Osteochondral Grafting of the Distal Tibia Without a Malleolar Osteotomy: An All-Arthroscopic Antegrade Approach

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Abstract: Osteochondral (OCD) lesions of the tibia are rare and can be treated with microfracture and debridement in the first instance. However, a major issue arises if bulk-grafting is required as access to the joint surface for perpendicular packing/insertion is not possible. Tibial osteotomy for access to the talus has morbidity associated with it, but moreover it does not significantly improve access to the tibia for standard retrograde (ie, from the joint surface into the bone) drilling and insertion of a graft into an OCD lesion. In order to obviate the need for malleolar osteotomy an antegrade approach through the bone rather than the joint can be used avoiding any disruption of the joint. We have developed this technique for use in the tibia and the talus and present a case of OCD autografting of the tibia to demonstrate this method of insertion without osteotomy. A jig is used to locate the surface of the lesion and then the tunnel is prepared by drilling onto this marker from the opposite side of the bone. This produces an oblique tunnel that requires harvesting of a matched graft. Insertion can then be performed from outside-in.

Level of Evidence: Diagnostic Level 5. See Instructions for Authors for a complete description of levels of evidence.

Key Words: osteochondral grafting of defects, tibial, autograft, antegrade/ retrograde, ankle arthroscopy

HISTORICAL PERSPECTIVE

Osteochondral (OCD) lesions of the tibia are rare. In the series from Ferkel's highly specialized unit, of 880 consecutive ankle arthroscopies, only 23 (2.6%) of the patients had a tibial OCD1 and only 11 of those studied had an isolated tibial OCD. In this series first-line treatment (debridement, microfracture, or even transmalleolar drilling) worked very well with 14/17 having good or excellent American Orthopaedic Foot and Ankle Society (AOFAS) scores following surgery. The whole literature contains just a few more cases and thus it is not possible to define the ideal management of these lesions. While the general perception is that tibial OCDs fare worse than talar ones, the management of these lesions largely relies on extrapolation of the data for talar OCDs instead. The best evidence we have is from Ferkel's series, the 6 patients with combined tibial and talar OCDs responded similarly to the 11 isolated tibial OCDs to treatment. However, one of the 2 poor outcomes occurred in a patient with combined tibial and talar OCDs. Overall, there was no correlation between chronicity, size, or location of the lesion and outcome.

From this study and the other case reports available,2–4 it would appear that treatment is worthwhile and that management along similar lines to the approach for talar OCDs has benefit. On this basis treatment, recommendations are that debridement and microfracture are appropriate for first-line treatment unless the defect is large and grafting of some kind if the defect is large or microfracture has failed. In light of the dearth of alternative treatment options this should therefore be considered. The issue with bulk-grafting with a plug is that this necessitates vertical access and this is much more of an issue for the tibia than it is for the talus. In the tibia this mandates a tibial osteotomy5 and this can be associated with a high rate of morbidity.There is very little in the literature to guide us on the use of bulk-grafting in the tibia, indeed there are just 2 cases reports in the literature before this study. One case involves primary grafting of a large tibial defect with a synthetic OCD plug6 and the other describes the use of an allograft OCD plug in the tibia.7

This is the first report on the use of the technique with autograft. The technique we present uses a bone tunnel to fill the defect from behind in an antegrade manner, thus obviating the need for a tibial osteotomy. We have used this technique in the tibia and also in the talus, here, we present the tibial technique using a case with >3 years of follow-up.

INDICATIONS AND CONTRAINDICATIONS

This technique has only been used as a revision procedure for OCD defects that have not responded to first-line surgical management with debridement and microfracture/bone grafting. It has not been used for primary management of an OCD.

