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CASE REPORT

Arthroscopic revision of osteochondral autograft in distal tibia: A case report demonstrating precision of intraoperative 3D fluoroscopy

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ABSTRACT

Graft failures of the tibial plafond are very rare. This article presents the technique of precise antegrade osteochondral auto-grafting under three-dimensional (3D) fluoroscopy. A 20-year-old athletic patient with a recurrent osteochondral lesion of the tibial plafond on a first osteochondral autograft after two years of follow-up was admitted. The revision osteochondral autograft was performed under real-time perioperative arthroscopic and 3D fluoroscopic control for greater precision. Surgery was followed by six weeks of non-weight-bearing in a walking boot. At one-year follow-up, the patient was effusion and pain free and returned to his previous activity level completely. Revision osteochondral autografting under arthroscopic and 3D fluoroscopic control seems to be an effective therapeutic option.

Keywords: Ankle arthroscopy, distal tibial, osteochondral autograft, osteochondral lesion, plafond, 3D fluoroscopy.

Osteochondral lesions of the tibial plafond are extremely rare and their true incidence is difficult to estimate.[1-3] Most osteochondral lesions of the ankle involve the talar dome. Involvement of the tibial plafond is rare.[1] Surgical management of these lesions is technically difficult due to limited access either with open surgery or arthroscopy.[2] To the best of our knowledge, there are no published cases in the literature describing a second anterograde osteochondral autograft application in the tibial plafond.[4] The present case study includes bilateral, symmetric defects which have only been reported once in the literature.[5] This report includes revision surgery of one side, the non-symptomatic side was followed by observation.

Similar to other osteochondral lesions of the talus, there are numerous possible etiologies of, particularly traumatic, vascular, necrotic or metabolic origin. The bilateral and perfectly symmetric location of these defects suggest a genetic origin which has also been described in talar lesions.[6-11] Baldassarri et al.[12] identified a history of trauma in 55% of cases, while 25% of the cases in the series by Cuttica et al.[1] were considered to be idiopathic.

Ross et al.[13] identified distribution of osteochondral lesions of the tibial plafond as 3% in zones 3 and 9, and up to 19 and 23% in zones 1 and 4. Elias et al.[14] found the same distribution in an magnetic resonance imaging (MRI) analysis of 38 lesions, with medial lesions in 38%, central lesions in 32%, and lateral lesions in 30%.

Numerous treatments reported in the literature for the treatment of these lesions are summarized in Table I which includes seven case reports,[15-21] one technical report,[22] and nine clinical series.[1-3,12,13,23-26]

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TABLE I
Literature review of osteochondral lesions of the tibial plafond

Authors	Year	Type	Number of cases	Technique
Parisien and Vangsness[24]	1985	Series	2	Debridement
Bauer et al.[3]	1987	Series	2	Debridement
Canosa[15]	1994	Case Report	1	Not reported
Bui-Mansfield et al.[26]	2000	Series	3	Not reported
Ueblacker et al.[23]	2004	Series	2	Osteochondral autograft
Chapman and Mann[21]	2005	Case Report	1	Osteochondral allograft
Mologne and Ferkel[2]	2007	Series	23	Debridement (×23), microfractures (×5), iliac graft (×2)
Pearce et al.[16]	2009	Case Report	1	Synthetic bone graft
Cuttica et al.[1]	2012	Series	13	Debridement/microfractures (×11), spongious graft (×2)
Ross et al.[13]	2014	Series	31	Microfractures
Desai et al.[16]	2016	Case Report	1	Debridement + microfracture + scaffold
Johnson et al.[22]	2017	Technical Note		Debridement + microfracture + scaffold
Okamura et al.[17]	2017	Case Report	2	Osteochondral autograft
Corso et al.[20]	2017	Case Report	1	Not reported
Baldassarri et al.[12]	2018	Series	27	Stem cells + scaffold
Lee et al.[25]	2019	Series	16	Microfractures
Hayashi et al.[18]	2019	Case Report	1	Osteochondral autograft

Kissing lesions first described by Canosa,[15] also reported in other series,[1,16] are two-sided osteochondral injuries which is a different entity which requires a different treatment strategy. In this study, the osteochondral lesion was tibial sided and the talar dome was preserved.

