OSTEOCHONDRITIS DISSECANS OF THE KNEE

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Osteochondritis dissecans (OCD) is a disorder of a joint that affects the subchondral bone and articular cartilage. The Research for Osteochondritis Dissecans of the Knee (ROCK) Group recently defined OCD as: "a focal idiopathic alteration of subchondral bone with risk for instability and disruption of adjacent articular cartilage that may result in premature osteoarthritis."

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The abnormal subchondral bone of an OCD lesion is referred to as the "progeny bone," and the normal surrounding bone is referred to as the "parent bone." While the knee is the most frequently affected joint, the elbow, ankle, shoulder, and hip can also be affected. In the knee, lesions occur most commonly within the lateral aspect of the medial femoral condyle. OCD can occur in children, adolescents, and adults, with juvenile OCD lesions having a better healing prognosis than adults.

OCD occurs more frequently in children and adolescents. A peak incidence was found in the adolescent age group of 19–29 per 100,000.[18] Generally, OCD seems to affect males more commonly than females (between 2:1 and 3:1).[18] However, as females and younger children participate in sports there has been an increased prevalence among girls and a younger mean age of OCD onset. In some cases, patients with OCD are at greater risk for developing early-onset osteoarthritis.[19]

Etiology/Patho-Anatomy

While the exact etiology is unknown, many theories have been proposed and studied. These theories include repetitive micro-trauma,[9] acute trauma,[16,24] inflammation,[15] disruption of normal endochondral ossification,[17] ischemia,[20] and genetic factors.[3] Some familial tendencies exist, but non-familial OCD is most prevalent. Repetitive micro-trauma is thought to be a leading cause of OCD.[9] This trauma could be caused by year round sports, early sports specialization, multiple sports in a single season or multiple teams in a single sport, and increased training intensity. Chronic repetitive microtrauma has been suggested to lead to a stress reaction within the subchondral bone.[4,14]

OCD can exist in many forms, but two major classifications exist: stable and unstable. The stable OCD lesion has intact articular cartilage, while unstable OCD (Figure 1) lesions may have compromised articular cartilage. In more advanced cases of OCD, the lesion can separate and form a loose body in the joint.

Studies have been performed to attempt to identify specific MRI findings that link the ability of OCD lesions to heal following non-operative treatment.

Evaluation

Anterior knee pain and variable amounts of intermittent swelling are typical complaints of patients with OCD of the knee. These complaints can progress to more persistent swelling or effusion, catching, locking, and/or giving way as the condition worsens. Unfortunately, pain and swelling are not always good indicators of unstable fragments or unstable lesions.

To characterize the lesion and physeal patency during an initial physical examination, standard weight-bearing radiographs of both knees are helpful.[14] The lateral view helps identify anterior-posterior lesion location and normal, benign accessory ossification centers in the skeletally immature knee. An axial view is helpful if a lesion of the patella or trochlea is suspected, and a "notch view" in 30 to 50 degrees of knee flexion may help identify the lesions of the posterior femoral condyle. OCD lesions of the knee are frequently found in the posterior 1/3 of the lateral aspect of the medial femoral condyle.

Figure 1. Medial femoral condyle OCD lesion in a 17 year old male football athlete.

Studies have been performed to attempt to identify specific MRI findings that link the ability of OCD lesions to heal following non-operative treatment.[7,25]

Nonoperative Treatment

For some stable OCD lesions, non-operative treatment can be utilized to promote healing in the subchondral bone and prevent chondral collapse, subsequent fracture, and crater formation. The skeletal maturity of the patient is a factor that can affect the efficacy of non-operative treatment.[14] Other factors are the size, stability, and location of the lesion. Lesions in the lateral condyle and trochlear groove area may have a worse prognosis for healing. For small stable lesions in skeletally immature patients with wide-open physes and no signs of instability on MRI, non-operative treatment is an option. This treatment option focuses on significant activity modification by limiting high impact activities.[4] A period of immobilization with bracing and protected weight bearing may be helpful. Non-operative treatment will typically be prescribed for three to six months. For those patients who fail non-surgical methods, surgical treatment to promote healing may be indicated. Skeletally mature patients with large lesions have a poor prognosis for healing with conservative management, and thus, surgical intervention may be warranted.[14]

