

# Arthroscopic Fixation of Knee Osteochondritis Dissecans With Interlinked Knotless All-Suture Anchors



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**Abstract:** Unstable, displaced, and persistently symptomatic osteochondritis dissecans of the knee typically requires surgical treatment. An arthroscopic, knotless fixation method using interlinked all-suture anchors is presented, with potential advantages over other current techniques in fixation over a broad zone, treatment versatility for a wide range of fragment types, retensioning ability after stressing, decreased risk of implant-breakage complications, and avoidance of additional surgery for implant removal.

## Introduction

The etiology of osteochondritis dissecans (OCD) remains unknown, but it is typically considered as a combination of multiple factors, including repetitive microtrauma, ischemia, and developmental disturbance, resulting in the separation of an osteochondral fragment, ranging from subtle subchondral instability with intact overlying cartilage to complete detachment and loose body formation.<sup>1</sup> Overall incidence of knee OCD is 9.5/100,000, and 15.4/100,000 and 3.3/100,000 for male and female patients, respectively.<sup>2</sup> In the knee, most cases are located in the medial femoral condyle (66.2%), followed by the lateral femoral condyle (18.1%), trochlea (9.5%), patella (6.0%), and lateral tibial plateau (0.2%).<sup>3</sup>

While stable OCD lesions with intact articular cartilage are often treated conservatively with success, especially in skeletally immature patients, unstable, displaced, or persistently symptomatic OCD lesions typically require surgical treatment for stabilization and healing facilitation. Techniques include fixation with

metal screws that may require staged removal, bio-absorbable screws or chondral darts, or microfracture and osteochondral grafting for irreparable fragments or if articular cartilage is no longer in satisfactory condition.<sup>4</sup>

We present a technique for arthroscopic knee OCD fragment fixation using knotless all-suture anchors that may offer advantages over other current techniques.

## Surgical Technique

### Indications

Arthroscopic OCD fixation is indicated in patients with an unstable or detached but reducible OCD fragment, or with an intact OCD fragment that has remained symptomatic despite conservative treatment.

### Patient Evaluation and Imaging

Patients typically report pain with activities roughly localizing to the lesion area. In unstable or detached lesions, catching and locking may be reported.

Preoperative radiographs and magnetic resonance imaging (MRI) demonstrate the location, dimension, and stability status of the OCD fragment, and possibly other intra-articular abnormalities (Fig 1). MRI arthrogram can help assess the articular cartilage condition and demonstrate subtle OCD fragment detachment.

### Patient Positioning, Initial Arthroscopic Assessment, and Base Preparation

Prepare the patient in a supine, standard knee-arthroscopy setup. Standard arthroscopy through

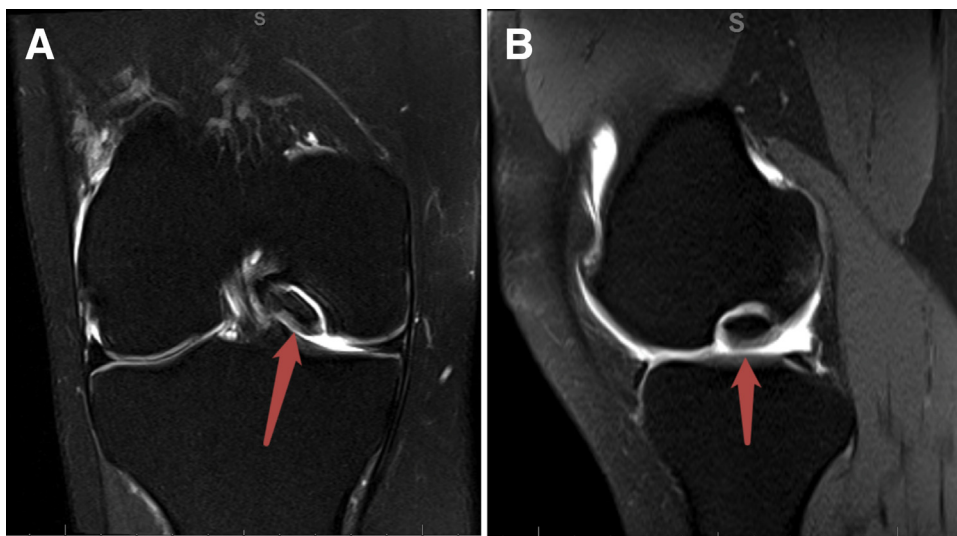
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**Fig 1.** Coronal (A) and sagittal (B) views, magnetic resonance imaging (MRI) arthrogram of right knee, demonstrating the osteochondritis dissecans fragment (arrow) in the lateral aspect of the medial femoral condyle, with contrast fluid presence between the fragment and condyle indicating the fragment is physically detached.