This report is an original case of revision surgery of the tibial plafond using a second osteochondral autograft following anterograde osteochondral autograft failure in a young athlete. Surgery was performed under arthroscopic and 3D fluoroscopic control to obtain the best graft positioning.

CASE REPORT

A 20-year-old male patient presented with pain and swelling of the left ankle. Initial imaging results showed a bilateral osteochondral lesion of the tibial plafond that was only symptomatic in the left ankle. Initial medical management that included non-weightbearing, discontinuation of sports, physical therapy, cortisone, and platelet-rich plasma injections was unsuccessful. The lesion of the left ankle measuring 1 cm^2 and 6 mm in depth was treated surgically. An osteochondral autograft harvested from the lateral trochlea was applied to the tibial osteochondral lesion in an anterograde fashion under arthroscopic control. One-year clinical, radiological, and computed tomography (CT) follow-up was satisfactory (Figure 1) and the patient returned to sports

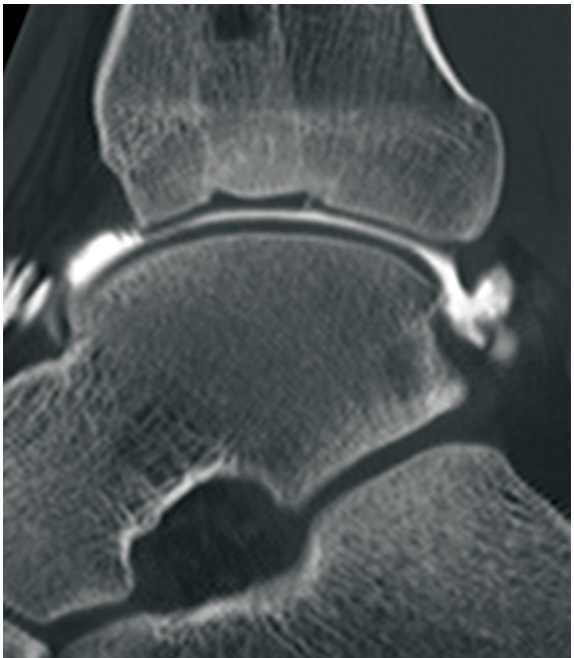

FIGURE 1. Sagittal computed tomography of the first osteochondral graft at one-year follow-up.

