

All-Arthroscopic Osteochondral Autograft Transfer Technique for Osteochondritis Dissecans of the Talus



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Abstract: Juvenile osteochondritis dissecans of the talus can be a challenging condition to treat in young patients. Previously described osteochondral autograft transfer techniques for medial talar lesions have been done via open approach, often requiring medial malleolus osteotomy. The purpose of this article is to present an all-arthroscopic osteochondral autograft transfer technique for a medial talar osteochondritis dissecans lesion in a skeletally immature patient.

Introduction (With Video Illustration)

Juvenile osteochondritis dissecans of the talus is a rare condition that can create challenges for both the patient and the treating surgeon. Multiple surgical treatment options have been described.¹ Although arthroscopic microfracture remains the standard of care for most lesions, larger lesions (>10 mm²) often fail microfracture and require the transfer of material to replace or regenerate cartilage, such as osteochondral autograft, osteochondral allograft, particulated juvenile cartilage transplantation, or autologous chondrocyte implantation.²

Osteochondral autograft transfer has been shown to have good results in these lesions, especially for larger lesions involving the shoulder of the talus, as it provides bony support.³⁻⁶ Typically, these procedures have been described as an open technique, often requiring malleolar osteotomy.³⁻⁶ We describe an all-arthroscopic osteochondral autograft transfer for a

medial talar osteochondritis dissecans lesion in a skeletally immature patient (Video 1).

Technique

The patient is positioned supine on the operative table with a blanket roll under the ipsilateral right hip. A thigh tourniquet is placed on the operative right leg. The operative leg is placed into a leg holder. An ankle distractor is used during arthroscopy (Arthrex, Naples, FL).

Under traction, an anteromedial portal to the right ankle is established medial to the tibialis anterior tendon, approximately 1 cm proximal to the tip of the medial malleolus. A 2.7-mm 30° arthroscope is used. An anterolateral portal is established under arthroscopic visualization with use of an 18-gauge needle. This portal is lateral to peroneus tertius and about 1.5 cm proximal to the tip of the lateral malleolus. Routine diagnostic ankle arthroscopy is performed and a 3.5-mm shaver is used to debride the extensive synovitis to allow for full visualization of the ankle joint. An arthroscopic probe is used to identify the borders of the lesion on the medial aspect of the talus, measuring 20 mm anterior to posterior and 15 mm medial to lateral (Fig 1A). The cartilage over the lesion is friable, nonviable, and is debrided with the use of a curette (Fig 1B). The underlying subchondral bone also is debrided using both portals with both a curette and an arthroscopic burr until bleeding bone is encountered, which leaves a defect that is 14 mm in depth (Fig 1C). Microfracture of the base of the osteochondritis dissecans (OCD) is performed using an arthroscopic awl. A 1- to 2-mm rim of bone is left intact over the medial “shoulder” of the talar dome to provide containment of defect and avoid “overspill” of the fibrin sealant into the medial gutter.

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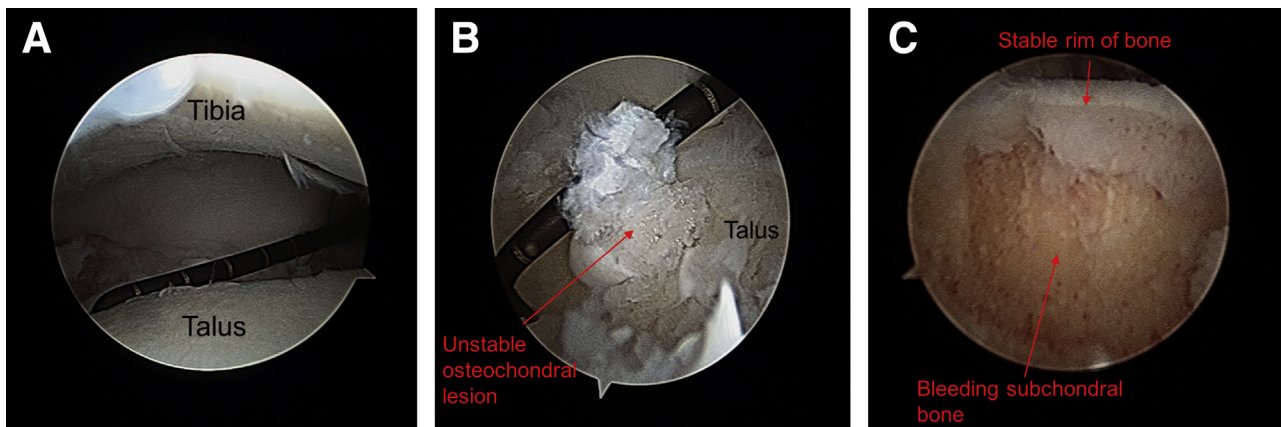


