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Comparison of Osteochondral Autografts and Allografts for Treatment of Recurrent or Large Talar Osteochondral Lesions

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Abstract

Background: The purpose of this study was to prospectively evaluate and compare the long-term clinical and radiographic outcomes of using osteochondral autograft and allograft to manage either recurrent or large osteochondral lesions of the talar dome (OLT) in a single surgeon's practice.

Methods: Between January 2008 and January 2014, a total of 40 patients presented with either a recurrent OLT that failed initial arthroscopic treatment (ie, excision, curettage, debridement, and micro-fracture) or a primary OLT greater than 1.5 cm^2 that had undergone no prior surgery. Before surgery, 20 patients were randomized to receive osteochondral autograft plugs (Arthrex, Naples, FL) from the ipsilateral superolateral distal femoral condyle whereas the remaining 20 were randomized to receive osteochondral allograft plugs from a fresh size-matched donor talus (Joint Restoration Foundation, Centennial, CO, and Arthrex, Naples, FL), but 4 of these were excluded that received a hemi-talus allograft with internal fixation. Preoperative and postoperative function and pain was graded using the Foot and Ankle Ability Measures (FAAM) scoring system and a Visual Analog Scale (VAS) of pain, respectively. Radiographs were assessed for osteochondral graft healing, joint congruency, and degenerative changes. Data regarding postoperative complications and revision surgeries were also recorded.

Results: Of the 20 patients who received osteochondral autograft, the mean FAAM score increased from 54.4 preoperatively to 85.5 at the time of final follow-up. The mean VAS pain score decreased from 7.9 of 10 preoperatively to 2.2 of 10 at final follow-up. Two patients (10%) that received osteochondral autograft, 1 for a recurrent OLT of 1.3 cm^2 and 1 for a primary OLT of 2.0 cm^2, developed a symptomatic nonunion at the entire graft site. Both of these patients had their autograft converted to talar allograft plugs and achieved full osteochondral healing. At the time of final follow-up, no patients who received osteochondral autograft developed ankle degenerative changes or knee complications. The mean FAAM score of the 16 patients who received osteochondral allograft plugs increased from 55.2 preoperatively to 80.7 at the time of final follow-up. This postoperative score was lower than that of the osteochondral autograft group, but not to a statistically significant degree ($P = .25$). The mean VAS pain score decreased from 7.8 of 10 preoperatively to 2.7 of 10 at final follow-up. This postoperative score was higher than that of the osteochondral autograft group but not to a statistically significant degree ($P = .15$). Three patients (18.8%) that received osteochondral talar allograft, 2 for recurrent OLTs less than 1.5 cm^2 and 1 for a primary OLT of 2.2 cm^2, developed a symptomatic nonunion at the entire graft site. Two of these 3 patients had their allograft converted to osteochondral autograft plugs harvested from the ipsilateral superolateral distal femoral condyle and achieved full osteochondral healing. At the time of final follow-up, 1 of these 16 (6.3%) patients who received talar allograft as OLT treatment had developed asymptomatic anterior ankle arthritis upon radiographs.

Conclusion: Using fresh talar osteochondral allograft provided results that were comparable to the use of distal femoral osteochondral autograft for treating recurrent or large OLTs. Although the use of allograft avoided the risk of knee complications when harvesting autograft from the distal femur, fresh talar allograft may have lower healing rates than osteochondral autograft.

Level of Evidence: Level II, comparative case series.

Keywords: osteochondral, autograft, allograft, lesion, talar dome

Introduction

Osteochondral lesions of the talar dome (OLT) are defined as localized defects in the articular cartilage that are deep enough to penetrate the underlying subchondral bone.[5,32] Most of these OLTs have a traumatic etiology where a portion of the talar dome's cartilage can be damaged during rotational ankle injuries, such as a ligamentous sprain or bony fracture.[2,4,10] With such ankle trauma, the talus can tilt underneath and compress against the distal tibial plafond with enough force to injure and/or fracture that section of the talar dome's cartilage. Whether OLTs are detected acutely or chronically, their healing potential is limited as a result of several factors. By definition, OLTs involve articular cartilage, which is composed of avascular hyaline cartilage. Because of its lack of blood supply, the ability of articular cartilage to heal itself can be inadequate.[38] To make matters worse, the talus is known to have a precarious intraosseous blood supply between anastomoses of the arteries of the tarsal canal, sinus, and sling.[26] In addition, this aspect of talar anatomy can have a further detrimental effect upon OLT healing.