anterolateral and anteromedial portals is performed, and concurrent pathology is addressed.

Assess the OCD fragment for cartilage and bone condition, dimension, stability, and reducibility (Fig 2). Prepare the base with a motorized shaver, curette, and/or microfracture pick, to enhance healing at the fragment/base interface. Provisionally reduce the OCD fragment to the base, and assess its orientation and reduction.

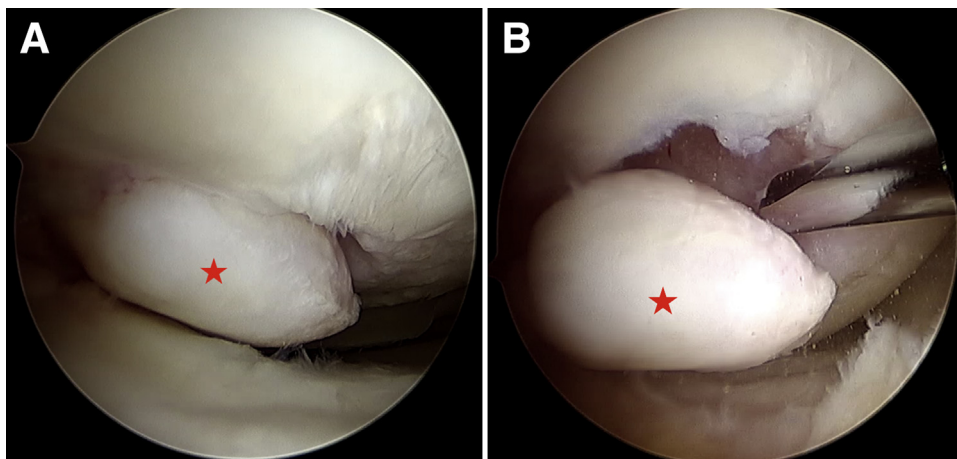
#### OCD Fragment Fixation

Place an arthroscopic cannula in the anterolateral portal to facilitate suture handling. Introduce the curved drill guide for the 1.8-mm diameter flexible drill for an all-suture knotless anchor (1.8 Knotless FiberTak, Arthrex, Naples, FL) through the anterolateral portal, place it on the fragment to hold it in reduction, to prepare for the first anchor placement (Fig 3A).

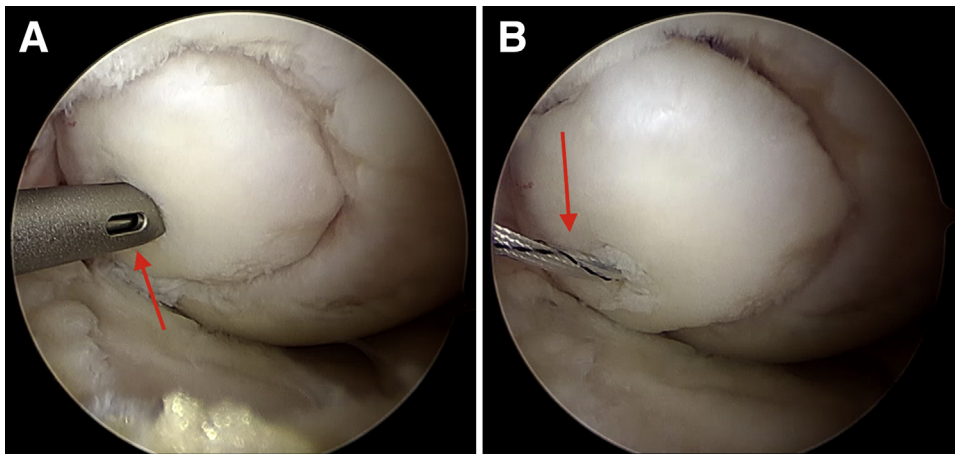
Fully advance the drill under power using the drill guide, through the OCD fragment and into the femoral condyle, and then remove it with the drill guide still holding the fragment securely in place. Carefully insert the FiberTak through the guide and OCD fragment, and into the femoral condyle. Release the suture bundle from the inserter handle, then remove the inserter. Pull back on the suture bundle slowly, but with a progressive increase of force, to expand and set the anchor within the femoral condyle, and then remove the drill guide (Fig 3B).

