Conservative treatment of juvenile osteochondritis dissecans of the knee

Dr Virginie Rampal MD, PhD

Department of Pediatric Orthopaedic Surgery
Lenval University Children's Hospital
06000 Nice, France

1. Definition

Osteochondritis dissecans (OCD) of the knee is defined as necrosis of the subchondral bone leading to lesions at the level of the articular cartilage. The juvenile form of osteochondritis dissecans (JOCD) appears in children [1,2].

The etiology of this pathology is thought to be multifactorial and multiple potential causes have been evoked (vascular, mechanical, or developmental mechanisms). It is important to note that the most frequently affected location (posterolateral aspect of the medial femoral condyle) is due to the load-bearing nature of the area, where there is maximal load. Osteochondral lesions at the level of the tibial spine may be due to significant traction [3].

Good outcomes of conservative treatment and cases with complete spontaneous resolution have been reported dating back 50 years ago [4-6]. Some cases of rapid spontaneous healing have also been reported: Only patients suffering from lingering and refractory pain for many months tend to seek medical care [7].

2. Type of treatment [8,9]

A panoply of conservative treatment modalities is available in the literature.

2.1. Medical treatment

Medical treatment has not shown to be effective in the management of JOCD [10].

2.2. Conservative treatment
2.2.1 Reduced physical activity

Patients diagnosed with JOCD are primarily managed by a global reduction in physical activity, especially with a cessation of all contact sports, running, jumping, squatting, and prolonged standing positions [3,9,12].

2.2.2 Physical therapy

Physical therapy may be useful as a complementary treatment modality and should be considered mainly for muscular strengthening. Iontophoresis (the use of continuous galvanic currents which may cause burns or injury to the physes in children) or shock-wave therapy have not shown to be effective in the treatment of JOCD and are not recommended in children.

2.2.3 Limb unloading [9]

Unloading of the limb is generally indicated with either partial weight-bearing with the use crutches, or non-weight-bearing with the use of a wheelchair.

Some authors recommend immobilization by casting or the use of an unloader brace with either a varus or a valgus deviation depending on the location of the osteochondral lesion [1,10]. The duration of the immobilization is usually 6 to 12 weeks and depends on the radiographic progression of the lesion. The use of unloading orthoses remains controversial as significant improvements in outcomes have yet to be shown [13].

3. Duration of treatment

The literature shows favorable results following conservative treatment for a duration ranging between 3 months to 2 years. A reduction in physical activity for a minimum of 6 to 12 months should be attempted before conclusions are made on the effectiveness of conservative treatment [10,12]. Frequent radiographic and clinical follow-up (every 6 to 8 weeks) are generally the norm and allow for a surveillance of the progression of the lesion, thereby guiding treatment. A follow-up MRI 4 to 6 months after initiation of treatment may be indicated. A reduction of at least 15% of the size of the lesion and a decrease in signal intensity in the bone surrounding the lesion indicate progression toward healing [10]. A gradual return to normal activity may thus be allowed, starting with certain activities with low impact on the knees (such as biking, swimming or walking).

Kocher et al. described a 3-phase protocol for the conservative treatment of JOCD [14]:

- Phase 1 consists of knee immobilization for a period of 4 to 6 weeks, partial weight-bearing and crutches. At the end of this stage, the knee should be pain-free.
- During phase 2 (weeks 6 to 12), brace-free weight bearing may be allowed. Physical therapy is usually initiated at this stage in order to regain range of motion and muscle conditioning.
- Phase 3 begins after 12 weeks when signs of clinical and radiographic healing begin to appear. This consists of a progressive return to sports after a follow-up MRI has been obtained.

4. Outcome assessment

A study conducted in 1999 by the French Society of Pediatric Orthopedics (SOFOP) defined the different outcomes of treatment of JOCD [8].

- The knee is said to be normal when it is free of pain, tenderness, and swelling. The lesion, as visualized on radiographs, must have either decreased in size or have

disappeared, without any evidence of intraarticular loose bodies or secondary osteoarthritis.
- The knee is said to be nearly normal if there is minimal pain or tenderness, with a persistent lesion on follow-up radiographs, without any cartilaginous damage.
- The knee is said to be abnormal if there is marked pain, gross joint effusion, a lesion >20mm in diameter, marked sclerosis, intraarticular loose body, or osteoarthritis.

Although radiographs are the primary diagnostic tool [11], an MRI of the knee is considered the mainstay in diagnosis as it allows a thorough assessment of the interface between the osteochondral fragment and the underlying bone [15,16].