PREOPERATIVE PLANNING

The illustrative case is of a 46-year-old male recreational athlete who presented with recurrent anteromedial ankle pain. The pain was very specific and was isolated to the anteromedial ankle joint line; x-rays taken showed a large tibial spur and magnetic resonance imaging (MRI) demonstrated an OCD (grade V) of the tibia (Fig. 1). In the first instance he was treated with repeat arthroscopic debridement, cheilectomy (under image control), and microfracture of the tibial OCD. At 3-month follow-up, there was no improvement in the anteromedial ankle pain. Repeat imaging showed that there had been sufficient resection of the tibial osteophyte but that the OCD had persisted (Fig. 2). Repeat arthroscopic debridement was performed at 6 months and the defect was curetted and treated with retrograde
packing through a small arthrotomy and cancellous bone graft taken from the ipsilateral calcaneum. This was pressure packed and pressurized while the tourniquet was released. The pain failed to respond to this management despite follow- up conservative measures including steroid and local anesthetic
infiltration over the next 12 months. The pain continued to be very specific and isolated to the anteromedial joint line and was present on weight-bearing and dorsiflexion of the ankle.

Computed tomography scan was performed, this showed that the graft had only partially incorporated (Fig. 3). The pain was severe and having a major effect on function and thus various surgical options were discussed including fusion of the ankle. However, the patient wished to return to sport and maintain the motion in the ankle and opted for an antegrade transtibial grafting after
having had an opportunity to read and discuss the literature on the various options. At this stage his AOFAS score was 34. Surgical planning was performed using both computed tomography and MRI scans, from these the dimensions of the lesion and thus the necessary graft size were calculated. The placement and angulation of the tibial tunnel was planned to ensure good bone margins, and enable the graft to be as vertical as possible without the tunnel being too long. Thus it was elected to place the entry site at the malleolar flare on the medial side of the tibia (Fig. 4).

TECHNIQUE

Ankle Arthroscopy

Routine procedures were followed; assessment confirmed the tibial and talar lesions and the latter was debrided and microfractured (Fig. 5).

Tunnel Placement

The Acuflex posterior cruciate ligament jig was set to the predetermined angle (Fig. 6), it was then placed into the ankle through the medial portal and placed on the tibial lesion. The guidewire was passed through the tibia from the medial aspect of the tibia exiting in the center of the lesion.

This was then overdrilled with a size 8-mm drill bit, an osteotome was passed through a portal and placed flat on the talus to protect it from the guidewire and the drill (Fig. 7).

Harvesting the Femoral OCD Graft

A lateral parapatellar arthrotomy was performed and the knee joint exposed. We identified a site on the margin of the femoral condyle that enabled an oblique 9-mm graft with the cartilaginous surface at 60 degrees to the longitudinal axis of the plug (Fig. 8).

Graft Insertion

The graft was inserted through the tibia under direct vision to ensure that it did not sit proud as damage to opposite side articular cartilage has been described when an OCD graft was left slightly proud of the surface. An osteotome was also placed over the defect through the lateral portal to allow some pressurization of the graft (Fig. 9). Marrow Stim (Biomet) iliac crest aspirate was injected down the tunnel and an interference screw was passed down the tibial tunnel behind the graft to help stabilize the graft, in particular preventing it passing back up the tunnel. The osteotome was again used to help pressurize the graft. The remainder of the tunnel was packed with cancellous bone graft. The incisions were sutured and a below-knee backslab plaster cast was applied. Postoperative thromboprophylaxis was given.

RESULTS

At 2 weeks the patient reported some medial ankle pain. At 6 weeks he reported that he had no pain at all. However, at the 12-week follow-up when he was back to normal function he was having some pain with an AOFAS score of 58. Despite this modest score by this stage he was performing a number of activities that he had not been able to do for over 2 years. His main discomfort was on a loaded dorsiflexion of the ankle and was very specifically anteromedial. On occasion this pain was severe enough that it caused his ankle to give way. If anything his symptoms appeared to deteriorate to month 4 before starting to improve. We have found this to be typical of this treatment and may be related to increasing levels of function.