Assess the fragment stability after first FiberTak placement, and choose the next FiberTak location that would provide the best stabilization and reduction when linked to the first location via repair suture (Fig 4, A and B). Place the second FiberTak in a similar fashion as the first.

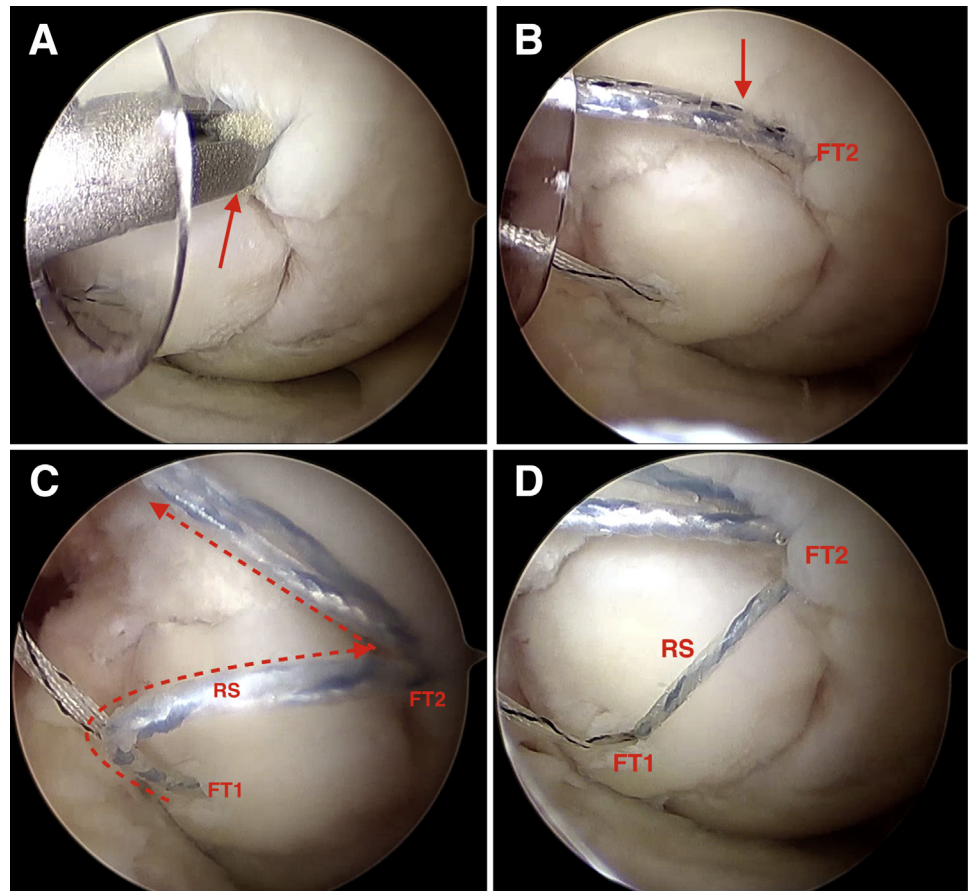
Next, shuttle the repair suture from one FiberTak, not through itself, but through the other FiberTak, then pull on the repair suture to cinch it down and provide



**Fig 2.** The patient is in the supine position. Arthroscopic views of the right knee, from the anteromedial portal (A) and anterolateral (B) portal, demonstrating the osteochondritis dissecans fragment (star), detached from the medial femoral condyle.