Upon presentation, OLTs can manifest with varying degrees of displacement and size, which ultimately affect their treatment options. While incomplete and/or nondisplaced OLTs have the potential to heal through nonoperative means, those OLTs that are complete and/or displaced have a worse prognosis and often require some type of operative repair.[36,37] To date, the accepted operative treatment for OLTs less than or equal to 1.5 cm^2 is an arthroscopic excision and curettage of the OLT with micro-fracture of the underlying subchondral bone.[34] This procedure results in growth of fibrocartilage at the OLT site, which is more than 85% to 90% successful at improving ankle pain and function.[20]

The appropriate operative methods for treating complete and/or displaced OLTs that are either recurrent and/or larger than 1.5 cm^2 are less clear. Arthroscopic excision, curettage, and microfracture can be performed, but is typically not as successful at restoring cartilage for those types of OLTs than if the lesion were of a primary or smaller kind.[7,31] This has led investigators to treat recurrent and/or large OLTs with an open osteochondral transplantation (OATS), which can take the form of single or multiple plugs of autograft or allograft that are harvested from either a patient's own lateral distal femoral condyle or a fresh talus, respectively.[3,27] Whether an autograft or allograft is used, the graft plug(s) is secured into the OLT site with a press-fit mosaicplasty technique that requires no internal hardware.[19] Yoon et al performed an osteochondral autograft transplant in 22 patients with recurrent OLTs and achieved high rates of cartilage healing with return to function.[40] To date, no authors have considered the use of an osteochondral talar allograft to treat recurrent OLTs.

Although the literature is limited regarding the treatment of recurrent OLTs, there are more studies that examine the role of an OATS for managing primary OLTs larger than 1.5 cm^2. Several authors have performed an osteochondral autograft transplant in patients with large OLTs and obtained high rates of cartilage healing with good return to function.[18,35] However, harvesting osteochondral plugs from a patient's lateral distal femoral condyle is not without risks. This particular surgery involves a separate incision at the lateral patello-femoral knee joint, which can cause donor-site pain and morbidity.[30] In addition, recent in vitro studies have shown that cartilage at the lateral distal femur has a lower proteoglycan and higher water content than cartilage at the talar dome.[14] Such differences in biochemical properties may make distal femoral cartilage less resistant to stresses at the ankle joint than talar dome cartilage.

To overcome potential problems with the use of distal femoral osteochondral autografts, some authors have performed an osteochondral talar allograft transplant in patients with large OLTs. However, success rates from this surgery are highly variable and range from 56% to 86% in the current literature.[15,16] One reason for observing a wide frequency of cartilage healing may be due to differences in operative technique among different surgeons. Some authors have performed a mosaicplasty of single or multiple osteochondral plugs of talar allograft that are press-fitted at the site of the OLT.[12] Others have performed a hemi- or complete transplant of the talar dome with talar allograft and internal fixation to manage large OLTs.[17,29] Another possible explanation for lower reported healing rates with the use of osteochondral allografts might be the allogeneic nature of these grafts.[27,39]

One question that remains when addressing recurrent or large OLTs is whether to utilize osteochondral lateral distal femoral autograft or talar allograft to achieve talar cartilage healing. The purpose of this study was to prospectively evaluate and compare the long-term clinical and radiographic outcomes of using osteochondral distal femoral autograft and talar allograft to manage either recurrent or large osteochondral lesions of the talar dome (OLT) in a single surgeon's practice.

Methods

This research was conducted in a prospective and randomized manner between January 2008 and January 2014. The primary inclusion criteria were those patients with an OLT where an osteochondral graft, either autograft or allograft, would be necessary as treatment and performed as a press-fit mosaicplasty at the lesion. Ultimately, such OLTs were

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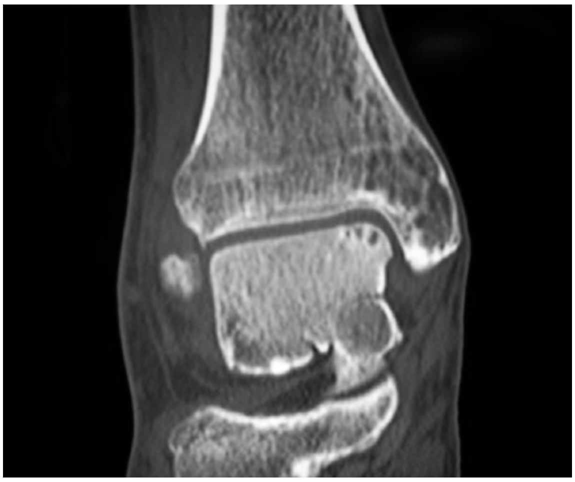

Figure 1. A coronal computed tomographic image of patient with a recurrent medial osteochondral lesion of the talar dome.