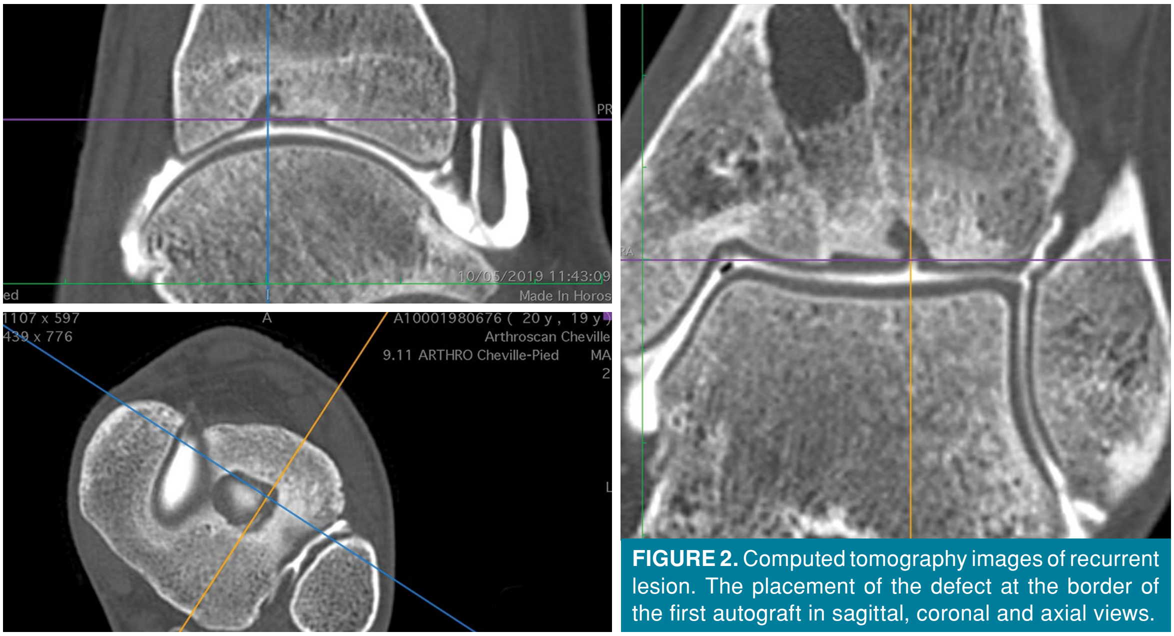

FIGURE 2. Computed tomography images of recurrent lesion. The placement of the defect at the border of the first autograft in sagittal, coronal and axial views.

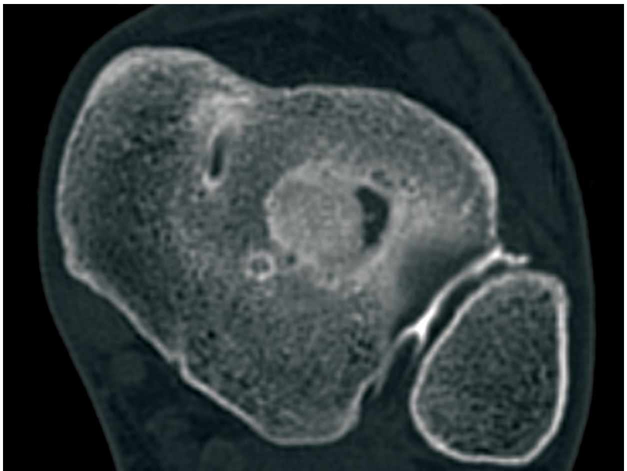

FIGURE 3. Axial computed tomography of ankle. The recurrent lesion is located on the anterolateral side of the first graft.

(football) at the same level of play. At 24 months of follow-up, the patient presented with recurrence of initial exercise-induced pain and joint swelling symptoms. Imaging tests (X-ray, arthrogram, computed tomography and scintigraphy) identified a new osteochondral lesion of 6 mm in diameter originating at the margin of the anterolateral side of the primary graft (Figures 2-4).

A revision osteochondral surgery was planned due to the patient's young age and high activity level besides the size and type of lesion. In the presence of a subchondral cyst to fill the defect, to perfectly restore the subchondral bone and the cartilage a revision osteochondral autograft was considered.

Under general anesthesia, the patient was placed in the supine position with the feet extending beyond the operating table. Ankle was placed in

FIGURE 4. Preoperative scintigraphy. There is an increased uptake corresponding to the distal tibial defect zone.

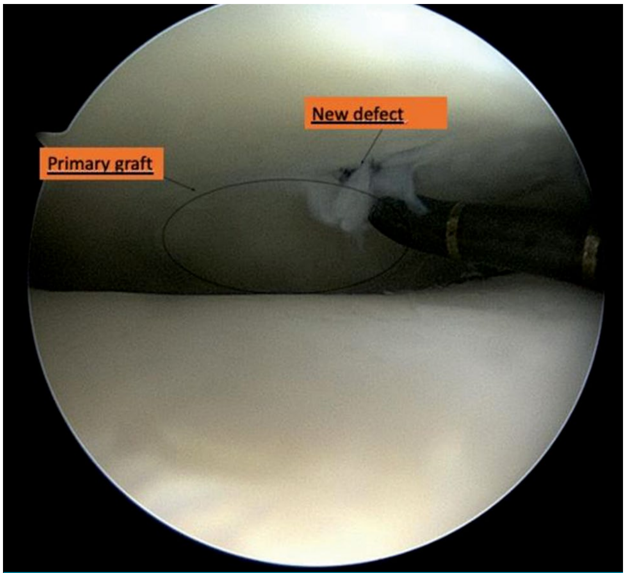

FIGURE 5. Arthroscopic view of the full thickness defect. There is a fibrillation of the cartilage seen from anterior view.

the neutral position and contralateral lower limb was lowered. A thigh tourniquet was applied. Prophylactic antibiotics were administered. Standard anteromedial and anterolateral portals were used. The chondral defect was identified, explored arthroscopically and measured to be 6 mm in diameter (Figure 5).