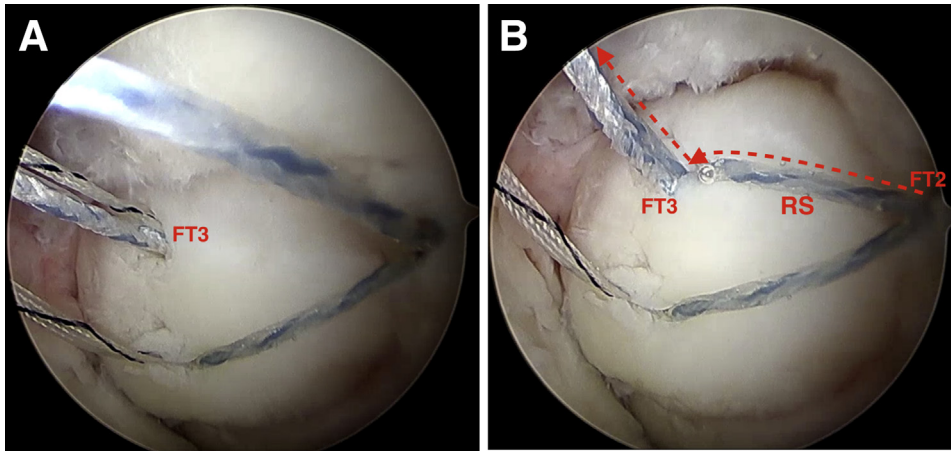


**Fig 3.** The patient is in the supine position. Arthroscopic views of the right knee, from the anteromedial portal. (A) The curved drill guide (arrow) for the 1.8 knotless FiberTak (Arthrex, Naples, FL) is placed on the osteochondritis dissecans (OCD) fragment, holding the fragment firmly in reduction. The drill is fully inserted through the fragment and into the condyle, then backed out with the guide still holding the fragment securely in reduction. The FiberTak is inserted through the fragment and into the condyle. The inserter is removed, and the suture bundle is progressively pulled back to set the FiberTak within the condyle. (B) The guide is removed after the FiberTak is fully set, with suture bundle emerging through the OCD fragment (arrow).