Operative Treatment

Operative treatment may be considered for many patients, including those with unstable or detached lesions, those who

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have failed to heal with non-operative treatment, and for patients approaching skeletal maturity.[14] The purpose of operative treatment is to promote healing of subchondral bone, maintain joint congruity, and stabilize the progeny regions of bone and cartilage when possible. In some cases, salvage or cartilage supplementation procedures may be necessary to replace osteochondral defects with allograft or autograft based procedures.[21] The goal of successful operative treatment is to provide a stable construct of subchondral bone, and repair cartilage with viability and biomechanical properties equivalent to or similar to native hyaline cartilage.[14]

For stable OCD lesions with intact articular cartilage, arthroscopic subchondral bone drilling is an option (Figure 2). The intention of this drilling is to stimulate vascular ingrowth and subchondral bone healing (Figure 3). Subchondral bone drilling can be done two ways: trans-articular and retro-articular.[2,8,13] Trans-articular is accomplished by drilling directly through the articular cartilage and to the subchondral bone. The retro-articular technique drills the lesion from behind without traversing the articular cartilage.

If the OCD lesion is unstable and hinged or loose in the joint, fixation may be indicated.[12] Bone grafting may also be indicated to restore articular congruency.[1] The goal is to fix the osseous portion of the fragment to the normal bone to allow healing and stabilization of the overlying articular surface. Implants, either metallic or bio-absorbable, may be used in arthroscopic or open reduction and internal fixation of the fragment.[14] Complications associated with the use of hardware include implant migration, adjacent cartilage damage, and hardware fracture. Osteochondral plugs have recently been presented as a biologic alternative to the use of hardware. The plugs provide bone graft as well as fixation of the lesion.[11,22]

For full-thickness defects where fixation is not possible, several salvage techniques exist, including marrow stimulation techniques such as microfracture, autologous chondrocyte implantation, and osteochondral autograft transplantation.[10] However, the clinical outcome data is more limited in the adolescent population.

Figure 2. Lateral femoral condyle OCD lesion in a 13 year old female soccer athlete.

Figure 3. This patient was treated with trans-articular drilling. Her pain resolved within 2 months of surgery. MRI was obtained 3 months after drilling, which demonstrates significant healing of the OCD progeny bone lesion.

Clinical Research

In 2011, the AAOS published an evidence based clinical practice guideline for OCD of the knee.[5,6] This guideline demonstrated several areas that need future research for the treatment of OCD, and the ROCK research group has used this guideline to establish a research outline for this condition. Future research, including epidemiologic studies, development of validated classification systems, development of a clinical registry, and randomized clinical trials are current research foci of the ROCK Group.[23]

Conclusions

OCD is a condition that may be increasing in prevalence in the pediatric and adolescent population. OCD is associated with significant morbidity, recognized through an inability to participate in sports and a potential for early-onset osteoarthritis development. Several studies have demonstrated excellent healing both with and without surgery in some patient groups, although additional research will need to determine the most effective, evidence-based treatments for OCD of the knee.


