Technical Note

Technique of Arthroscopically Assisted Transtrochanteric Drilling for Femoral Head Chondral Defects

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Abstract: Microfracture is a marrow-stimulation technique in which damaged cartilage is drilled or punched, perforating the subchondral bone and generating a blood clot within the defect that matures into fibrocartilage. Microfracture for the treatment of small cartilage defects of the hip has shown good results. Arthroscopic procedures are less invasive than open procedures and have a reduced incidence of complications such as infection or avascular necrosis of the femoral head. Furthermore, arthroscopic procedures allow for a shorter recovery time, resulting in not only lower overall treatment costs but also higher patient satisfaction. Medial and parafoveal cartilage defects of the femoral head can be challenging to effectively microfracture using standard arthroscopy portals because of the acute angles required for instrument manipulation. This report describes a technique for microfracturing these challenging areas of the femoral head using a 2.7-mm K-wire and drilling in a transtrochanteric direction using arthroscopic and imaging guidance to target the area of chondral damage.

Chondropathies of the acetabulum and femoral head not only are a frequent cause of pain and functional limitation but also, if not adequately treated, may progress to joint arthrosis.[1] Arthroscopic or open approaches may be used to access the area of chondral damage. Open approaches often require a surgical hip dislocation, which has an increased risk of infection and avascular necrosis of the femoral head, in addition to increased recovery time and longer hospitalization.[2] Surgical techniques available for the repair of chondral defects include debridement, microfracture, autologous chondrocyte implantation, and osteochondral transplantation.[3] Chondroplasty is the treatment of choice for partial-thickness defects with the aim of debriding the defect to remove any damaged cartilage and creating a smooth surface.[1] Microfracture is the standard of care for full-thickness chondral defects.[1] Microfracture involves drilling or punching the cartilage defect to penetrate the subchondral bone so that blood and bone marrow are released into the defect, initiating repair with fibrocartilage.[4]

The techniques of microfracture in the hip have largely been extrapolated from the knee literature.[5-7] The indications have largely been derived from the knee and include focal and contained lesions, usually less than 4 cm in size.[6] The technique is easy to perform, is cost-effective, and has produced good clinical results in the hip in the absence of osteoarthritis, with no significant complications reported.[5]

The technical challenges of microfracture involve the location of cartilage defects. Acetabular-sided defects are usually easier to instrument than femoral-sided defects through standard arthroscopy portals. The sphericity of the femoral head has led to difficulties in accessing cartilage defects with microfracture awls or drills through standard arthroscopy portals. The purpose of this report is describe a technique and its associated pearls, pitfalls, and indications to allow effective access to microfracture such areas on the femoral side.

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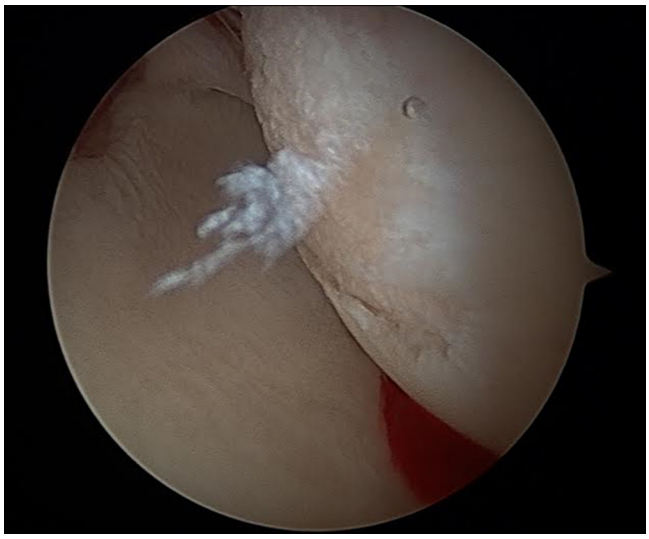

Fig 1. Parafoveal femoral head chondral lesion measuring less than 4 cm debrided to stable rim.