By the 6-month stage, a contralateral hallux rigidus was also contributing to his symptoms. As there were grade IV radiologic features this was treated with a first metatarsophalangeal joint fusion using a plate and screws. He was managed with a heel weight-bearing Darco shoe for 6 weeks. This increased the pressure on the right ankle and this was troublesome until months 8 to 9 when the first metatarsophalangeal joint was functioning well enough for him to use it fully.
The right ankle continued to improve and at follow-up at exactly 12 months he had an AOFAS score of 86, Manchester Oxford Foot Questionnaire of 46, and foot function index of 17. By this stage he was walking his dog 10 to 20 miles a week including over rough terrain. He had also resumed training and was running both on the treadmill and outdoors, building up to taking part in an organized hill run of approximately an hour duration which he completed successfully and he has continued to run regularly on trails as well as on the road. The postoperative MRI scan has been independently reported as showing complete integration of the graft. The scan appearances also suggest that the overlying hyaline articular cartilage was maintained. At final follow-up at 36 months the improvement was maintained and he was regularly running 10K, before surgery he was not able to participate in any sports and had severe pain in activities of daily living with very major impediment of work and social function. There was no donor site morbidity (Figs. 10, 11).

POSTOPERATIVE MANAGEMENT

Surgery to week 2: non–weight-bearing in a cast. Weeks 2 to 6: weight-bearing in a boot and non–weightbearing ankle range-of-motion exercises. Weeks 6 to 10: protected weight-bearing in a boot and physiotherapy. Week 10: full rehabilitation. Week 16: MRI scan.

POSSIBLE CONCERNS, FUTURE OF THE TECHNIQUE

Careful tunnel planning is essential. If this is too oblique then a large oval graft is required. From the view down the tibial tunnel in Figure 9, one can see that the exit is ovoid and larger than the 9-mm plug that was taken. If the tunnel is too long then the graft there can snag and rotate on the way down and we suspect there may also be an increased risk of stress fracture. We believe that optimum placement is at the shoulder of medial malleolous. We have performed this procedure in the talus and in the tibia, the latter on 3 occasions and found that this mode of access is feasible with careful preoperative planning and this is the key to safe access for a well-aligned graft. There have been no failures of planning and in all cases the graft fitted well and sat parallel to the surface. There was no loosening and in the graft incorporated in all cases. There were no fractures or other complications.

All patients have at least 12 months' follow-up and have gone from severe symptoms to mild/no symptoms based on their outcome scoring. There has been at least moderate improvement in pain (AOFAS score improved by at least 40 points) and this occurred even if the graft subsided slightly or if there were additional intra-articular pathgologies. In fact it may be preferential to sit the graft slightly below the surface of the joint. Before surgery none of the patients were able to participate in sport or recreation although they had all wished to do so. At final follow-up all had returned to recreational activity. The technique has also been successfully applied to the central and medial zones of the talus to avoid a medial malleolar osteotomy. However, this needs to be proven in larger numbers in order to fully assess the efficacy of the technique. There is no doubt that this will be a challenge as it is a rare condition.

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Figures:

FIGURE 1. Initial presentation. A, Plain x-rays showing large tibial and talar osteophytes. B–D, Magnetic resonance imaging showing central tibial osteochondral lesion.