References

1. Anderson AF, Lipscomb AB, Coulam C. Antegrade curettement, bone grafting and pinning of osteochondritis dissecans in the skeletally mature knee. *Am J Sports Med.* 1990;18(3):254-261.
2. Anderson AF, Richards DB, Pagnani MJ, Hovis WD. Antegrade drilling for osteochondritis dissecans of the knee. *Arthroscopy.* 1997;13(3):319-324.
3. Andrew TA, Spivey J, Lindebaum RH. Familial osteochondritis dissecans and dwarfism. *Acta Orthop Scand.* 1981;52(5):519-523.
4. Cahill BR. Osteochondritis Dissecans of the Knee: Treatment of Juvenile and Adult Forms. *J Am Acad Orthop Surg.* 1995;3(4):237-247.
5. Chambers HG, Shea KG, Anderson AF, et al. Diagnosis and treatment of osteochondritis dissecans. *J Am Acad Orthop Surg.* 2011;19(5):297-306.
6. Chambers HG, Shea KG, Anderson AF, et al. American Academy of Orthopaedic Surgeons Clinical Practice Guideline on: The Diagnosis and Treatment of Osteochondritis Dissecans. *J Bone Joint Surg Am.* 2012;94(14):1322-1324.
7. De Smet AA, Ilahi OA, Graf BK. Untreated osteochondritis dissecans of the femoral condyles: prediction of patient outcome using radiographic and MR findings. *Skeletal Radiol.* 1997;26(8):463-467.
8. Edmonds EW, Albright J, Bastrom T, Chambers HG. Outcomes of extra-articular, intra-epiphyseal drilling for osteochondritis dissecans of the knee. *J Pediatr Orthop.* 2010;30(8):870-878.
9. Fairbank HA. Osteochondritis dissecans. *British Journal of Surgery.* 1933;21(81):67-73.
10. Gudas R, Simonaityte R, Cekanauskas E, Tamosiunas R. A prospective, randomized clinical study of osteochondral autologous transplantation versus microfracture for the treatment of osteochondritis dissecans in the knee joint in children. *J Pediatr Orthop.* 2009;29(7):741-748.
11. Kobayashi T, Fujikawa K, Oohashi M. Surgical fixation of massive osteochondritis dissecans lesion using cylindrical osteochondral plugs. *Arthroscopy.* 2004;20(9):981-986.
12. Kocher MS, Czarnecki JJ, Andersen JS, Micheli LJ. Internal fixation of juvenile osteochondritis dissecans lesions of the knee. *Am J Sports Med.* 2007;35(5):712-718.
13. Kocher MS, Micheli LJ, Yaniv M, Zurakowski D, Ames A, Adrignolo AA. Functional and radiographic outcome of juvenile osteochondritis dissecans of the knee treated with transarticular arthroscopic drilling. *Am J Sports Med.* 2001;29(5):562-566.
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(7):1181-1191.
15. Konig F. [Ueber freie Korper in den Glenken]. *Zeiteschr Chir.* 1888;27:90-109.
16. Krappel F, E B, U H. Are bone bruises a possible cause of osteochondritis dissecans of the capitellum? A case report and review of the literature. *Arch Orthop Trauma Surg.* 2005;125(8):545-549.
17. Laor T, Zbojniewicz AM, Eismann EA, Wall EJ. Juvenile osteochondritis dissecans: is it a growth disturbance of the secondary physis of the epiphysis? *AJR Am J Roentgenol.* 2012;199(5):1121-1128.
18. Linden B. The incidence of osteochondritis dissecans in the condyles of the femur. *Acta Orthop Scand.* 1976;47(6):664-667.
19. Linden B. Osteochondritis dissecans of the femoral condyles: a long-term follow-up study. *J Bone Joint Surg Am.* 1977;59(6):769-776.
20. Linden B, Telhag H. Osteochondritis dissecans. A histologic and autoradiographic study in man. *Acta Orthop Scand.* 1977;48(6):682-686.
21. Micheli L, Curtis C, Shervin N. Articular cartilage repair in the adolescent athlete: is autologous chondrocyte implantation the answer? *Clin J Sport Med.* 2006;16(6):465-470.
22. Miniaci A, Tytherleigh-Strong G. Fixation of unstable osteochondritis dissecans lesions of the knee using arthroscopic autogenous osteochondral grafting (mosaicplasty). *Arthroscopy.* 2007;23(8):845-851.
23. Shea KG, Carey JL, Grimm NL, Jacobs JC, Jr. Making Clinical Practice Guidelines ROCK. *AAOS Now.* Vol 6: American Academy of Orthopaedic Surgeons; 2012.
24. Shea KG, Jacobs JC, Jr., Grimm NL, Pfeiffer RP. Osteochondritis dissecans development after bone contusion of the knee in the skeletally immature: a case series. *Knee Surg Sports Traumatol Arthrosc.* 2012.
25. Wall EJ, Vourazeris J, Myer GD, et al. The healing potential of stable juvenile osteochondritis dissecans knee lesions. *J Bone Joint Surg Am.* 2008;90(12):2655-2664.