Technique

Patient Setup

The patient is placed supine on a hip traction table with the feet secured in well-padded boots and a large well-padded perineal post abutting the medial thigh. The operative extremity is placed in neutral abduction and slight flexion, with 15° of internal rotation of the foot. The operative extremity is prepared and draped in standard fashion. Safe access to the hip joint to minimize damage to the labrum and femoral head is performed as previously described by Domb et al.[8] Anterolateral and modified anterior portals are established. The surgeon performs a capsulotomy with a beaver blade, incising the capsule parallel to the acetabular rim from the 12- to 3-o'clock position, connecting the 2 portals. A diagnostic arthroscopy is performed consisting of a circumferential examination of the entire labrum and central compartment.

Assessment of Cartilage Defects

Cartilage defects are classified on the acetabular side using the acetabular labrum articular disruption[9] and Outerbridge[10] grading systems. The acetabular labrum articular disruption classification is as follows: grade 1, softening of adjacent cartilage; grade 2, early peeling of cartilage (carpet delamination); grade 3, large flap of cartilage; and grade 4, loss of cartilage. The Outerbridge classification is as follows: grade 0, normal cartilage; grade 1, cartilage with softening and swelling; grade 2, partial-thickness defect with fissures on the surface that do not reach the subchondral bone or exceed 1.5 cm in diameter; grade 3, fissuring to the level of the subchondral bone in an area with a diameter greater than 1.5 cm; and grade 4, exposed subchondral bone. Cartilage defects on the femoral side are graded according to the Outerbridge classification. The location of cartilage defects is documented according to the clock-face notation for both the acetabulum[11] and femur.[12]

Table 1. Indications and Contraindications for Arthroscopically Assisted Transtrochanteric Microfracture for Femoral Head Chondral Defects

Indications
Femoral head chondral defect measuring <4 cm^2
Femoral head chondral defect in parafoveal or medial region of head
Contraindications
Patient cannot comply with postoperative weight bearing
Patient has osteoarthritis
Patient has systemic inflammatory arthritis

Arthroscopic and Image-Guided Transtrochanteric Drilling of Femoral Cartilage Defect

A chondrotome is used to debride the cartilage defect to a stable rim once it has been graded and sized and the location has been documented (Fig 1, Video 1). The indication for transtrochanteric drilling is a defect measuring less than 4 cm^2 within the parafoveal region of the femoral head that cannot be easily accessed with angled awls (Table 1). An assistant holds the arthroscope with the cartilage defect centered in the field of view. A malleable hooked flexible instrument (e.g., EFLEX TAC-S [Smith & Nephew, Memphis, TN]) is curved before placing it into the hip joint to allow passage around the femoral head and to allow the hook to sit in the center of the cartilage defect (Fig 2). A 2.7-mm guidewire is positioned on the skin in the anteroposterior plane, and a line is drawn to determine an appropriate entry point on the lateral femoral cortex. A stab skin incision in made through the skin and fascia, and the guidewire is advanced to triangulate

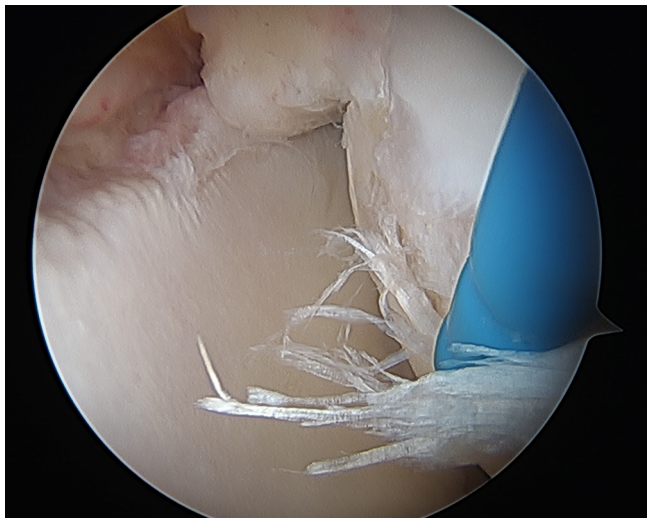

Fig 2. Center of chondral lesion localized with tip of hooked instrument.