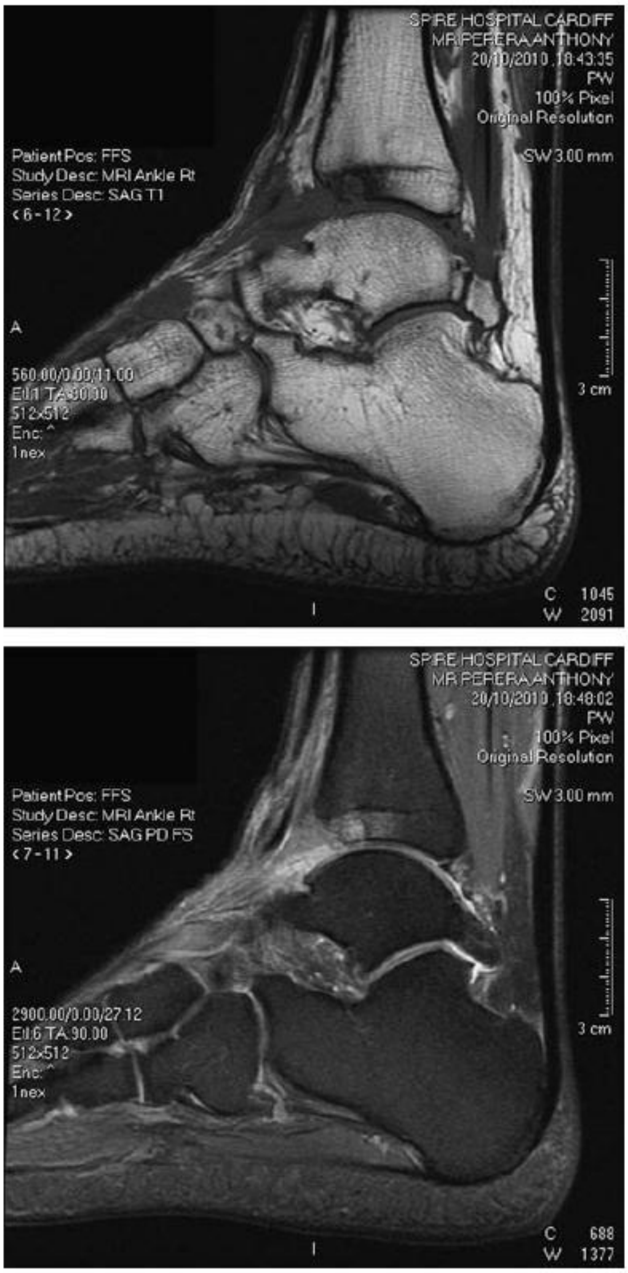


FIGURE 2. Magnetic resonance imaging 3 months after first-line surgical management demonstrating remaining tibial osteochondral lesion. There is poor incorporation of the graft material.

FIGURE 3. A, Coronal magnetic resonance view. B, Sagittal view of partially incorporated bone graft.

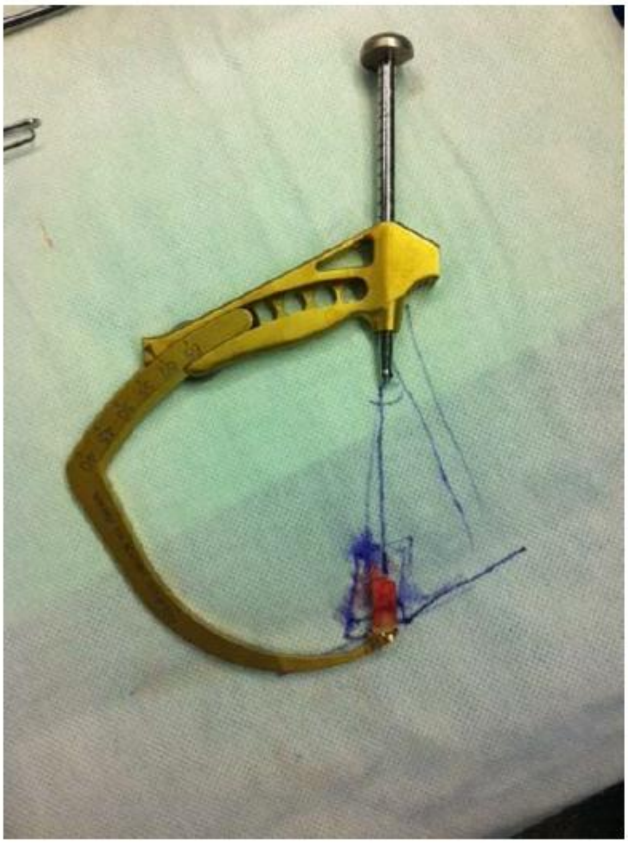


FIGURE 4. Intraoperative sketch for jig calibration (shown with the jig and graft once harvested).