Kramer's MRI-based grading system [17] (Table 1) has shown a high correlation to Guhl's arthroscopic grading system [18] (Table 2).

5. Indications

Even though many treatment modalities have been described for the management of JOCD, conservative treatment remains the preferred method.

5.1. Patient-dependent factors:

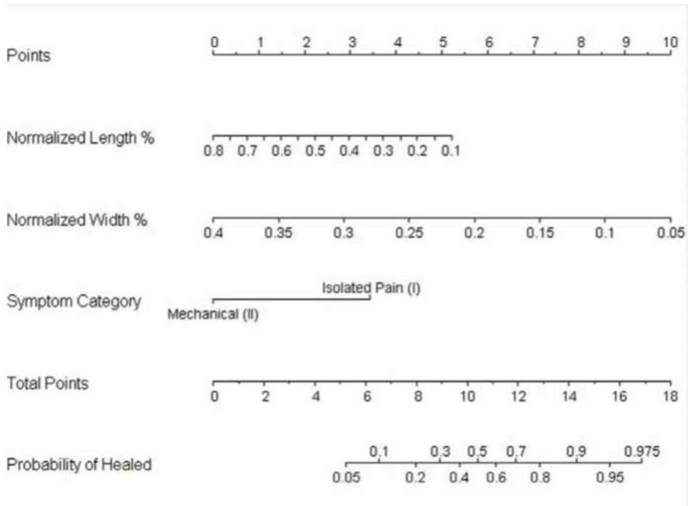
- Age, especially skeletal age: In patients with an open distal femoral physis, conservative treatment should be the preferred treatment modality [1,8,15,19,20,21]. Imminent closure of the physes (within 6 months of the initiation of management) is thought to be a factor of poor prognosis [21].
- Compliance of the patient, parent and surgeon to the treatment plan is indispensable [1,9,21], especially since cessation of physical activity for a minimum of 1 year may be extremely difficult for child athletes, especially elite athletes, to abide by. However, family members should be properly educated on the fact that conservative treatment often confers better outcomes than surgery, and that the duration of cessation of sports is not reduced by surgical intervention [21].
- The presence of functional signs (swelling, blocking) [9], which represent independent risk factors for the failure of functional treatment [10].
- Concomitant ipsilateral discoid meniscus [9,20].
- Delay between the start of symptoms and diagnosis (less or more than 6 months) [9,20].
- Body mass index [9].

5.2. Lesion-specific factors at the time of initiation of treatment:

- Lesion stability, or absence of tears of the articular cartilage (as evaluated on T1-weighted images in all 3 planes) [1,8,15, 20, 21]: Stability of the lesion is one of the primary factors dictating the expected outcomes after conservative treatment. In one multicentric study, poor outcomes of conservative treatment were found in 25% of all patients. However, at the moment of initiation of treatment, only 10% of the patients who had favorable expected outcomes and 45% of those who had unfavorable expected outcomes, ended up with unfavorable outcomes [8].

- The same study also showed that, when the expected outcome was favorable, conservative treatment showed better results compared than those treated surgically (10% vs 25% of abnormal knees, respectively). Inversely, when the expected outcome was unfavorable, surgical treatment yielded superior results (33% vs 44% of abnormal knees, respectively) [8].
  The International Cartilage Repair Society (ICRS) classification [22] categorizes 4 different groups with decreasing lesion stability (I to IV). From this classification, groups I and II have shown up to 78% of favorable outcomes when treated conservatively [23].
- Location of the lesion: The classic location (Intercondylar notch of the medial condyle) is a factor of good prognosis compared to other locations [7-9]. Patellar lesions generally carry the worst prognosis [9].
- Size of the lesion: although no clear consensus exists between authors on threshold values, the values cited by most studies would be around 12mm [20,21].

Nevertheless, MRI data should not be considered in isolation as an indication for surgical treatment [24-28] due to the high sensitivity but low specificity of this imaging modality [10,28]. By combining both clinical and imaging data, in 2018, Wall et al. [1] proposed an algorithm predicting the probability of healing of a given lesion, with excellent intra- and inter-rater reliability [29].



The size of the lesion is therefore a primary prognostic factor predicting the progression of the lesion. The normalized size of the lesion along with the importance of clinical symptoms may predict the probability of healing. The equation relies on the size of the lesion on T1-weighted images in both the coronal and sagittal planes, which is then normalized according to both the maximal width and length of the femoral condyles. Cut-off values were reported in this article as being between 200 and 290 mm^2.