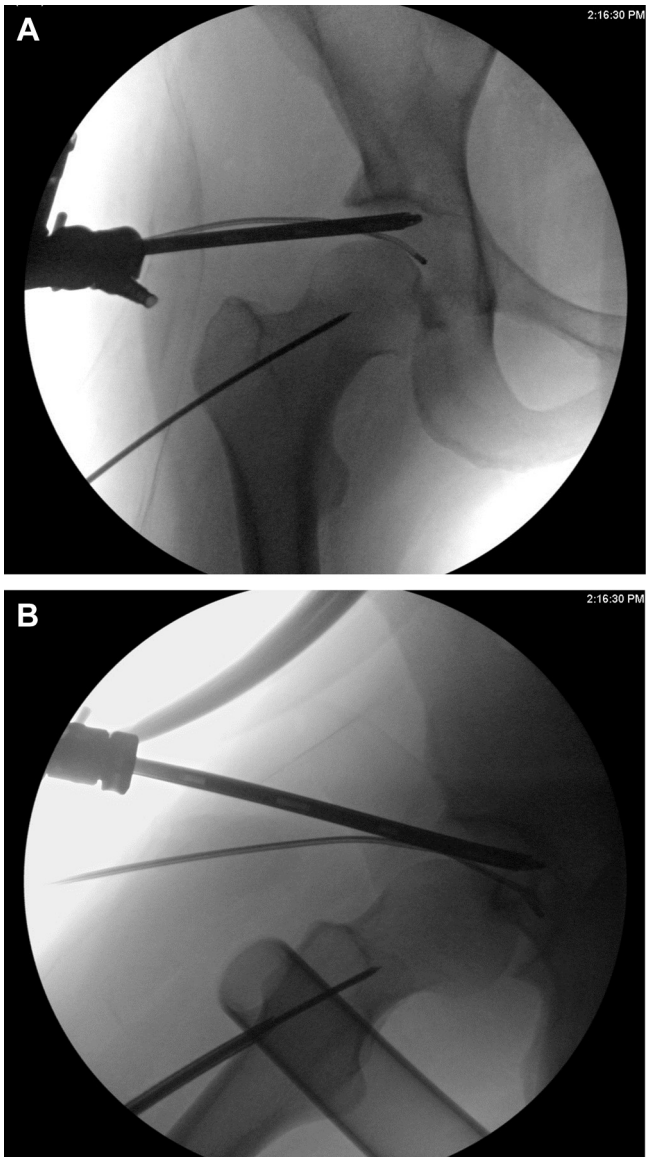

Fig 3. Trajectory of guide pin verified under fluoroscopy on anteroposterior and lateral images.

with the hook of the probe centered on the cartilage defects. Advancement of the guidewire is confirmed on anteroposterior (Fig 3A) and lateral (Fig 3B) fluoroscopic images to ensure correct orientation in both planes before exiting the femoral head. Multiple passes are made with the wire to ensure drilling of most of the cartilage defect (Fig 4).

Postoperative Rehabilitation

For the first 2 weeks, the patients are placed in a hip brace (DJO Global, San Diego, CA) with limited range of motion from 0° to 90° of flexion at all times. Patients are non–weight bearing for the first 8 weeks, and they are limited to 20 lb of partial weight bearing on the operative extremity. All patients start physical therapy on the first postoperative day to initiate range of motion. This is accomplished by using a continuous passive motion machine for 4 hours per day or a stationary bike for 2 hours per day. At 2 weeks postoperatively, the brace is discontinued with emphasis on range-of-motion exercises. At 8 weeks postoperatively, the patients start gradually increasing their weight bearing to full weight bearing.

Discussion

We have described a technique for arthroscopically assisted transtrochanteric microfracture for femoral head chondral defects. Indications for the technique are full-thickness cartilage defects and unstable cartilage flaps measuring less than 4 cm^2 in areas that are difficult to instrument with microfracture tools through standard hip arthroscopy portals. These areas commonly include the parafoveal region and the medial femoral head. Contraindications for the technique are patients who are unable to comply with postoperative weight-bearing restrictions, osteoarthritis, or systemic immune-mediated diseases. The technique is technically feasible, has no reported adverse events, and leaves additional treatment options available to the patient with persistent pain (Table 2).