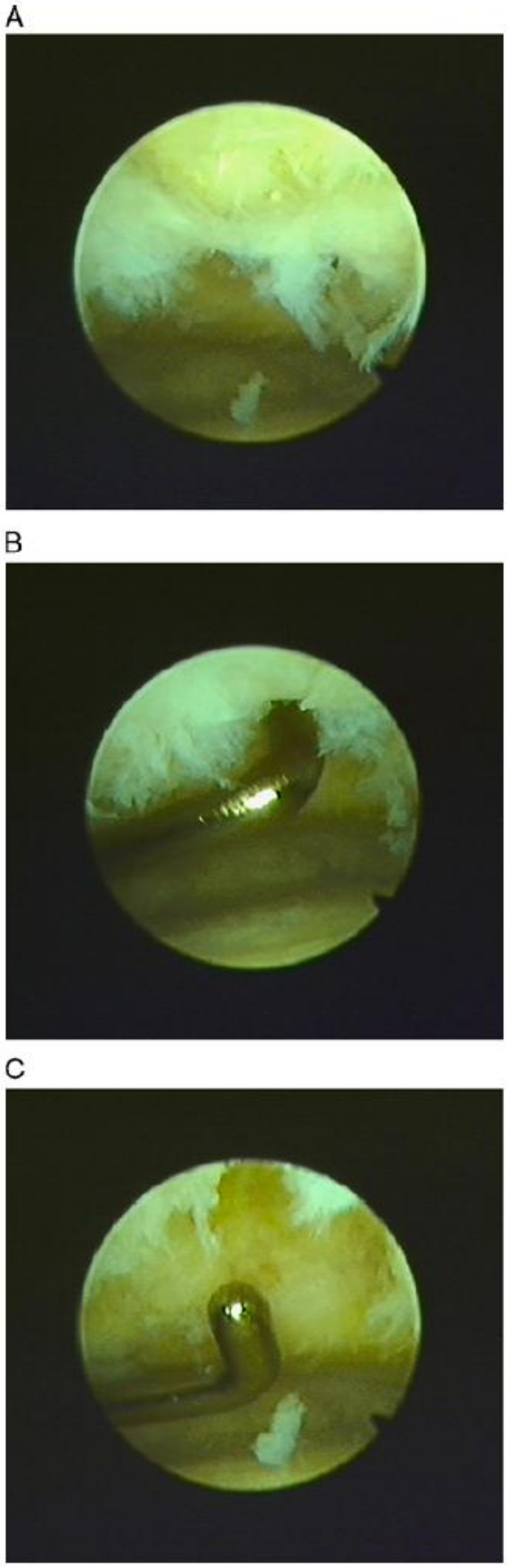


FIGURE 5. Arthroscopic views. A, Tibial osteochondral lesion at first viewing; (B) debridement underway; (C) after debridement.

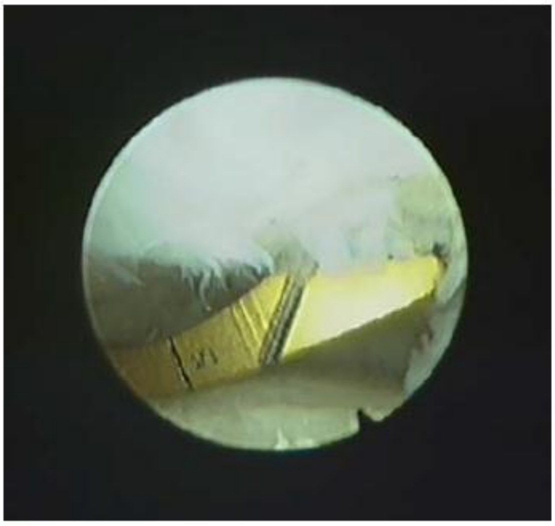


FIGURE 6. Posterior cruciate ligament jig on tibial lesion.

