Trends in the Surgical Management of Osteochondritis Dissecans of the Knee at a High-Volume Pediatric Hospital Network

Scott LaValva, BA[1,2]
Eileen Storey, BA[1]
James Carey, MD, MPH[2]
Kevin Shea, MD[3]
John Polousky, MD[4]
Theodore Ganley, MD[1,2]

[1]Department of Orthopedic Surgery, The Children's Hospital of Philadelphia, PA

[2]Perelman School of Medicine The University of Pennsylvania, Philadelphia, PA

[3]Department of Orthopaedics St. Luke's Clinic, Boise, ID

[4]Department of Orthopaedics and Sports Medicine Children's Health Andrews Institute, Dallas, TX

Introduction

Osteochondritis dissecans (OCD) in the skeletally immature patient has remained a challenging condition within the orthopedic community since its first description well over a century ago.[1] The etiology of OCD has yet to be fully elucidated, though several mechanisms have been proposed.[2-14] The disease has become an increasingly common cause of knee pain and dysfunction amongst adolescents,[15-17] thus necessitating treatment modalities that are effective in reducing symptoms and altering the progression of the degenerative process.[18,19] In general, operative treatment is indicated for stable lesions upon failure of conservative management and for detached or unstable lesions.

No universal consensus exists for the specific surgical method used as only limited high-quality clinical studies investigate the comparative effectiveness of different treatments. Therefore, many different surgical techniques are currently utilized by orthopedic surgeons in practice.[20] In this study, we aim to characterize the practice patterns of a single, high-volume cartilage surgeon treating exclusively pediatric patients at a single center over time. Specifically, we are interested in trends related to the specific drilling techniques for stable lesions and fixation methods for unstable lesions. We expect that this data may be helpful by 1) revealing the techniques utilized by a high-volume OCD surgeon, which may aid in treatment selection in the absence of high-quality clinical data to guide decision-making and 2) observing trends in operative technique over time, which may help identify factors in the primary literature that have contributed to observed changes.

Methods

Under the approval of the Institutional Review Board, a retrospective chart review was performed to analyze patients with a diagnosis of OCD who underwent surgical treatment from 2008 through 2015. These patients were identified by querying surgical logs using the surgical OCD Current Procedural Terminology (CPT) code, which yielded 419 patients. Exclusion criteria included non-knee OCD, an unclear OCD diagnosis and unclear operative reports with respect to surgical technique.

After applying exclusion criteria, 214 procedures were evaluated. Patient demographics, OCD lesion characteristics and specific surgical technique(s) were recorded using Research Electronic Data Capture Network (REDCap). One hundred and one subchondral bone drilling procedures were performed for stable, intact lesions on 93 patients (75 males, 18 females; mean age 13.87 +/− 2.11 years). Trends in internal fixation were similarly determined by identifying fixation procedures for unstable lesions. 16 procedures performed on 16 patients met these criteria (9 males, 7 females; mean age 14.88 +/− 1.09). These procedures for drilling and fixation were sorted by year and analyzed for the drilling technique or fixation method used.

Results

Drilling

Of the 101 procedures that were analyzed from 2008 through 2015, there was substantial variation in the drilling technique used to treat stable, intact OCD lesions of the knee (Figure 1). For drilling procedures that occurred during 2008 and 2009, 83.3% were treated with transarticular-only drilling while 10% were treated with transarticular/notch combined drilling (Figure 1B). Retroarticular and transarticular/retroarticular combined drilling were less common. In 2010 and 2011, transarticular/notch combined drilling became the most commonly performed technique at 79.5%. From 2012 through 2015, there was a slight rise in the proportion of lesions treated with transarticular-only drilling, but transarticular/notch drilling remained the most common technique (53.85%).

Internal Fixation

Compared to drilling procedures, there were significantly fewer total internal fixation procedures performed (Figure 2A). Throughout 2008 and 2009, all of the fixation procedures were performed with bioabsorbable headless compression screws (Arthrex) (Figure 2B). After 2009, bioabsorbable headless compression screws were not used for any of the fixation procedures that were performed. Instead, from 2010 through 2013, metal headless compression screws and suture fixation were the chosen