Fig 1. With the patient supine, viewing with the arthroscope from the anterolateral portal on a right ankle. (A) An arthroscopic probe from the anteromedial portal is used to identify the margins of the osteochondritis dissecans. Intact cartilage is firm, non-ballotable to probing. The delaminated unviable cartilage is soft, ballotable, and easily delaminated by probing the unstable osteochondral defect. (B) The arthroscopic probe is used to show the osteochondral lesion. The nonviable cartilage over the lesion is debrided using a curette and an arthroscopic burr, including all underlying non-viable, friable, nonbleeding bone. (C) With the patient supine, viewing from the anterolateral portal, the osteochondral lesion is visualized with nonviable cartilage and bone removed down to healthy bleeding subchondral bone, leaving a 1- to 2-mm rim for containment of the lesion. At the base of the lesion, an arthroscopic awl is used to perform microfracture in order to stimulate bleeding.

The tourniquet is then let down and we turn our attention to the patient's ipsilateral knee. A standard 3-cm lateral parapatellar knee arthrotomy is made to expose the lateral trochlear ridge (Fig 2A). A total of 5 autologous osteochondral plugs are harvested from the lateral femoral condylar ridge using a single-use osteochondral autograft transport system (Arthrex): 2 measuring 10 mm in diameter \times 15 mm in depth, 2 measuring 8 mm in diameter \times 15 mm in depth, and 1 measuring 6 mm in diameter \times 5 mm in depth. Care is taken to ensure the area of harvest does not articulate

with the patella. The incision over the knee is then closed in a layered fashion.

On the sterile back table, the osteochondral plugs are prepared for implantation. A 15-blade scalpel is used to remove the cartilage from each plug at the osteochondral junction to create cartilage discs (Fig 2 B and C). The remaining bone is then minced with the use of a rongeur.

We then reinflate the tourniquet. Dry arthroscopy is established by suction of all arthroscopic fluid from within the joint with the arthroscopic shaver-suction.