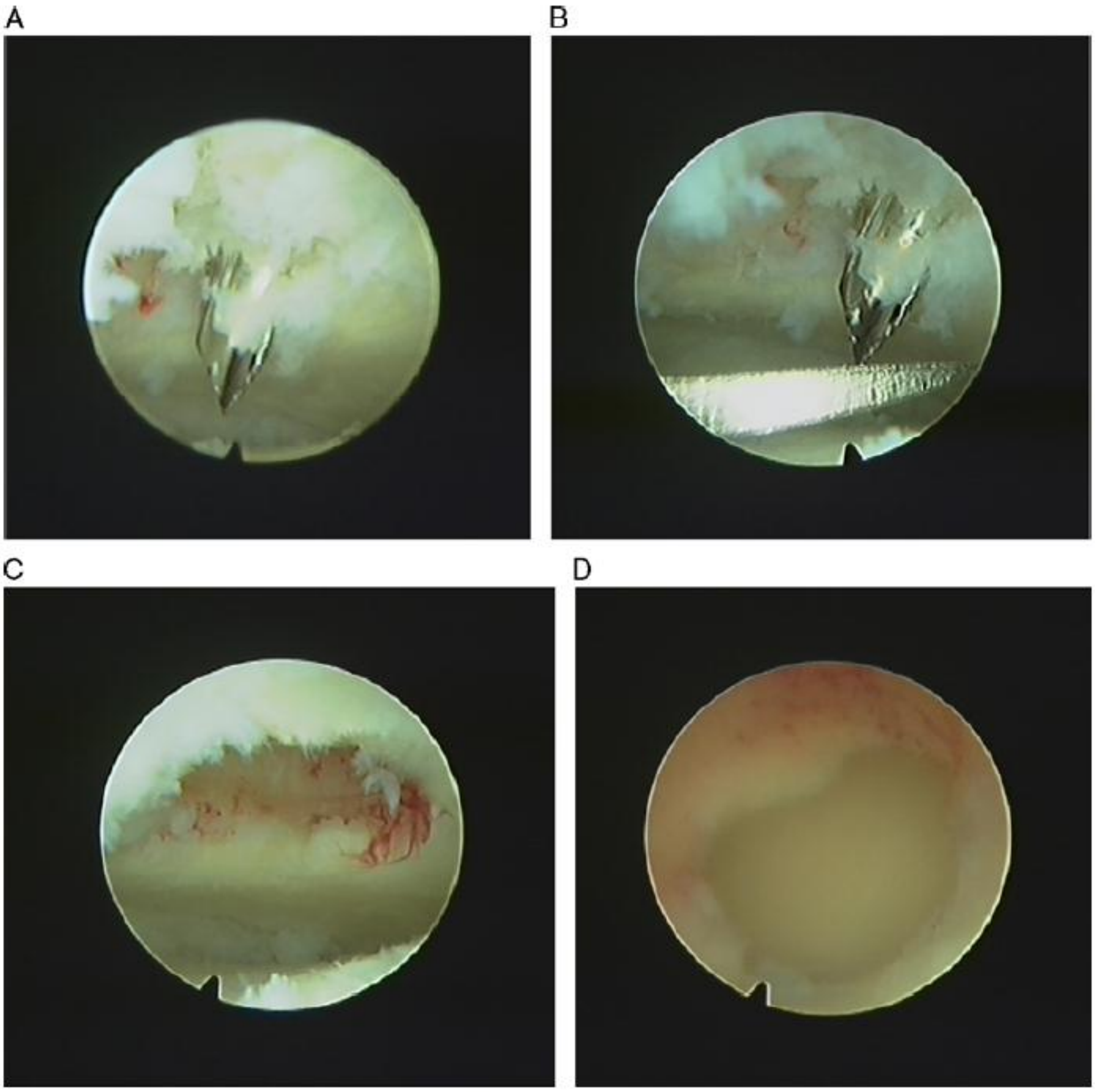
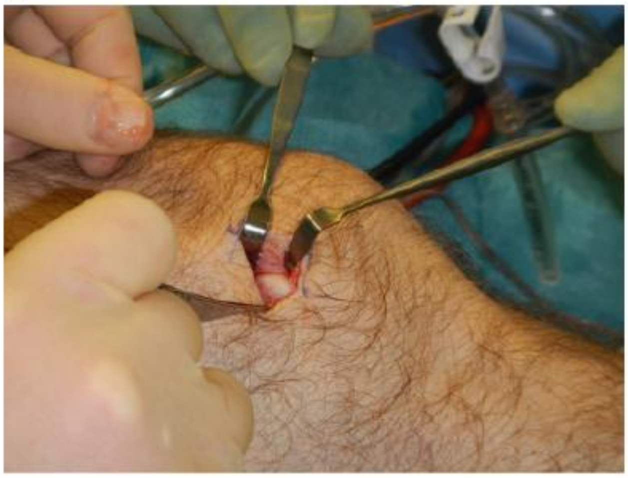