To install the O-armTM fluoroscopic guidance system (Medtronic Inc., MN, USA), firstly the reference frame was applied to the anteromedial side of the distal tibia with two Schanz pins and with an upward inclination to facilitate access of the receiver. Proper positioning and fixation of the reference frame was verified with O-arm. The entry point and the optimal trajectory to reach the lesion which was planned preoperatively based on 3D reconstructions were determined with the help of fluoroscopic guidance system (Figure 6). From a 2-cm longitudinal anterolateral incision, 2.4 mm drill bit of the Osteochondral Autograft Transfer System (OATS) (Arthrex, Naples, FL, USA) was inserted based on O-arm (Medtronic Inc., MN, USA) recommendations.

The center of the defect (Figure 7) was drilled with a 6-mm reamer as decided by pre- and intraoperative planning. Proper placement of the guide and reamer was checked arthroscopically, as well.

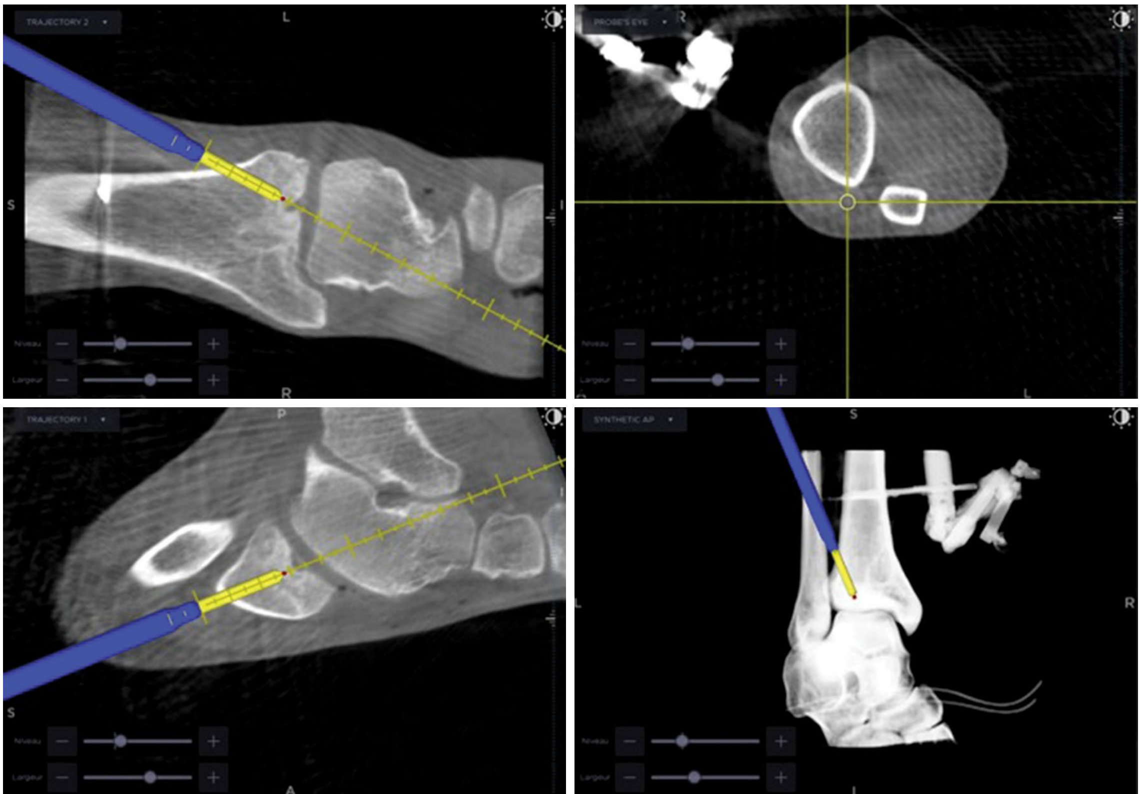

FIGURE 6. Fluoroscopic images. The verification of the trajectory of the guide with 3D fluoroscopy in the sagittal, coronal and 3D images.