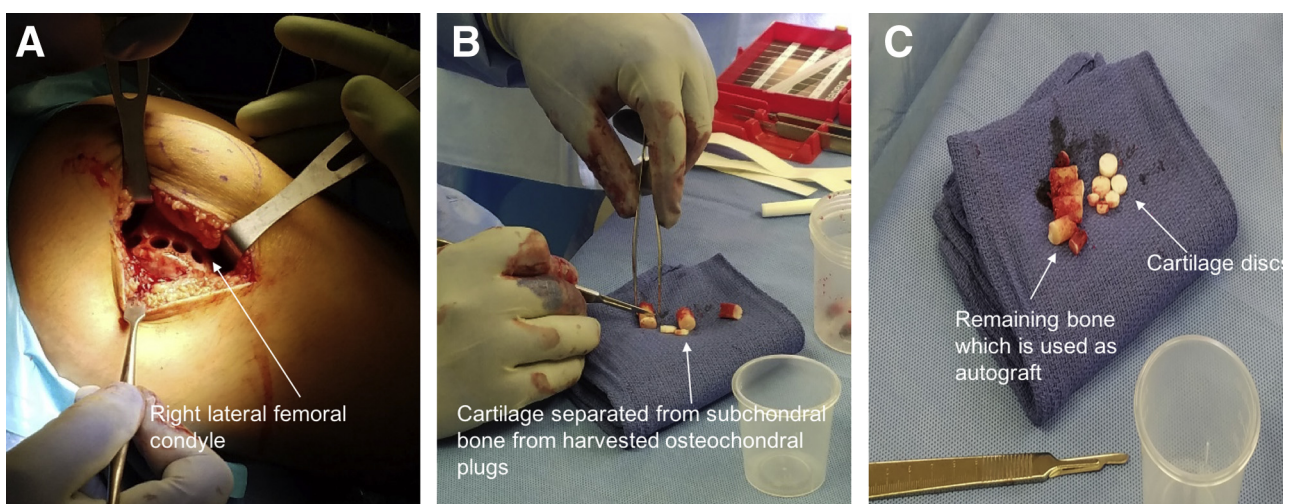


Fig 2. (A) A 4-cm lateral parapatellar skin incision is performed to harvest 5 osteochondral autografts from the lateral, non-articular portion of the right femoral condylar ridge using the a single use osteochondral autograft transport system (Arthrex): 2 measuring 10 mm in diameter \times 15 mm in depth, 2 measuring 8 mm in diameter \times 15 mm in depth, and 1 measuring 6 mm in diameter \times 5 mm in depth. No backfill of the donor site is performed. (B) On the sterile back table, using a scalpel, the cartilage plugs are separated from the bony components. (C) The cartilage discs separated from bone.