FIGURE 7. A–C, Guidewire insertion and drilling down onto a narrow osteotomy. D, The view through the tibial tunnel looking down onto the talus, ovoid exit onto articular surface.

A



B

FIGURE 8. A, Harvesting the graft - on oblique graft is taken from the lateral condyle. B, Graft insertion from the medial tibial cortex performed under direct arthroscopic vision.

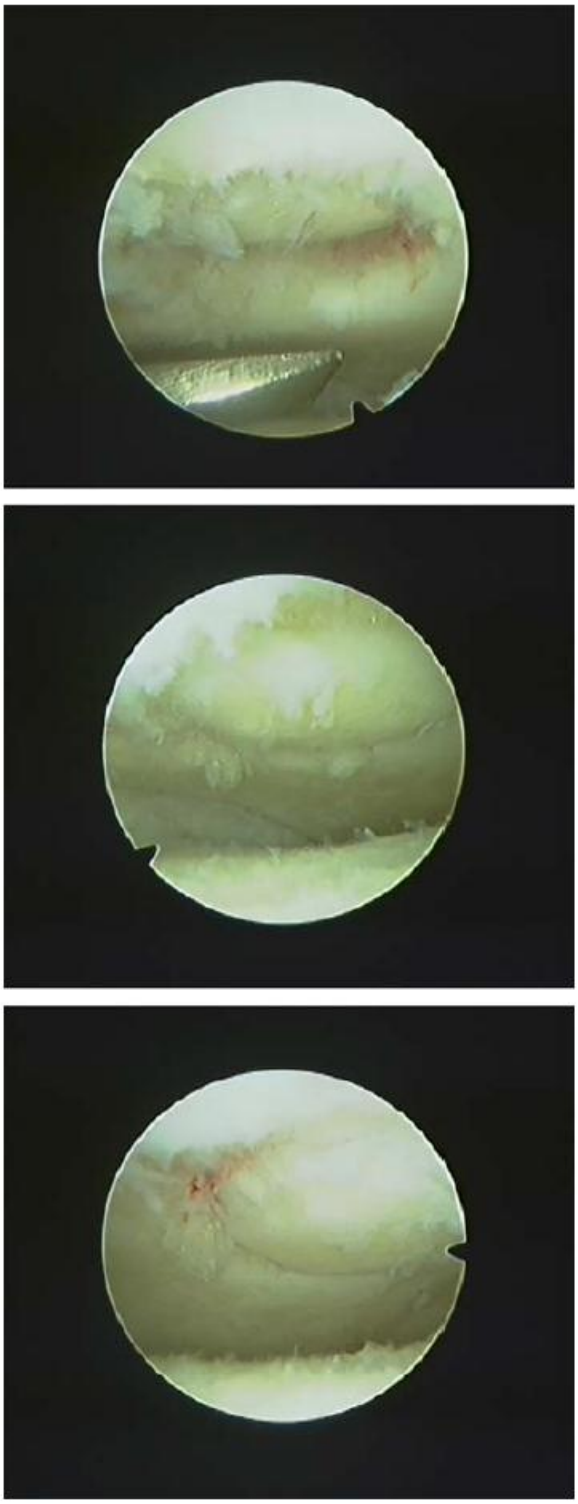


FIGURE 9. Intraarticular view of graft insertion. Gradual insertion of the graft is performed with a flat osteotome providing back pressure so that it is not proud of the surface.

