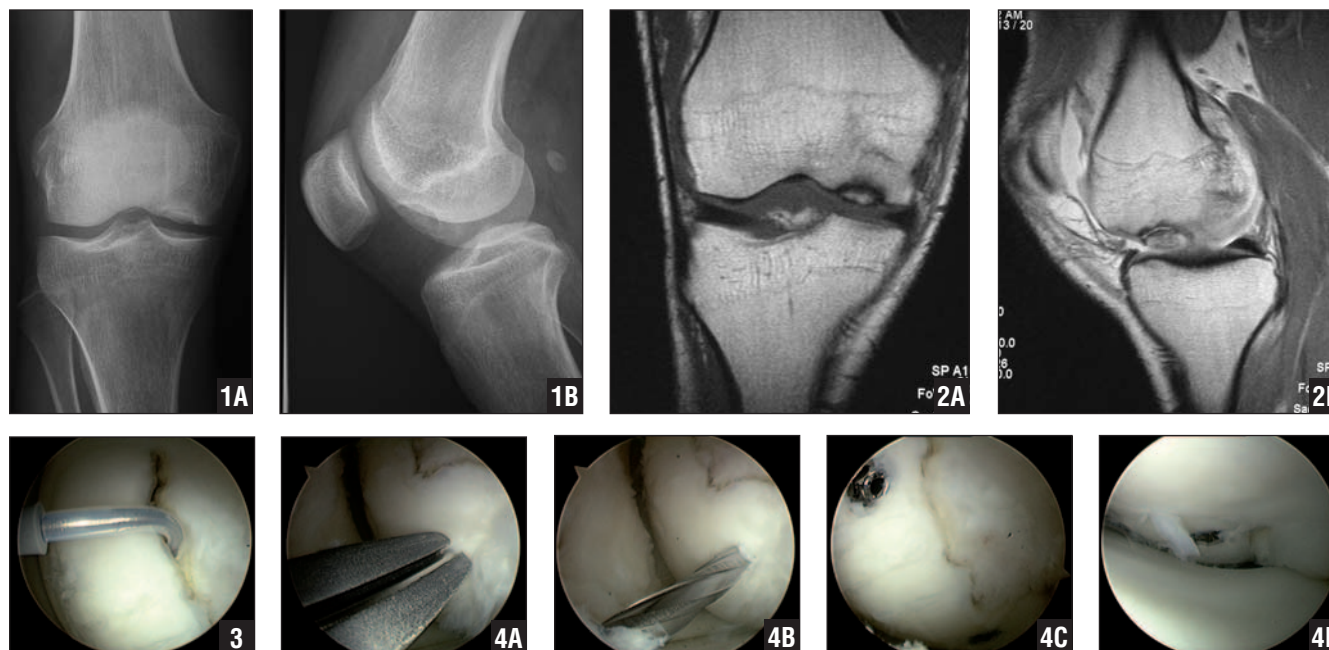


Figure 1: AP (A) and lateral (B) radiographs of an OCD lesion in the medial femoral condyle. **Figure 2:** Coronal (A) and sagittal (B) MRI cuts depicting an OCD lesion in the femoral condyle. Note the sclerotic appearance of the defect bed, and presence of a bright fluid signal behind the fragment. **Figure 3:** The fragment is carefully mobilized, often requiring a release of superficial fibers of the PCL. **Figure 4:** Compression screw fixation: a guide wire is drilled through the fragment into the femoral condyle (A); the guide wire is overdrilled (B); the screw is placed, compressing the fragment into the bed (C); at the end of the procedure, the knee is taken through a range of motion to ensure that the screw head is seated under the articular surface and does not abrade against the opposing surface (D).

MATERIALS AND METHODS

Through a retrospective, IRB-approved review of the surgical logs of three senior surgeons at our institution (B.R.B., C.A.B.-J., B.J.C.) for the years 1990-2002, 22 teenage patients were identified as meeting the following inclusion criteria: unstable OCD lesion; classic location; treated with internal fixation; minimum 2-year follow-up. Even though patients were identified retrospectively, data collection had been performed in a prospective manner with regular radiographic and functional evaluation. Of 22 patients, 9 patients could not be located, and 1 patient was unwilling to return for a follow-up examination, leaving 12 patients for inclusion into the study. These patients were evaluated by a single surgeon (K.F.) who was uninvolved in the patients' prior surgical care in an attempt to minimize surgeon's bias.