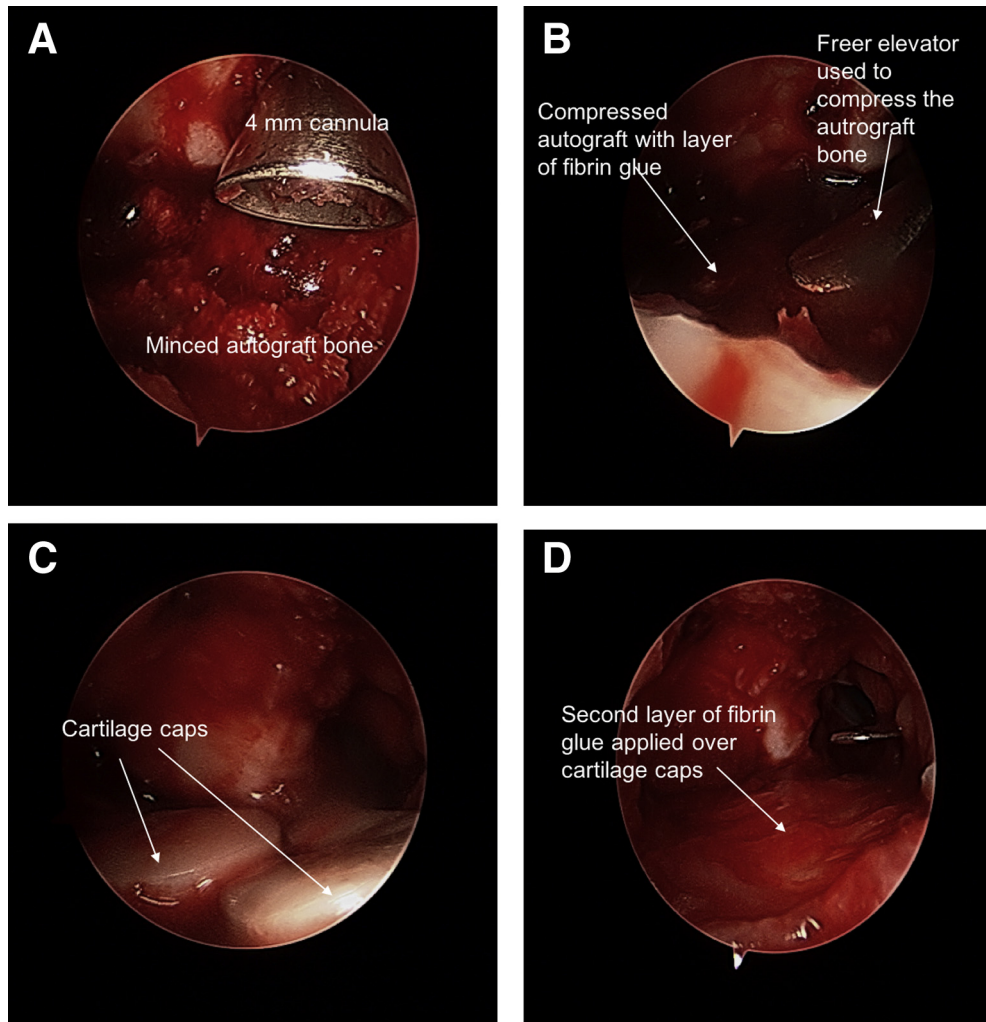


Fig 3. With the patient supine, under dry conditions, viewing from the anterolateral portal with the arthroscope of the right ankle. (A) A 4-mm arthroscopic camera cannula is inserted into the anteromedial portal. Bone graft from the osteochondral plugs is minced and inserted into the cannula and the trocar for the cannula is used to push the bone graft into the defect. (B) The bone graft is further compressed into the defect using a freer elevator. After the bone is compressed, fibrin glue (Tisseel) is placed over surface of the introduced bone graft. (C) While the initial layer of fibrin glue is setting, the chondral plugs are introduced with a hemostat through the anteromedial portal with the foot maintained in plantarflexion within the ankle distractor. They are placed from posterior to anterior into the defect on the superior aspect of the autograft bone. (D) The chondral plugs are placed and another layer of fibrin glue (Tisseel) is placed over the chondral plugs in a “sandwich technique.” This is held in place with a freer elevator through the anteromedial portal while the fibrin glue (Tisseel) is allowed to set for 7-10 minutes. This gives the “cobblestone/mosaic” appearance of the chondral plugs that is perfectly leveled with the surrounding articular cartilage.

The minced bone is fed into the 4-mm arthroscopic cannula, which is introduced through the anteromedial portal. The bone graft is then plunged out of the sheath by pushing on it via the arthroscopic trocar and impacted into the defect under arthroscopic visualization from the anterolateral portal. The bone graft is compressed and layered to the level of the subchondral bone (Fig 3A). The superior aspect of the bone graft is smoothed with a freer elevator (Fig 3B). Fibrin glue (Tisseel, Deerfield, IL) is then used over the bony surface as a sealant between the bony and cartilaginous interface in a “sandwich technique.”⁷

While the fibrin glue is setting, the 5 cartilage plugs are placed over the fibrin glue. These are introduced with a hemostat through the anteromedial portal with the foot maintained in plantarflexion within the ankle distractor. They are placed from posterior to anterior into the defect on the superior aspect of the autograft bone (Fig 3C) and another layer of glue is placed over the top to provide stability for the construct by adhering the multiple plugs together and sealing any defects in between (Fig 3D). It is imperative to maintain dry working conditions at this point to allow the fibrin glue to dry. The fibrin sealant is left to dry.

Table 1. Key Surgical Steps of All-Arthroscopic Osteochondral Transfer for Medial Talus Osteochondritis Dissecans

Position patient's supine
Portal placement: anteromedial and anterolateral
Osteochondral lesion is identified
Debridement of lesion down to bleeding, healthy bone
Must maintain at least a 1-2 cm rim of bone medially for containment
Microfracture the base of the lesion
Harvest osteochondral plugs from lateral femoral condyle
Separate cartilage from bone with scalpel
Remove fluid from ankle joint and maintain dry conditions
Crush autograft bone and insert into osteochondral defect via 4-mm arthroscope cannula
Compress bone in defect down to subchondral bone layer
Apply fibrin glue over the top of the autograft bone
Place cartilage plugs onto the fibrin glue layer from posterior to anterior
Apply fibrin glue over the cartilage plugs in a "sandwich" technique
Hold in place with freer elevator until fibrin glue sets (7-10 min)

for 7 to 10 minutes after which the construct is inspected one final time under dry arthroscopy and stability of the reconstructed OCD is confirmed by arthroscopic guided range of motion of the ankle. The arthroscopic portals are then closed in a standard fashion (Table 1).