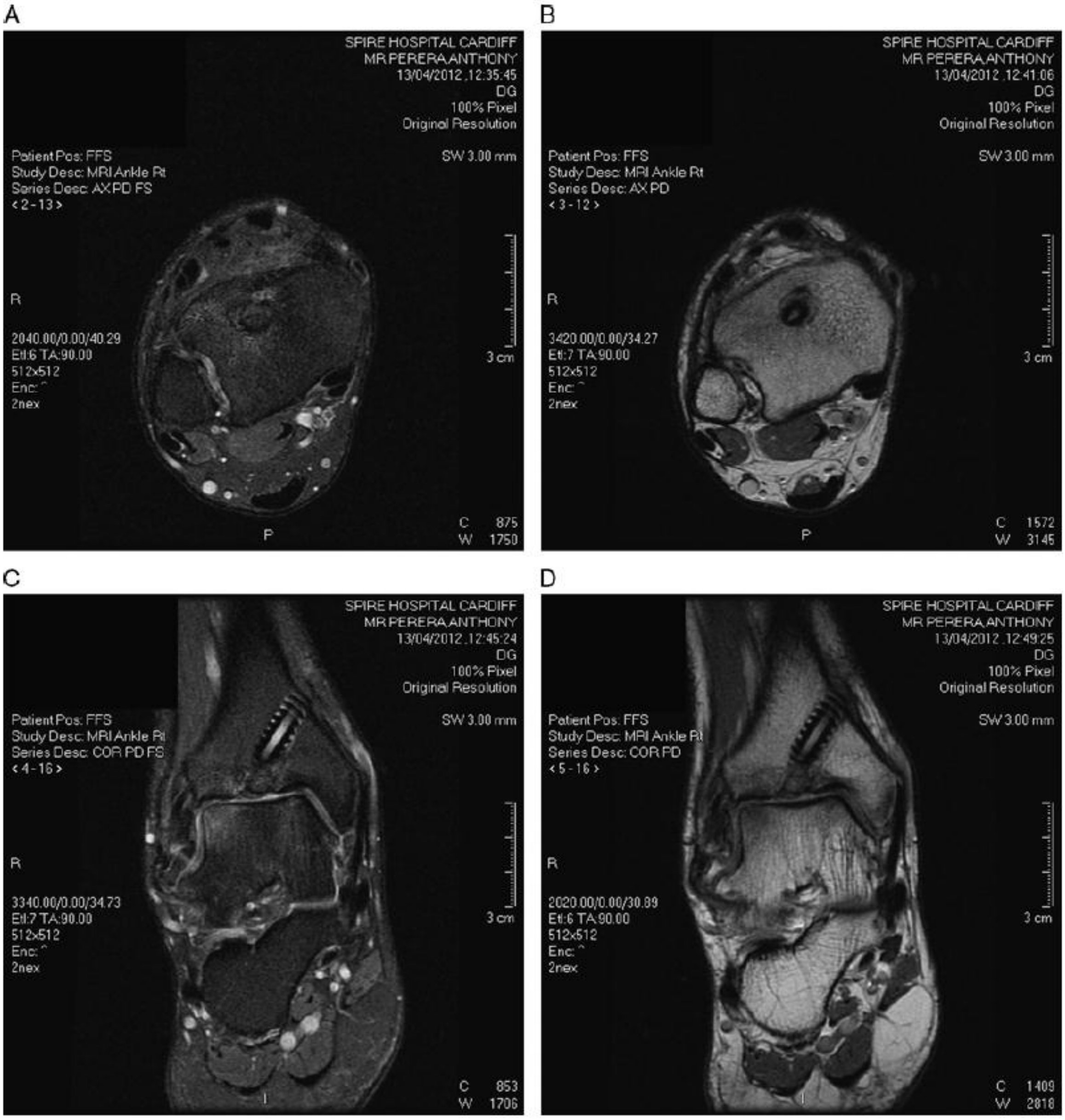


FIGURE 10. Postoperative magnetic resonance imaging scans. A, Axial of distal tibia; (B) and (C) coronal views of the graft. There has been good incorporation of the graft and the surface is smooth with subchondral bone and cartilage preserved on the graft.

FIGURE 11. Plain x-rays postoperative, the tunnel is faintly visible.