Microfracture relies on recruiting marrow factors that promote fibrocartilage to replace damaged hyaline cartilage.[1] Most of the research published on microfracture has been conducted on the knee, with full benefits usually not seen for a minimum of 6 to 12 months and continued improvement lasting up to 2 years.[5-7] Philippon et al.[13] reported on 9 patients who underwent second-look arthroscopy with a previous microfracture for acetabular chondral defects. The mean percent fill of the defect was 91%, with good-quality cartilage at a mean of 20 months. Byrd and Jones[14] reported on 207 patients treated

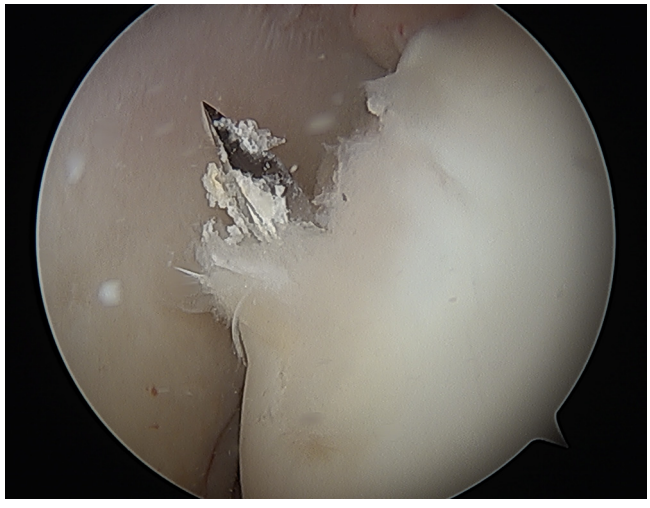

Fig 4. Arthroscopic confirmation that chondral defect is perforated by K-wire.

Table 2. Pearls and Pitfalls for Arthroscopically Assisted Transtrochanteric Microfracture for Femoral Head Chondral Defects

Pearls
Localize the center of the chondral defect with the tip of a malleable hooked instrument.
Localize the entry point on the anteroposterior radiograph such that the 2.7-mm guidewire aims for the tip of the hooked instrument.
Alternate between anteroposterior and lateral images to ensure that the trajectory of the guidewire is in line with the defect.
Confirm the exit of the guidewire by arthroscopy.
Pitfalls
Not centering the chondral lesion on the screen
Placing the tip of the hooked instrument eccentrically on the chondral defect
Not confirming the correct trajectory of the 2.7-mm guidewire while alternating between anteroposterior and lateral fluoroscopy

arthroscopically for cam-type femoroacetabular impingement, of whom 58 patients, who had grade 4 chondral defects of the acetabulum, underwent microfracture. In patients who received microfracture, the modified Harris Hip Score improved an average of 20 points, from 65 points preoperatively to 85 points postoperatively. Karthikeyan et al.[15] reported on 20 patients who underwent second-look arthroscopy after the index procedure involving microfracture for acetabular defects. At an average time of 17 months for the second surgical procedure, the mean percent fill was 96% for the chondral defect, and the mean Non-Arthritic Hip Score improved by 23.5 points at 21 months.

In comparison with microfracture of acetabular defects, there is a paucity of literature on the outcomes after microfracture of femoral head chondral defects. Philippon et al.[13] reported that 9 of 47 patients who underwent microfracture of both the femoral head and the acetabulum were statistically more likely to require a total hip arthroscopy than patients who only underwent microfracture on 1 side of the joint. Khanna et al.[16] presented the results of 17 patients treated with a surgical hip dislocation and osteochondral allograft for chondral defects of the femoral head. At a mean follow-up of 41.6 months, 13 patients had a fair to good outcome, 1 patient required revision surgery, and 3 patients required a total hip arthroplasty. However, compared with open procedures, arthroscopic techniques result in less blood loss, shorter hospitalization, and easier visualization of intra-articular pathology, without trochanteric osteotomy.[2]

In conclusion, our technique of arthroscopically guided transtrochanteric drilling of femoral chondral defects allows access to areas that are difficult to instrument with microfracture tools through standard hip arthroscopy portals and reduces the risks associated with open intervention to treat these lesions. The technique has no reported adverse outcomes and, when indicated, may help improve outcomes after hip arthroscopy for patients with femoral chondral defects.

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