Rehabilitation

Postoperatively, the patient is placed into a well-padded below knee splint for 2 weeks. At the 2-week visit, the patient is transitioned to a fracture boot and began ankle range of motion. The patient is kept non-weightbearing for 10 to 12 weeks.

Discussion

Young patients with open physes who develop osteochondral lesions of the talus often are initially treated conservatively due to the good vascularity of the bone from the physeal chondral plate. However, when conservative management fails, surgical options must be considered. With smaller lesions, typically less than 1.5 cm², arthroscopic microfracture has been described.² Microfracture results in the development of fibrocartilage over the talus, which is thought to potentially degenerate over time. At long-term follow-up, studies have shown decreased function and increased pain.⁸ Shimozono et al.⁹ showed in a recent study that subchondral bone was not restored at midterm follow-up after microfracture and there was significant development of subchondral cysts over time, which correlated with worsening clinical outcome.

For larger lesions of the talus, procedures which aim to replace the articular cartilage have been described. Osteochondral allograft, autologous osteochondral graft, particulated juvenile cartilage transplantation,

and autologous chondrocyte implantation have all been described. Mosaicplasty using autologous osteochondral transfers have been shown to have good success in treating osteochondritis dissecans of the talus.³⁻⁵ In addition to providing articular cartilage, osteochondral transfers provide bony support. For medial talar lesions in which osteochondral transfers are being used, previous techniques have described the need for an open approach with medial malleolus osteotomy to access the medial talus.^{3,10-12} Our technique allows for the osteochondral defect to be managed arthroscopically, thus avoiding the need for medial malleolar osteotomy in a patient with open physes.

The proposed technique's main advantage is that it allows for large medial osteochondral lesions with significant bone loss to be managed entirely arthroscopically which negates the need for associated open procedure with medial malleolar osteotomy to access the lesion. In younger patients, the ability to treat these lesions without performing an osteotomy and potentially violating the physis is very beneficial. Another advantage is there is less risk of incorrect sizing or uneven impaction of the osteochondral plug which could lead to uneven articular surfaces.

Autologous graft harvested from the ipsilateral knee does have known donor-site morbidity; however, use of autologous osteochondral grafts for the mosaicplasty negates the cost, concern of chondrocyte viability and infection risk associated with allograft osteochondral graft.^{1,13} For this procedure, it is imperative to have a contained defect; therefore, care must be taken to not fracture any remaining bone on the medial talus. However, with arthroscopic magnification, as little as 1 to 2 mm of medial or lateral talar wall can be preserved even with shoulder lesions, allowing its revascularization after reaching circumferential healthy bleeding bony bed and grafting with autologous viable bone, which makes uncontained defects a relative contraindication with this procedure. We also acknowledge that bone grafting with large, intact, whole bony plugs from the donor knee is a challenge with this all-arthroscopic technique, requiring mincing the bony plug to facilitate arthroscopic grafting, which theoretically may jeopardize the mechanical structural support of the reconstructed bony aspect of the OCD. Sizing the autologous chondral discs to perfectly fill the defect can be another technical challenge, requiring trimming of the plugs for a perfect fit to minimize gaps that have been found to heal with inferior fibrocartilage with the originally described osteochondral autograft transfer procedure. This has to be minimized to avoid turning the chondral plugs into "minced articular cartilage fragments," which has its potential disadvantages, including chondrocyte death at the minced margins and creating more fibrous tissue between the

smaller minced fragments. It is therefore imperative to accurately measure the defect dimensions with a graded arthroscopic probe after debridement to plan accordingly the number and size of required plugs. Another potential disadvantage is that dry working conditions must be maintained when placing the articular discs and fibrin glue, in addition to the challenging technicality of the procedure. In conclusion, this technique allows us to treat large osteochondral lesions of the talus arthroscopically without the need for tibial osteotomy.

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