All patients had undergone pre-operative evaluation with conventional radiographs (Figure 1) as well as magnetic resonance imaging (MRI) to classify the

lesion (Figure 2). Based on the system described by Cahill and Berg,³ all defects were described as 2C lesions located in the classic, eccentric position in the lateral aspect of the medial femoral condyle. Magnetic resonance imaging demonstrated a high signal consistent with fluid behind the fragment (Figure 2B)—a finding characteristic for unstable OCD lesions. However, lesions were not displaced out of their bed.

Patients presenting to our facility with a symptomatic, nondisplaced OCD lesion undergo an initial nonoperative treatment course aimed at decreasing joint inflammation and achieving union of the lesion. The program consists of short-term immobilization, followed by a period of ≥ 6 weeks of nonweight bearing. Subsequently, patients are asked to modify their activities to avoid impact-loading of the lesion. Persistent pain for >3 -5 months and apparent nonunion on radiographs and/or MRI are indications to consider surgical fixation. All patients in this study

participated in this protocol, and elected for surgical intervention due to failure of conservative management. One patient with a concomitant anterior cruciate ligament tear was treated acutely.

No patients had undergone prior surgical procedures for this, or any other pathologic entity of the ipsilateral knee.

All patients underwent arthroscopic or mini-open internal fixation of the OCD lesion with a compression screw. Initially, the lesions were localized through a standard diagnostic arthroscopy of all three compartments of the knee. If found to be not amenable to arthroscopic fixation, a miniarthrotomy was performed to expose the defect. The lesions were then opened to expose the often sclerotic bed. This was performed by superficially releasing fibers of the posterior cruciate ligament insertion to expose the lateral margin of the lesion (Figure 3) which was then hinged open slightly on a medial cartilage bridge. Thereafter, the bony bed was prepared with a curette and microfracture awl as needed to remove

or perforate the sclerotic surface. The lesion was reduced back into its bed, and fixated with either one or two conventional 3.5-mm AO compression screws, or standard Acutrak headless screws (Acumed, Beaverton, Ore), based on surgeon's preference (Figure 4).

Patients were kept nonweight bearing on crutches for 6-8 weeks. Physical therapy with range of motion (ROM) exercises as tolerated and straight-leg-raising-quad-strengthening was instituted on postoperative day 1. Patients returned for follow-up after 7-10 days for suture removal. Radiographs were obtained at this visit (Figure 5), as well as after 6 weeks. Based on surgeon's preference, screws were removed between 8 and 10 weeks, either arthroscopically or through a mini-arthrotomy. Postoperatively, patients were rapidly advanced to full-weight bearing, but were restricted from impact activities for 4 to 5 months. They were observed clinically and radiographically every 3 months for 1 year.

ASSESSMENT

At follow-up, patients were assessed with several well-established and validated scoring systems. In addition, the following parameters were recorded in both legs: thigh girth, alignment, knee ROM, presence of effusion, and single-leg-hop distance. Standard anteroposterior, flexion posteroanterior, and flexion lateral weight-bearing radiographs were obtained at final follow-up (Figure 6).

Findings in the operated extremity were compared to the uninvolved, contralateral extremity with the use of the Student's *t* test. The level of significance was set at 0.05.

RESULTS

Twelve patients (10 males, 2 females) were evaluated at an average of 6 years (range: 24-184 months) after surgical fixation of an unstable OCD lesion. The average age at the time of surgery was 16 years (range: 12-19 years) (Table 1). At

Table 1

Epidemiologic Characteristics of Study Population	
Gender	10 males, 2 females
Average Age (years)	16 (range: 12-19)
Affected side	8 left, 4 right knees
Average lesion size (cm ²)	4.85 (range: 1.8-7.5)
Fixation technique	Acutrek screw (8); 3.5-mm AO screw(4)
Average time from symptoms to surgical fixation (months)	17 (range: 0.5-84)
Average follow-up (months)	72 (range: 24-184)

Table 2

Results				
Scoring System	Average	Standard Deviation	Minimum	Maximum
Noyes Activity Scale	86.7	14.9	55	100
Tegner Activity Score	8.2	2.1	4	10
Lysholm	82.1	17.9	46	100
IKDC	82.8	15.3	58	100
KOOS				
Pain	89.9	10.4	75	100
Symptoms	87.5	10.7	71	100
ADL	96.8	3.7	88	100
Sports participation	80.4	16.2	50	100
QoL	79.7	17.1	50	100
SF-12				
PCS	44.7	2.6	41	50
MCS	55.5	6.1	46	62