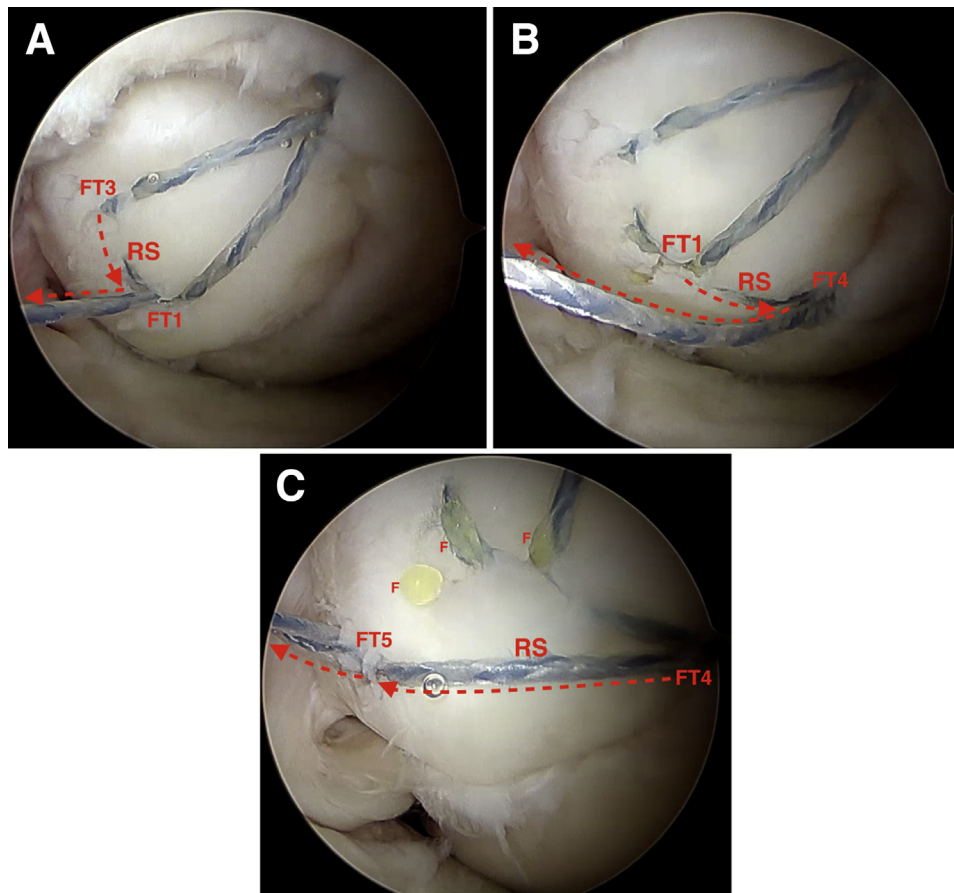


**Fig 4.** The patient is in the supine position. Arthroscopic views of the right knee, from the anteromedial portal. (A) Drill guide (arrow) is placed at the margin of the fragment for the next FiberTak placement, and the drill driven directly into the condyle. (B) The second FiberTak (FT2) is placed, with its suture bundle (arrow) emerging from the femoral condyle at the margin of the osteochondritis dissecans (OCD) fragment. (C) The repair suture (RS) from the first FiberTak (FT1) is shuttled through the second FiberTak (FT2) (arrows showing direction of repair suture passage). (D) The repair suture (RS) is tightened, linking the two anchors (FT1, FT2), and providing compressive stabilization to the OCD fragment all along the cinched repair suture.



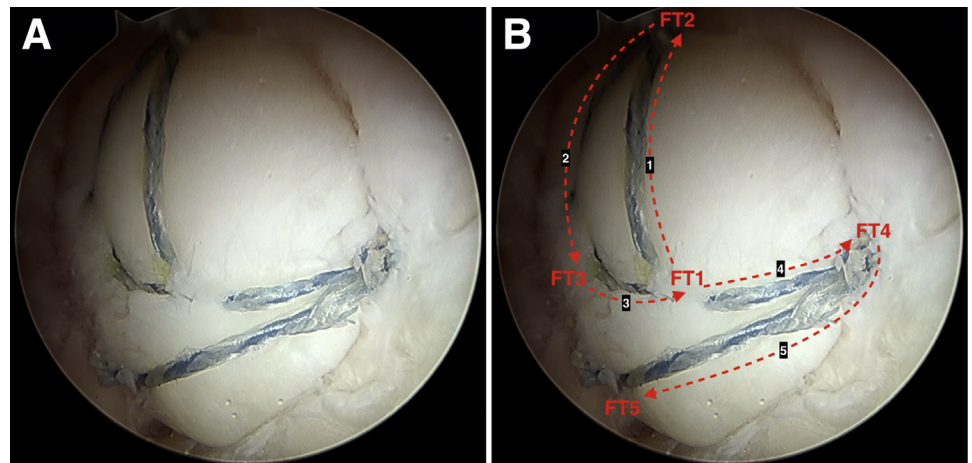


**Fig 5.** The patient is in the supine position. Arthroscopic views of the right knee, from the anteromedial portal. (A) The third FiberTak (FT3) is placed, this time through the osteochondritis dissecans fragment again. (B) The repair suture (RS) from the second FiberTak (FT2) is shuttled through the third FiberTak (FT3) and then tightened (arrows showing direction of repair suture passage).



**Fig 6.** The patient is in the supine position. Arthroscopic views of the right knee, from the anteromedial portal. (A) The repair suture (RS) from the third FiberTak (FT3) is shuttled through the first FiberTak (FT1) and then tightened (arrows showing direction of repair suture passage). (B) A fourth FiberTak (FT4) is placed, at the fragment edge and directly into the condyle. The repair suture (RS) just shuttled through the first FiberTak (FT1) is shuttled through the fourth FiberTak (FT4) and then tightened (dashed arrows showing direction of repair suture passage). (C) The knee is slightly more flexed in this view to access the posterior portion of the OCD fragment. A fifth FiberTak (FT5) is placed in the posterior aspect, through the fragment. The repair suture (RS) from the fourth FiberTak (FT4) is shuttled through the fifth FiberTak (FT5) and then tightened (arrows showing direction of repair suture passage). Note the marrow fat droplets (F) emerging from the multiple drilling locations, indicating increased overall OCD fragment compression upon final repair suture placement.