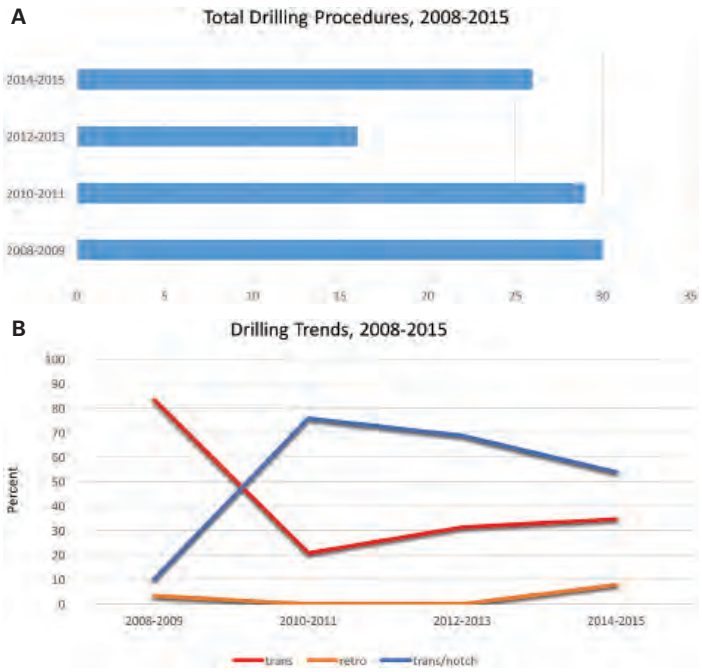

Figure 1. Total procedures performed **(A)** and trends in surgical technique by two-year period **(B)** from 2008 through 2015.

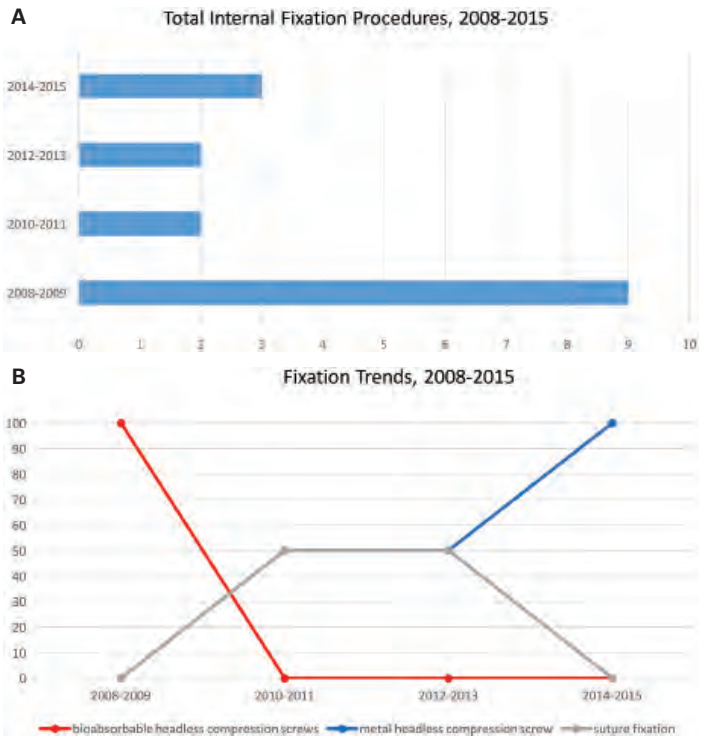

Figure 2. Total fixation procedures performed **(A)** and trends in fixation method **(B)** from 2008 through 2015.

methods, each accounting for 50% of the cases requiring fixation. By 2014-2015, 100% of the cases requiring fixation were achieved with metal headless compression screws.

Discussion

The most notable change in drilling technique from 2008 through 2015 was the sudden change in preference from transarticular-only drilling (83.3% in 2008-2009) to transarticular/notch combined drilling (75.9% in 2010-2011), which held until combined drilling became the preferred method in 2015 (53.85%) (Figure 1). With regard to internal fixation, the most significant change was the sudden switch from 100% of fixations achieved with bioabsorbable screws in 2008-2009 to 0% in 2010-2011 (Figure 2B). This trend continued through 2015, at which point the metal headless compression screws were the only method utilized to achieve fixation.

While it is difficult to predict what accounts for these changes in practice patterns, the formation of the Research in OsteoChondritis Dissecans of the Knee (ROCK) study group in 2009 resulted in a surge in collaborative work investigating the treatment of OCD of the knee,20-24 most notably the first AAOS Clinical Practice Guideline in 2010.18 The surgeon whose practice patterns have been analyzed in this study serves as an active participant and consumer of ROCK publications and meetings, which may have played a role in the difference in surgical management between 2008 (prior to the founding of the ROCK group) and 2015.

Limitations to the study include the small sample size, especially for internal fixation of unstable lesions. In addition, we were not able to account for specific contributing factors to operative technique, including exact lesion size, location, etc., given the limited sample size for each characteristic.

