Technical Note

Open Treatment for Unstable Osteochondritis Dissecans of the Knee: Autologous Bone Grafting and Bioabsorbable Fixation

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Abstract: Osteochondritis dissecans is a common osteochondral abnormality affecting the knee. In unstable lesions, the underlying bone can be significantly abnormal and necessitate treatment. Although many techniques exist, we favor an open surgical approach to ensure that the bone is properly managed. Autologous bone graft can easily be obtained locally and used to restore the bony architecture. The subsequent use of bioabsorbable implants provides a robust means of fixation that allows for single-stage surgery. This Technical Note describes a straightforward but reliable approach to a challenging pathology.

Osteochondritis dissecans (OCD) is an osteochondral abnormality encountered in adolescent and young adult populations in which a portion of subchondral bone is disturbed and separated from its surrounding environment. The underlying pathophysiology is not clear but may have contributions from traumatic, genetic, inflammatory, and vascular causes.[1-3] The most common site of OCD lesions is the knee, particularly the medial femoral condyle, accounting for 60% of cases.[4] Although nonoperative management is appropriate initially for stable lesions, surgical intervention is frequently required for lesions that are unstable or refractory to conservative treatment, which may represent 35% to 70% of cases.[4,5] The pathology can be challenging, but when these lesions are addressed operatively, attention to the subchondral bone is critical to success.[6-9] The purpose of this article is to highlight straightforward steps to address both the osseous scaffold and articular surface to stimulate healing.

Surgical Technique

Setup

Representative preoperative imaging is shown in Fig 1. Anesthesia typically involves a single-shot adductor canal block. The patient is positioned supine on a standard operating table. The ipsilateral leg is placed into a limb positioner for the knee (Spider2; Smith & Nephew, Andover, MA) (Fig 2). The contralateral limb is placed into a padded well-leg holder, and the foot of the bed is dropped. This setup allows for freedom of position of the limb without assistance, as well as space for both the surgeon and assistant to stand on either side of the knee.

Technique

Video 1 details our approach to these cases. A vertical incision is made from the inferior patella to the medial aspect of the tibial tubercle. Diagnostic arthroscopy is performed through portals made beneath skin flaps. Any concomitant pathology is addressed at this time. We then proceed with a medial parapatellar arthrotomy. The extent of the incision is dictated by the required exposure—for a lesion on the extension surface of the medial femoral condyle, a fairly small incision can typically be used. A dual Z-retractor (Zimmer, Warsaw, IN) is then placed in the medial gutter, and a sharp, 90° Hohmann retractor is placed in the notch.

The lesion is identified, and the border is circumferentially marked (Fig 3). Although the border of an

Fig 1. Preoperative imaging in a 14-year-old male patient. (A) Imaging obtained 4 years earlier for an unrelated reason does not show an osteochondritis dissecans lesion. (B) Standing anteroposterior view. (C) Standing Rosenberg view. (D) Measurement of long-leg alignment. Magnetic resonance imaging with representative sagittal (E) and coronal (F) cuts showing the large size (27 mm anteroposterior × 22 mm medial-lateral) and extensive bony involvement. (L, left.)

unstable lesion is often clear, some lesions can appear fairly normal on the surface. In these cases, a freer elevator is used to palpate the sulcus between the normal adjacent cartilage and the lesion. If a portion of the cartilage is intact, a No. 15 blade scalpel is used create a smooth, vertical circumference around the lesion while a lateral hinge is left intact. The freer is then used to gently elevate the fragment and leave it hinged toward the notch.

Given that the bone is an important aspect of the underlying pathology, it is critical to evaluate bone both on the underside of the fragment and in the lesion bed. Careful debridement is then undertaken. On the fragment side, a rongeur and curette are used to allow for control and to avoid injury to the cartilage. Care is taken to remove fibrous tissue and expose healthy bone but not to damage the fragment. For the bone bed, a high-speed spherical burr (CORE machine; Stryker, Kalamazoo, MI) is used under constant irrigation via the arthroscopy inflow tubing, and after each pass, the base is inspected. Once there is normal, bleeding bone throughout, the debridement is complete. We do not favor microfracture of the base given that this has already been debrided back to healthy bone and any holes could affect implant fixation security.