6. Results

No significant differences have been reported in terms of final outcome between the different methods of conservative treatment [8]. Over 50% of lesions treated conservatively seem to heal within the first year [30], with some authors reporting healing rates of over 90% [31].

The primary goal of treatment is the relief of symptoms [7] with the use of crutches if necessary, and by respecting the 1-year period of sports cessation [32].

7. Conclusion

Conservative treatment in patients with JOCD is indicated in patients with:

- Open physes
- Classic locations (medial femoral condyle)
- Limited size of the lesion
- Fragment still attached to underlying bone (ICRS I or II)

Sports cessation, eventually accompanied by unloading of the limb (crutches) thereby leading to a pain-free life generally leads, within 1 year, to complete healing of the lesion [2,9,18].

Prematurely resorting to surgical fixation of the osteochondral fragment, especially in the absence of functional signs, must be avoided, even in cases where there is sequestration of the osteochondral lesion. In fact, the sequestrated fragment may eventually reincorporate underlying bone [3], thereby transforming from an isolated lacunar image to a sequestrum that ends up progressively incorporating.

The primary issue remains the determination of the stability of the lesion. Actual classifications based on MRI do not allow for the accurate determination of lesion stability.

References

1. Wall EJ, Vourazeris J, Myer GD, Emery KH, Divine JG, Nick TG, Hewett TE. The healing potential of stable juvenile osteochondritis dissecans knee lesions. J Bone Joint Surg Am. 2008 Dec;90(12):2655-64. doi: 10.2106/JBJS.G.01103.
2. Bruns J, Werner M, Habermann C.Osteochondritis Dissecans: Etiology, Pathology, and Imaging with a Special Focus on the Knee Joint. Cartilage. 2018 Oct;9(4):346-362. doi: 10.1177/1947603517715736. Epub 2017 Jun 22. Review.
3. Cahuzac JP, Mansat C, Clément JL, Pasquie M, Gaubert J. [The natural history of osteochondritis dissecans of the knee in children].[Article in French] Rev Chir Orthop Reparatrice Appar Mot. 1988;74 Suppl 2:121-4.
4. Green WT, Banks HH. Ostepchondritis dissecans in children J Bone Joint Surg. 1953 ; 35-A :26-47
5. Van Demark RE. Osteochondritis dissecans with spntaneous healing. J Bone Joint Surg. 1952 ; 34-A : 143-48
6. Clanton TO, DeLee JC.Osteochondritis dissecans. History, pathophysiology and current treatment concepts.Clin Orthop Relat Res. 1982 Jul;(167):50-64.
7. Cahill BR, Phillips MR, Navarro R.The results of conservative management of juvenile osteochondritis dissecans using joint scintigraphy. A prospective study.Am J Sports Med. 1989 Sep-Oct;17(5):601-5; discussion 605-6.
8. Hefti F, Beguiristain J, Krauspe R, Möller- Madsen B, Riccio V, Tschauner C, Wetzel R, Zeller R. Osteochondritis dissecans: a multicenter study of the European Pediatric Orthopedic Society. J Pediatr Orthop B. 1999 Oct;8(4):231-45