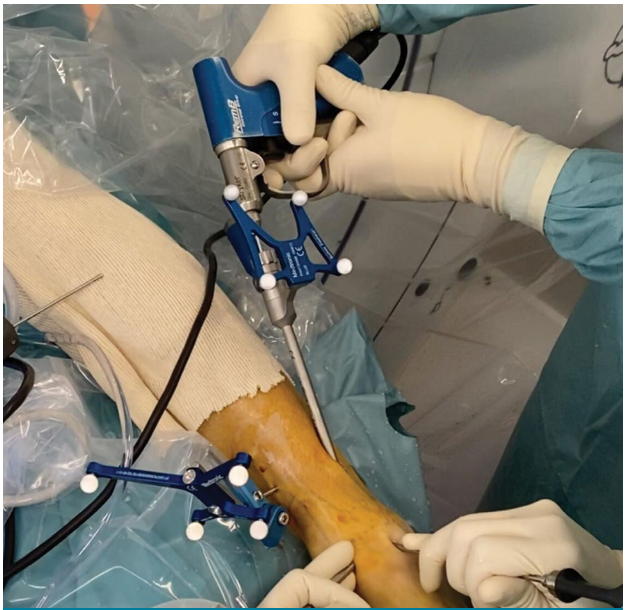

FIGURE 7. Intraoperative view of the placement of 3D fluoroscopic landmarks and the reamer. The inclination of reamer is clearly visible.

FIGURE 8. Intraoperative photograph. The bone plug and the relatively small skin incision are demonstrated.

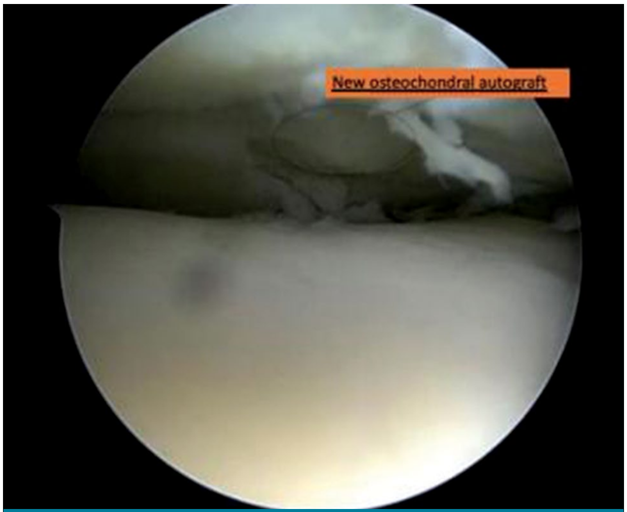

FIGURE 9. Arthroscopic view of the ankle. It allows intraarticular verification of the alignment of the chondral surfaces.

FIGURE 10. Fluoroscopic control. A better alignment of subchondral bones was achieved compared to the first bone plug.

An osteochondral plug of 6 mm in diameter was harvested from the donor site of the superolateral trochlea through a 2 cm incision on the previous parapatellar scar. This step had to be performed with care to obtain matched chondral plugs with the reamed tunnel. Preoperative planning revealed a plug which was presumed to have an inclination angle of 40° with the articular surface.

The graft was implanted in an antegrade fashion taking care to keep the angle of the harvested plug, in line with the receiver site to reconstruct the joint line (Figure 8). Real-time arthroscopic view (Figure 9) and 3D fluoroscopic images were used to verify the final placement of the osteochondral autograft (Figure 10).

At one-year follow-up, the patient had no signs of inflammation in the left ankle and the patient was completely pain free with a full range of motion.

The patient was informed that data concerning the case would be submitted for publication, and he provided consent.