**Fig 7.** The patient is in the supine position. Arthroscopic views of the right knee, from the anteromedial portal. (A) Appearance after fixation is complete. (B) The sequence of repair suture passage and interlinkage (numbered arrows) from the first FiberTak through the fifth FiberTak (FT1-FT5) is summarized.



the first stabilization (Fig 4, C and D). If satisfied with suture tension, cut the repair suture flush on the articular surface to reduce suture tangle potential; alternatively, it can be left for later retensioning.

Place more FiberTak anchors, choosing locations and number of anchors strategically to efficiently and evenly distribute compressive stabilization, and link each newly placed FiberTak to the construct by shuttling an existing repair suture through it, until the overall FiberTak interlinkage construct provides satisfactory compressive stabilization throughout the fragment (Figs 5 and 6).

After final FiberTak placement, cycle the knee through motion to confirm stability, retension as

needed with remaining repair sutures if any, and then cut the sutures flush with the surface once fragment security is satisfactory (Fig 7).

Further stimulate intra-articular bleeding at this time, to enhance fragment healing. From the anteromedial portal, use the FiberTak curved drill guide and drill to make multiple small holes into the debrided lateral wall of the notch.

The surgical procedure is demonstrated in Video 1. Pearls and pitfalls are summarized in Table 1.

### Rehabilitation

Weight bearing is limited to toe-touch for the first 2 weeks, and then advanced to full as tolerated. Passive

**Table 1.** Pearls and Pitfalls

#### Fragment reduction

- Use the curved drill guide for the 1.8 knotless FiberTak (Arthrex, Naples, FL) as a convenient, one-step reduction and anchor placement device. The guide's serrated tip helps to hold and control the fragment, while a secure fragment reduction with the guide indicates an ideal location for FiberTak placement.
- It is important to hold the fragment solidly in place with the curved drill guide any time the drill is being inserted or removed through the fragment, or the drill may rotate the fragment and disturb the reduction.

#### Anchor placement

- Anchor placement through the reduced fragment and into the condyle locks in reduction and promotes bleeding into the fragment/condyle interface. Anchor placement directly into the condyle at the edge of the fragment enhances stability and limits edge liftoff.
- A combination of anchor placements through the fragment and directly into the condyle is generally recommended, to most effectively distribute the compression force.
- During FiberTak placement through the fragment, a subtle loss of fragment reduction may imperil anchor placement into the condyle. Two suggestions are to hold the drill guide firmly with base of the hand resting on the patient's knee to maintain trajectory and have an assistant stabilize the inserter to reduce sideways wobble during anchor impaction.
- Place the anchors strategically to avoid crossing one repair suture over another, which reduces the compression effectiveness of the suture on the top, as it sits partly off the surface, and also causes a focal prominence that can abrade the opposite articular surface.
- If drilling and placing the anchor through a particularly thick fragment, drill extra-deep and consider using extra-long 1.8 knotless FiberTaks for the hip to compensate for an effectively shallower FiberTak placement depth within the condyle that may compromise anchor deployment.

#### Suture management

- When getting ready to shuttle a repair suture through a FiberTak, retrieve the repair suture and the loop end of shuttle suture together, with a sliding suture retriever, to avoid suture tangling and tissue interposition. An accessory arthroscopic portal can dock inactive sutures for later handling can help reduce tangling.
- A twist tends to accumulate in the repair suture, as it is shuttled through a FiberTak, occasionally resulting in a kinked loop that compromises shuttling and final tightening. Use a sliding suture retriever to pull up and straighten out the kinked loop, and the suture can be further tightened.