9. Andriolo L, Candrian C, Papio T, Cavicchioli A, Perdisa F, Filardo G Osteochondritis Dissecans of the Knee - Conservative Treatment Strategies: A Systematic Review..Cartilage. 2019 Jul;10(3):267-277. doi: 10.1177/1947603518758435. Epub 2018 Feb 22.
10. Yang JS, Bogunovic L, Wright RW. Nonoperative treatment of osteochondritis dissecans of the knee. Clin Sports Med. 2014; 33: 295-304
11. Nepple JJ, Milewski MD, Shea KG. Research in osteochondritis dissecans of the knee : 2016 update. J Knee Surg. 2016 ; 29 : 533-38
12. Jones MH, Williams AM. Osteochondritis dissecans of the knee: a practical guide for surgeons. J Bone Joint Surg. 2016: 98-B: 723-9
13. Tepolt FA, Kalish LA, Heyworth BE, Kocher MS. Non operative treatment of stable juvenile osteochondritis dissecans of the knee: effectiveness of unloader bracing. J Pediatr Orthop (B) 2019: 00-00
14. Kocher MS, Tucker R, Ganley TJ, Flynn JM. Management of osteochondritis dissecans of the knee: current concepts review. Am J Sports Med. 2006; 34: 1181-91
15. Jürgensen I, Bachmann G, Schleicher I, Haas H Arthroscopic versus conservative treatment of osteochondritis dissecans of the knee: value of magnetic resonance imaging in therapy planning and follow-up..Arthroscopy. 2002 Apr;18(4):378-86.
16. De Smet AA, Ilahi OA, Graf BK. Untreated osteochondritis of the femoral condyles: prediction of patient outcome using radiographic and PR findings. Skeletal radiol 1997; 26:463-7
17. Kramer J, Stiglbauer R, Engel A et al. MR contrast arthrography in osteochondrosis dissecans. J Comput Assist Tomogr. 1992; 16: 254-260
18. Guhl JF. Arthroscopic treatment of osteochondritis dissecans. Clin Orthop Relat Res. 1982; 167: 65-74
19. Green JP. Osteochondritis dissecans of the knee. J Bone Joint Surg. 48(B): 1966:82-91
20. Nakayama H, Iseki T, Kambara S, Yoshiya S. Analysis of risk factors for poor prognosis in conservatively managed juvenile osteochondritis dissecans of the lateral femoral condyle. Knee. 2016; 23: 950-54
21. Cahill BR, Ahten SM. The three critical components in the conservative treatment of juvenile osteochondritis dissecans (JOCD). Physician, parent, and child.Clin Sports Med. 2001 Apr;20(2):287-98, vi.
22. Brittberg M, Winalski CS. Evaluation of cartilage injuries and repair. J Bone Joint Surg. 2003 ; 85-A : 58-69
23. Ananthaharan A, Randsborg PH. Epidemiology and patient-reported outcome after juvenile osteochondritis dissecans in the knee. Knee. 2018 Aug;25(4):595-601.
24. Haeri Hendy S, de Sa D, Ainsworth K, Ayeni OR, Simunovic N, Peterson D. Juvenile Osteochondritis Dissecans of the Knee: Does Magnetic Resonance Imaging Instability Correlate With the Need for Surgical Intervention?.Orthop J Sports Med. 2017 Nov 14;5(11):2325967117738516.
25. Kijowski R, Blankenbaker D, Shinki K, et al. Juvenile versus adult osteochondritis dissecans of the knee: appropriate MR imaging criteria for instability. Radiology. 2008; 248: 571-78
26. O’Connor M, Palaniappan M, KhanN, et AL; Osteochondritis dissecanss of the knee in children: a comparison of MRI and arthroscopic findings. J Bone Joint Surg. 2002; 84: 258-62
27. Samora WP, Chevillet J, Adler B, et al. Juvenile osteochondritis dissecans of the knee: predictors of lesion stability. J Pediatr Orhtop. 2012; 32:1-4
28. Chen C, Liu Y, Chou P, et al. MR grading system of osteochondritis dissecans lesions: comparison with arthroscopy. Eur J Radiol. 2013; 82: 518-25

29. Uppstrom TJ, Haskel JD, Gausden EB, Meyer R, Shin YW, Nguyen JT, Green DW.Reliability of predictive models for non-operative healing potential of stable juvenile osteochondritis dissecans knee lesions. Knee. 2016 Aug;23(4):698-701.
30. Masquijo J, Kothari A. Juvenile osteochondritis dissecans (JOCD) of the knee: current concepts review. EFORT Open Rev. 2019 May 17;4(5):201-212. doi: 10.1302/2058-5241.4.180079. eCollection 2019 May
31. Sales de Gauzy J, Mansat C, Darodes P, et al. Natural course of osteochondritis dissecans inchildren. J Pediatr Orthop (B). 1999 ; 8 : 26-8
32. Cepero S, Ullot R, Sastre S. Osteochondritis of the femoral condyles in children and adolescents: our experience over the last 28 years. J Pediatr Orthop B. 2005 Jan;14(1):24-9.

Table 1: Kramer's MRI stages [17]

MRI Stages	Definition
I	Hypointense T1-weighted signals, irregularly outlined subchondral bone
II	Hypointense T1- and T2-weighted signals, clear delimitation of the lesion
III	Hypointense T1-, moderate hyperintense T2-weighted signals
IV	Hypointense T1-, evident hyperintense T2-weighted signals
V	Loose body within joint

Table 2: Guhl's arthroscopic stages [18]

Arthroscopic stages	Definition
I	Irregular and softened cartilage , no visible fragment
II	Breached articular cartilage, non-displaceable fragment
III	Breached articular cartilage, displaceable but still partially attached fragment
IV	Loose body within joint