The fragment is then replaced into its native position and assessed. If minimal to no bone was removed and the fragment sits flush with the adjacent cartilage, we

Fig 2. Operative setup showing the involved side in a limb positioner for the knee viewed from the side (A) and front (B). This setup uses the standard Spider2 positioner along with a sterile, padded boot (#) and sterile attachment (*) to allow for free and unassisted knee positioning.
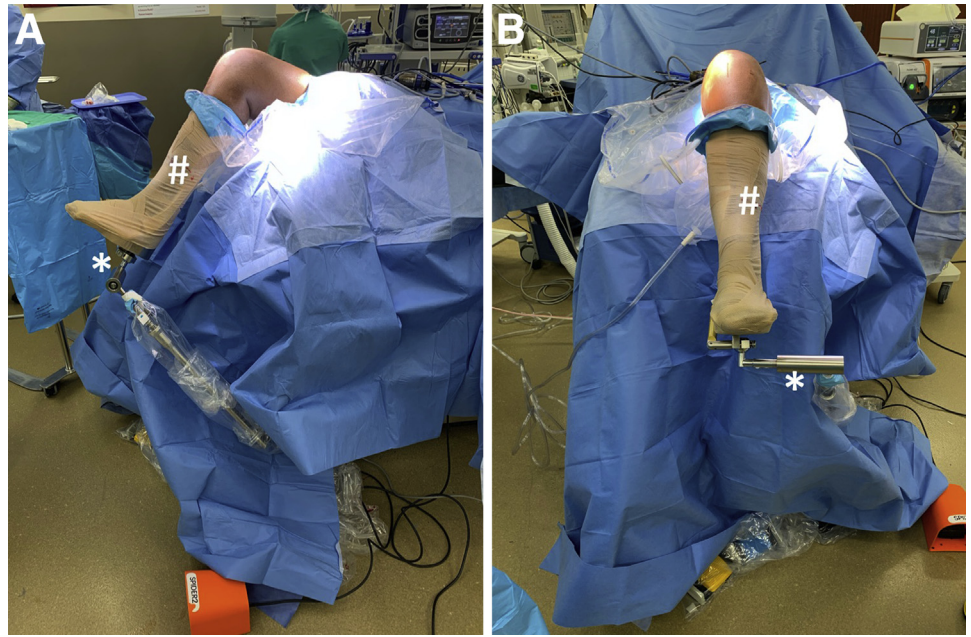
proceed with fixation. However, unstable OCD lesions with extensive bony involvement often require enough bone to be removed that the fragment then sits in a countersunk position. In this case, we proceed with autologous bone grafting.

Harvesting bone graft is performed locally from the medial aspect of the tibial metaphysis proximal to the pes anserinus insertion. For skeletally immature patients, the physis must be accounted for. A mini C-arm can be used intraoperatively. Alternatively, the location of the physis can be noted preoperatively on magnetic resonance imaging by measuring the distance from the medial tibial plateau; 10 mm is then added to this intraoperatively to provide a margin for error. A square window is planned with 1-cm sides, and electrocautery is used to incise 3 sides of the periosteum, leaving the posterior side intact. A handheld micro-sagittal saw (CORE machine) with a 9-mm blade is used for unicortical penetration of the same 3 sides. A quarter-inch curved osteotome is used to elevate the cortical flap, leaving the posterior hinge intact. A curved curette is ideal for graft harvest. In cases of open physes, care must be taken to only direct the curette distally. All bone then underwent fine morcellation.

We proceed with grafting into the base of the lesion. Graft is placed in the defect and lightly impacted with a tamp. We frequently reassess the fragment position throughout this process to anatomically restore the underlying bone bed. As the fragment is replaced, thumb pressure is applied to provide a sense of the anticipated position once compression fixation is in place. We carefully evaluate the fragment from multiple angles to see where it is countersunk and, accordingly, where more graft is required. The fragment must be circumferentially flush with the adjacent cartilage prior to proceeding with fixation.

With the fragment in anatomic position, fixation points are planned and marked. Our guiding principle is to use screws as the primary fixation on the portions of the fragment that contain bone because these provide the best compression and stability. However, some OCD fragments are chondral only—in these cases, we prefer a combination of dart fixation and circumferential suturing. The fragment is provisionally stabilized with 0.028-inch K-wires in the anticipated dart positions. Fixation is undertaken with 3.0-mm BioCompression screws (Arthrex, Naples, FL) that are countersunk 2 to 3 mm below the chondral surface. The K-wires are then sequentially removed and replaced in the same holes by 1.3-mm Chondral Darts (Arthrex). Given that the diameter of the K-wires is less than that of the drill for the darts, we have found this to be an efficient way of avoiding unnecessary holes. Stability is then assessed, which is admittedly somewhat subjective. If extra fixation is warranted, No. 4-0 Polysorb suture (Covidien, Minneapolis, MN) is placed circumferentially in simple fashion. The borders and screw holes are then covered with Tisseel fibrin glue (Baxter, Deerfield, IL) and allowed to dry for 5 minutes.