**Table 2.** Advantages/Disadvantages

Advantages	
•	Arthroscopic/minimally invasive approach
•	Increased area of compression all along the repair sutures linking the anchors, not only at implant placement points
•	Fixation versatility, especially for fragments with thin bone layer
•	Small footprint enhances fixation construct flexibility.
•	Knotless design eliminates weak spots in fixation and allows for retensioning.
•	Soft, all-suture anchor can be placed through a curved guide and avoids complications associated with solid-implant breakage or prominence or the need for subsequent surgical screw removal.
Disadvantages	
•	Demand on arthroscopic proficiency, especially in suture management
•	Possible implant cost concerns
•	Potential abrasion of opposing articular surface
•	Need for clinical validation

and active motion recovery and open-chain strengthening can start as soon as tolerated. Closed-chain strengthening and proprioception can start once full weight bearing is tolerated. At 3 months postoperatively, dynamic activities are gradually introduced, with the goal of returning to running and agility activities by 4 to 6 months postoperatively.

## Discussion

Multiple methods for OCD fragment fixation have been reported, using metallic or bioabsorbable compression screws, and bioabsorbable nails and darts. The most recent reports include techniques using suture tape and solid press-fit anchors demonstrated through a mini-open approach,<sup>5</sup> as well as fixation with solid anchors and sutures arthroscopically tied to secure down the fragment.<sup>6</sup>

The main advantages of our technique are arthroscopic approach; increased fixation stability and efficiency with suture linkage; small implant footprint conducive to customization of fixation pattern; knotless design; ability to retension if desired; no need for staged implant removal; and no solid-implant breakage, displacement, or prominence-associated complications.

Arthroscopic approach is advantageous over the open method for its minimal invasiveness and the ability to closely inspect and concurrently treat other intra-articular conditions. Conversion to an open technique is available if necessary.

The linking of anchors by repair sutures broadens the zone of compression beyond the points of implant placement, similar to the suture-bridge concept for rotator cuff repair, and therefore, fewer FiberTaks may potentially provide the same or better fixation compared to more darts or screws. For fragments with thin bone, this method also provides a key advantage over screw/dart implant methods that may have suboptimal fragment purchase.

The use of all-suture anchors provides multiple advantages: it eliminates the damaging effects of broken or displaced screws, darts, or solid anchors, seen in 23-37% of cases with use of such implants;<sup>7,8</sup> permits retensioning after stressing; can be inserted through a curved guide, which greatly aids drilling trajectory flexibility to allow for optimal reduction and drilling of the fragment; and does not require repeat surgery for screw removal.

The small, 1.8-mm footprint of the FiberTak allows for placement flexibility and suture interlinking based on assessment of the OCD fragment behavior after each stabilization step. This enhances construct design flexibility to best customize the fixation to maximize stability. The knotless technology eliminates a potential weak link in the fixation construct<sup>9</sup> and potential abrasion damage on the opposing articular surface.

Goldenberg et al.<sup>10</sup> recently reported their technique of knee acute osteochondral fracture fixation, with two 1.8 knotless FiberTaks in the fracture base, extra-articular drilling and passing suture bundles through the osteochondral fragment, and then reintroducing the fragment back into the joint for final fixation. Their acute-fracture fixation technique and our OCD fixation technique share many advantages. If arthroscopic reduction is possible, we believe our technique is also suitable for acute osteochondral fracture fixation, with additional benefits: in-situ, one-step drilling and anchor placement through the fragment, eliminating the fragment removal, drilling, suture passage, and reintroduction steps, and avoiding the potential reduction difficulty if extra-articular fragment drilling does not precisely match the FiberTak locations and distance within the base.

Drawbacks of our technique include: a demand on arthroscopic proficiency, especially in management of suture bundles from multiple anchors; potential of increased implant-related costs; possible abrasion of the opposing articular surface by sutures; and the need for validation through clinical studies.

Advantages and disadvantages of the technique are listed in [Table 2](#).

In summary, we present an arthroscopic technique of knee osteochondritis dissecans fragment fixation that takes advantage of the unique features and properties of the knotless, all-suture technology to offer potential benefits over other current fixation methods.

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