Conclusion

We have provided an analysis of surgical practice patterns in the management of osteochondritis dissecans (OCD) of the knee from a single, high-volume cartilage surgeon treating exclusively pediatric patients at a single center. The surgeon's preferred techniques shifted between 2008 and 2015, which may reflect his participation in the ROCK study group and the group's collaborative effort to improve OCD research and standardize optimal care. As of 2015, the most common drilling methods were transarticular/notch combined drilling and transarticular-only drilling for stable lesions and the most common internal fixation method for unstable lesions was with headless metal compression screws. However, the persistence of considerable variability in treatment highlights the need for further collaborative high-quality clinical studies.

References

1. F K. Ueber freie korper in den gelenken. *Dtsch Z Chir.* 1887;27:90-109.

2. Edmonds EW, Shea KG. Osteochondritis dissecans: editorial comment. *Clin Orthop Relat Res.* 2013;471(4):1105-1106.

3. F.M. C. Osteochondritis dissecans. Description of the stages of the condition and its probable traumatic etiology. *Am J Surg.* 1937;38(3):691-699.

4. Fairbanks H. Osteo-chondritis Dissecans. *Br J Surg.* 1933;21(81):67-82.

5. Grimm NL, Weiss JM, Kessler JI, *et al.* Osteochondritis dissecans of the knee: pathoanatomy, epidemiology, and diagnosis. *Clin Sports Med.* 2014;33(2):181-188.

6. Linden B. The incidence of osteochondritis dissecans in the condyles of the femur. *Acta Orthop Scand.* 1976;47(6):664-667.

7. Linden B. Osteochondritis dissecans of the femoral condyles: a long-term follow-up study. *J Bone Joint Surg Am.* 1977;59(6):769-776.

8. Ribbing S. The hereditary multiple epiphyseal disturbance and its consequences for the aetiogenesis of local malacias--particularly the osteochondrosis dissecans. *Acta Orthop Scand.* 1955;24(4):286-299.

9. Laor T, Zbojniewicz AM, Eismann EA, *et al.* Juvenile osteochondritis dissecans: is it a growth disturbance of the secondary physis of the epiphysis? *AJR Am J Roentgenol.* 2012;199(5):1121-1128.

10. Schenck RC, Jr., Goodnight JM. Osteochondritis dissecans. *J Bone Joint Surg Am.* 1996;78(3):439-456.

11. Richie LB, Sytsma MJ. Matching osteochondritis dissecans lesions in identical twin brothers. *Orthopedics.* 2013;36(9):e1213-1216.

12. Gans I, Sarkissian EJ, Grant S*F, et al.* Identical osteochondritis dissecans lesions of the knee in sets of monozygotic twins. *Orthopedics.* 2013;36(12):e1559-1562.

13. Bates JT, Jacobs JC, Jr., Shea KG, *et al.* Emerging genetic basis of osteochondritis dissecans. *Clin Sports Med.* 2014;33(2):199-220.

14. Yellin JL, Trocle A, Grant SF, *et al.* Candidate Loci are Revealed by an Initial Genome-wide Association Study of Juvenile Osteochondritis Dissecans. *J Pediatr Orthop.* 2015.

15. Chambers HG, Shea KG, Carey JL. AAOS Clinical Practice Guideline: diagnosis and treatment of osteochondritis dissecans. *J Am Acad Orthop Surg.* 2011;19(5):307-309.

16. Wall E, Von Stein D. Juvenile osteochondritis dissecans. *Orthop Clin North Am.* 2003;34(3):341-353.

17. Kessler JI, Nikizad H, Shea KG, *et al.* The demographics and epidemiology of osteochondritis dissecans of the knee in children and adolescents. *Am J Sports Med.* 2014;42(2):320-326.

18. 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.

19. Cahill BR. Osteochondritis Dissecans of the Knee: Treatment of Juvenile and Adult Forms. *J Am Acad Orthop Surg.* 1995;3(4):237-247.

20. Yellin JL, Gans I, Carey JL, *et al*. The Surgical Management of Osteochondritis Dissecans of the Knee in the Skeletally Immature: A Survey of the Pediatric Orthopaedic Society of North America (POSNA) Membership. *J Pediatr Orthop.* 2015.

21. Research in OsteoChonrdritis Dissecans (ROCK) study group. https://kneeocd.org/

22. Gunton MJ, Carey JL, Shaw CR, *et al*. Drilling juvenile osteochondritis dissecans: retro- or transarticular? *Clin Orthop Relat Res.* 2013;471(4):1144-1151.

23. Edmonds EW, Albright J, Bastrom T, *et al.* Outcomes of extra-articular, intra-epiphyseal drilling for osteochondritis dissecans of the knee. *J Pediatr Orthop.* 2010;30(8):870-878.

24. Carey JL, Grimm NL. Treatment algorithm for osteochondritis dissecans of the knee. *Clin Sports Med.* 2014;33(2):375-382.