The knee is gently taken from extension into full flexion, and the repair is re-evaluated. Assuming the fragment is stable, we proceed with extensive irrigation and closure.
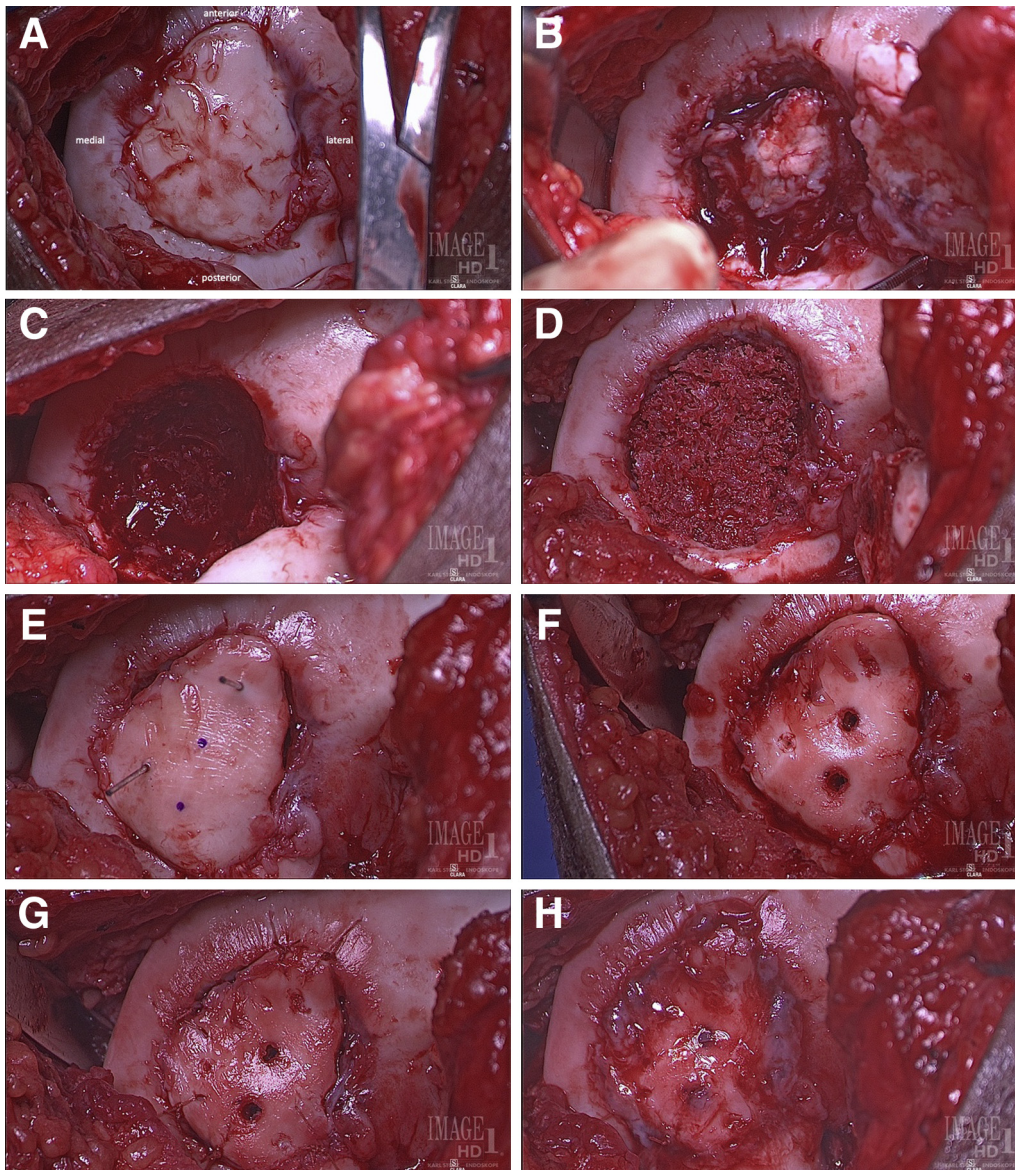
Fig 3. Intraoperative open treatment images of left knee from patient in Fig 1. (A) Osteochondritis dissecans lesion. (B) After the lesion is elevated, fibrinous tissue is seen in the base. (C) Base of lesion after debridement back to bleeding bone. (D) Bony base restored with autologous bone graft. (E) Provisional fixation with 0.028-inch K-wires. (F) Bioabsorbable repair with 2 screws and 4 darts (Arthrex). (G) Peripheral augmentation with No. 4-0 Polysorb suture. (H) Final repair construct after application of Tisseel fibrin glue.

Postoperative Protocol

A hinged knee brace is used at all times—locked in extension for walking or sleeping and unlocked at rest. Initial motion is 0° to 30° for the first 2 weeks and then advanced 15°/wk. Continuous passive motion is used for the first 6 weeks. Weight bearing is maintained at toe touch (20%) for 6 weeks and is advanced to 50% for 2 weeks and then full weight bearing at 8 weeks. Impact activity is avoided until 5 to 6 months postoperatively, and formal return to sport typically occurs between 8 and 12 months after appropriate milestones are met.