Abbreviations: IKDC=Internation Knee Documentation Committee, KOOS=Knee and Osteoarthritis Outcome Score, ADL=activities of daily living, QoL=quality of life, PCS=, MCS=

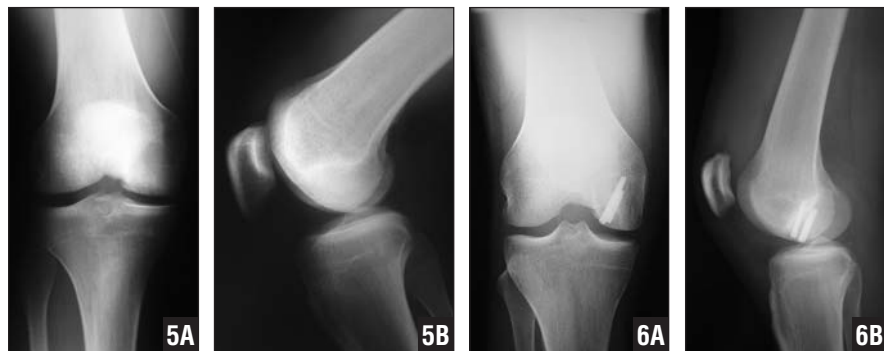


Figure 5: Postoperative radiographs showing fragment fixation with two compressive screws in AP (A) and lateral (B) views. **Figure 6:** AP (A) and lateral (B) radiographs 6 years after OCD fixation and subsequent screw removal showing a well-healed lesion and no degenerative changes.

What is already known on this topic

- Osteochondritis dissecans lesions of the knee have an incidence that is estimated between 0.02% and 1.2%, are more common in boys than girls by a factor of 2, and typically manifest between 10 and 15 years of age.
- Smaller lesions (<2 cm), in the classic location on the lateral aspect of the medial femoral condyle have a better prognosis—especially in children with open growth plates.

What this article adds

- Treatment of unstable OCD lesions in an active, teenage population by compression screw fixation led to predictable healing in all cases.
- Patients reported high satisfaction and a virtually normal knee function.

the time of secondlook arthroscopy for hardware removal, all lesions appeared to be stable to probing. No surgical or postsurgical complications occurred. One patient had a subsequent chondroplasty 6 years after the index procedure. The fragment was found to be stable, but had developed a small chondral defect where it bordered on surrounding cartilage.

On physical examination at the most recent follow-up, all patients demonstrated normal gait; one patient had a small effusion. No statistical difference was noted in ROM, thigh girth, ligamentous stability, or tenderness to palpation when compared to the contralateral extremity. Functional evaluation with a single-leg-hop test demonstrated no statistically significant differences with an average distance of 133 cm on the affected, and 136 cm on the unaffected side. All patients reported being satisfied with the outcome, and would undergo the same procedure again. Table 2 reports the results of patient assessment through a variety of scoring systems.

Radiographic evaluation at the time of final follow-up demonstrated normal alignment, healed lesions, and no arthritic changes in all patients.

DISCUSSION

Our results demonstrate that internal fixation of unstable OCD lesions of the knee provides a stable and functional knee, even in the active teenage population. Our patients reported excellent satisfaction with their functional outcomes and

an overall low morbidity at a minimum of 2 years after fixation; all patients reported that they would undergo surgical fixation again. These findings are in agreement with prior studies that have demonstrated good to excellent results in >80% of patients^{6,8,12}; the classic articles of Johnson⁶ and Thomson¹² describing compression screw fixation of OCD lesions found good or excellent outcomes reported by 88% and 80% of patients, respectively; Makino's⁸ more recent article from 2005 found healing in 14 of 15 lesions treated with Herbert screw fixation.

Further analysis of our data showed no significant differences in outcomes based on size of the lesion. Even though not statistically significant, a trend was noted towards worse outcome with longer delay before surgery.

Our study shares the limitations of prior publications, such as a comparatively small patient population. We were able to locate only 12 of 22 patients for follow-up, an issue commonly encountered in a young and geographically mobile group. Also, the age span at the time of operation was 7 years (12-19 years), thus including both skeletally mature and immature patients. Even though outcomes of OCD treatment are known to vary in these two groups, this holds mainly true for conservative management of stable lesions. Unstable fragments, such as seen in our patient population, have a low chance of healing in either age group, and we feel that our results are therefore not excessively influenced by this factor.

CONCLUSION

Arthroscopic or mini-open fixation of unstable Cahill Type-2C OCD lesions in a teenage population has demonstrated excellent patient satisfaction with low morbidity at an average of 6 years after surgery. ■

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