DISCUSSION

The presented case is very rare. Cuttica et al.[1] reported one osteochondral lesion of the tibial plafond in a series of 14 to 20 osteochondral lesions of the heel. A consecutive series of 880 arthroscopies of the ankle revealed 2.6% when all indications were included,[2] while another evaluated a series of 31 chondral defects of the ankle and revealed 6.4% when talar and tibial osteochondral lesions were included.[3]

Our patient's initial defect located at the intersection of zones 2,3,5,6 described by Cuttica et al.[1] The right and left defects were located in exactly the same place (Figure 11). The only other bilateral lesions described in the literature[5] were in a more anterior position. Ross et al.[13] identified distribution of osteochondral lesions of the tibial plafond as 3% in zones 3 and 9, and up to 19 and 23% in zones 1 and 4. Elias et al.[14] found the same distribution in an MRI analysis of 38 lesions, with medial lesions in 38%, central lesions in 32% and lateral lesions in 30%. Baldassarri et al.,[12] who found a majority of medial lesions, (55%) suggested that there was a direct relationship between these lesions and a traumatic event during inversion of the ankle.

The advantages and the quality of the harvested osteochondral graft have been reported for the tibial plafond in two articles (a total of four patients).[17,23] One case report describes poor results after osteochondral autograft implantation for a central lesion of the tibial plafond following failure of a cancellous bone graft in a 14-year-old child. However, details of the surgical intervention were not presented.[1]

In this case, the entry point and drilling trajectory were planned based on the preoperative CT; the trajectory of the osteochondral autograft was planned to be divergent to primary autograft and in the center of the new lesion which was located at the margin of the first lesion (Figure 12). The 3D O-arm navigation system was used to optimize the final orientation of the autograft. The use of this system has been well documented in traumatic foot and ankle injuries mainly in the treatment of calcaneal fractures.[27] Other uses have been reported for arthrodesis of the hind-foot,[28] ankle arthroplasties[29] and talocalcaneal coalition resection.[30] The use of this system to navigate osteochondral graft placement in distal tibia has not been described. Alignment of the autograft and receiver site subchondral bones was achieved with precision with the aid of O-Arm guidance (Figure 10).

In conclusion, this is the first case of a revision antegrade osteochondral autograft transfer to treat a recurrent lesion of the tibial plafond which emerged

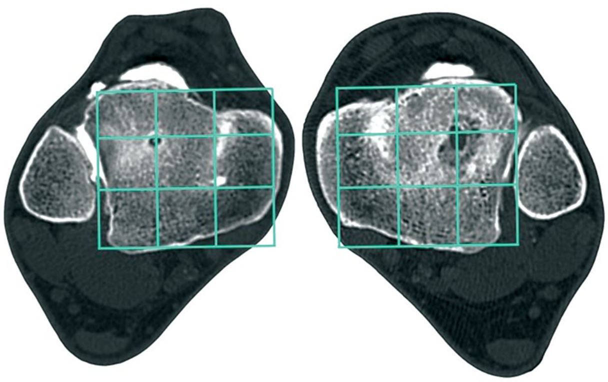

FIGURE 11. Axial computed tomography image of distal tibias. Demonstration of symmetrical bilateral lesion with different sizes.

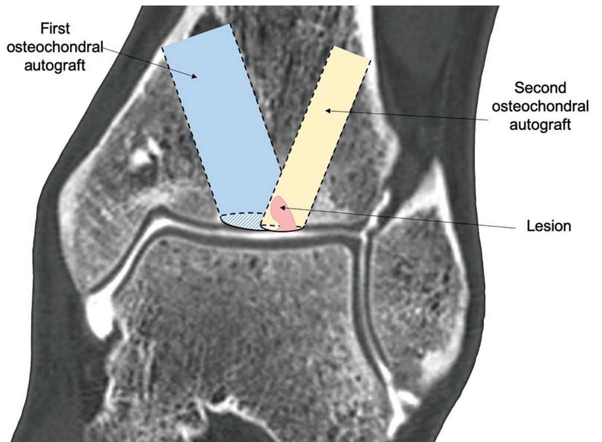

FIGURE 12. Preoperative planning of revision. Schematic representation of the revision surgery ensures differ-ent trajectories of two bone plugs and the ability of the autograft to fill the defect.

at the edge of the first lesion, two years after a first osteochondral autograft, under dual perioperative control with ankle arthroscopy and 3D fluoroscopic guidance.

Declaration of conflicting interests

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