Postoperative radiographs are typically obtained around 8 to 9 months (Fig 4) to show final bony healing prior to return to sport.

Discussion

An intact chondral surface and structurally sound underlying bony architecture are critical to normal knee function. Unfortunately, both can be compromised in OCD, often with the bone disproportionately affected. Intraoperatively, thorough evaluation of the lesion necessitates attention to both structures.
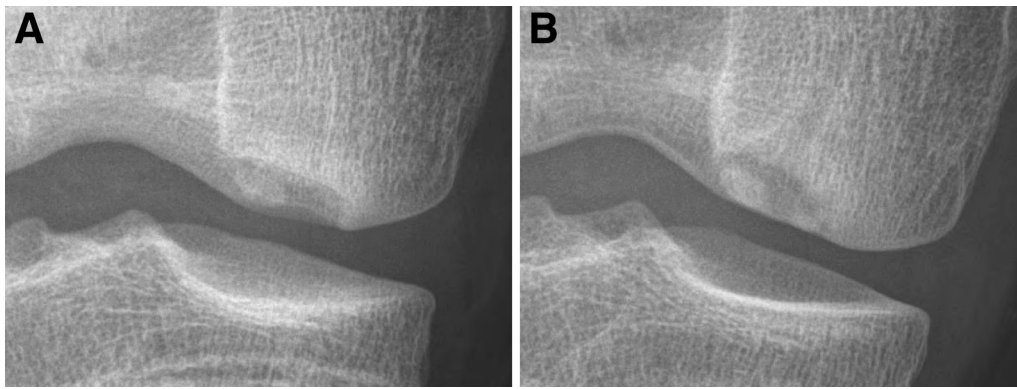
Fig 4. Preoperative (A) and postoperative (8 months) (B) radiographs of a 15-year-old male patient. Although the outline of the osteochondritis dissecans lesion remains visible, the underlying bony contour is notably improved.

Certainly, this has been described successfully arthroscopically.[10,11] However, in cases in which the bone is significantly involved on preoperative magnetic resonance imaging, we advocate an open approach to achieve optimal visualization and bone grafting (Table 1). Other authors have noted the importance of autologous graft in this setting and have shown good results in terms of bony healing, outcome scores, and return to activity.[9,12,13]

Fixation is at the surgeon's discretion because numerous methods have been associated with successful clinical outcomes using either headless metal screws[8,9,14] or bioabsorbable screws.[15-17] Because polymers have improved over time, we favor bioabsorbable implants given that these allow for single-stage surgery and minimize the risk of damage to the opposing chondral surface prior to screw removal. Augmentation with absorbable suture and glue can also be advantageous in scenarios in which extra fixation is warranted. We believe that this technique assimilates advancements in implant technology with comprehensive debridement and restoration of the articular and subchondral surfaces.

In conclusion, unstable OCD lesions are challenging, particularly when the underlying bone is involved. Many surgical techniques exist; however, we believe the bone must be meticulously managed when necessary. In such cases, we favor an open technique that allows for thorough debridement with autologous bone grafting. Fixation is surgeon specific, although our preference is for a single-stage procedure with bioabsorbable implants tailored to the nature of the lesion.

Table 1. Pearls and Pitfalls

Pearls
    The Spider2 limb positioner offers tremendous freedom of movement of the knee without an assistant.
    The Z-retractor is an excellent tool to place in the gutter to help with visualization and avoid injuring the condyle.
    Proper identification of the OCD lesion border is critical if not readily visible. The blunt end of a freer elevator is an excellent tool to palpate and outline this border.
    During bony debridement, the surgeon should carefully evaluate the bone on both sides of the OCD lesion and debride back to healthy bone as necessary.
    When harvesting bone graft, often more is required than one might anticipate.
    Bone graft must undergo fine morcellation to fill the defect without creating an irregular surface.
    Use of bioabsorbable screws necessitates the entire depth to be tapped to avoid undue stress on the screw during insertion.
    For bioabsorbable dart placement, the guide must be held very still because the implant has quite a small diameter—otherwise, there is a risk of fracturing the implant.
Pitfalls
    The physis is at risk when making the cortical window and harvesting graft. This must be accounted for both preoperatively and intraoperatively.
    Damage to the OCD fragment must be avoided—extreme care should be exercised if debriding bone on the backside of the fragment itself.
    Lack of adequate bone grafting is a potential error. The surgeon should harvest and place as much graft as is necessary to allow the OCD fragment to sit flush with the adjacent cartilage.
    The surgeon should avoid placing too much fibrin glue because this can adhere to or catch on surrounding structures—only a thin layer is required. Trimming can be performed as necessary with small scissors (Iris or Stevens) after the glue dries.

NOTE. Unique advantages and pearls for technical success, as well as potential risks to be mindful of when performing this open technique, are listed.
OCD, osteochondritis dissecans.

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