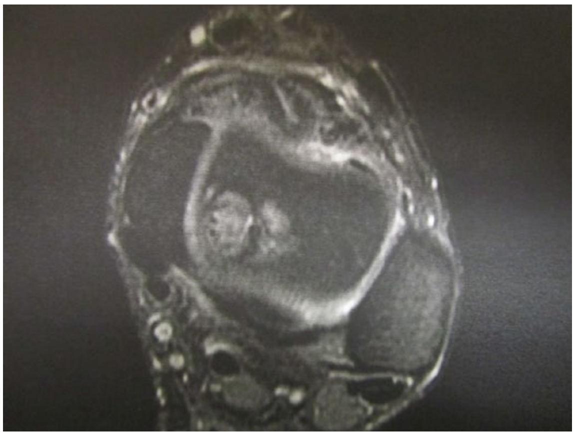

Figure 2. An axial magnetic resonance image of a patient with a primary, large posteromedial osteochondral lesion of the talar dome.

either recurrent ones that failed initial arthroscopic surgery or a primary lesion greater than 1.5 cm^2 that had undergone no prior surgery. At the time of clinical presentation, all patients received either computed tomography (CT, Figure 1) or magnetic resonance imaging (MRI, Figure 2) to confirm the OLT and its recurrent and/or large nature. Particular attention was paid to the location and extent of the OLT. Using a previously reported grid classification scheme, the OLT's location was described to occupy 1 of 9 portions of the talar dome: anteromedial (1), anterocentral (2), anterolateral (3), centromedial (4), central direct (5), centrolateral (6), posteromedial (7), posterocentral (8), and posterolateral (9).[11] Patients with OLTs that involved either the medial or

Figure 3. An example of a patient with a medial osteochondral lesion of the talar dome, but was excluded from this study because of involvement of the medial shoulder of the talar dome.

lateral shoulder of the talar dome (Figure 3) were excluded from this study since those lesions were not amenable to contain osteochondral plugs.[1] Rather, those patients often require a partial or complete talar dome allograft with internal fixation and were excluded from this research to minimize differences in operative technique between patients.

All patients had failed appropriate nonoperative management, which included a 4-week trial of non-weightbearing (NWB) immobilization in either a controlled ankle motion (CAM) boot or short leg cast (SLC). If patients with either a recurrent and/or large OLT improved with nonoperative modalities, they did not receive surgery and were excluded from this study. A summary of this study's specific inclusion and exclusion criteria can be found in Table 1.

Upon failure of nonoperative treatment, patients with either a recurrent and/or large OLT were offered enrollment in this study to receive either osteochondral autograft or allograft as the operative option. At the time of scheduling surgery, patients were assessed clinically and functionally. Patients were graded according to the Foot and Ankle Ability Measure (FAAM) Sports scoring system and a Visual Analog Scale (VAS) of pain.[6,25] At this same visit, an independent observer randomized patients to receive either lateral distal femoral autograft or talar allograft. Neither the

Table 1. Study Inclusion and Exclusion Criteria.

Inclusion
Patients with a recurrent OLT that fail recent nonoperative treatment, which include a minimum of 4 weeks of NWB immobilization.
Patients with a large OLT (greater than or equal to 1.5 cm^2) that fail recent nonoperative treatment, which include a minimum of 4 weeks of NWB immobilization.
Patients with either a recurrent or large OLT that do not involve the (medial or lateral) shoulder of the talar dome and are amenable to operative treatment with osteochondral (autograft or allograft) plugs.
Exclusion
Patients with a recurrent OLT that have improved symptoms from recent nonoperative treatment.
Patients with a large OLT (greater than or equal to 1.5 cm^2) that have improved symptoms from recent nonoperative treatment.
Patients with either a recurrent or large OLT that involve the (medial or lateral) shoulder of the talar dome and are not amenable to operative treatment with osteochondral (autograft or allograft) plugs.

Abbreviations: NWB, non-weightbearing; OLT, osteochondral lesion of the talar dome.

surgeon acting as principal investigator (PI) nor the patient was blinded from what type of osteochondral graft would be used during surgery. This study was performed with appropriate approval and consent from the institutional review board (IRB) at our practice and its affiliated hospitals. No funding was obtained from any outside source in the performance of this study.

Forty patients were initially enrolled in this study for treatment of a recurrent and/or large OLT. Twenty patients received osteochondral autograft plug(s) from the superolateral distal femoral condyle without internal fixation. While the other 20 patients had an osteochondral allograft from a fresh talus for management of their OLT, 16 received this in the form of osteochondral plug(s) without internal fixation. Intraoperatively, 4 allograft patients were discovered to have OLTs with significant involvement of either the medial or lateral shoulder of the talar dome. Those 4 patients received a hemi-talus allograft with internal fixation as operative treatment and were subsequently excluded from postoperative data collection. The final autograft and allograft groups were similar in terms of sex distribution, age, side of surgery, involvement with a Workers' Compensation (WC) claim, type and location of OLT, and preoperative FAAM and VAS scores (Table 2).

The 20 patients who received osteochondral autograft from the lateral distal femoral condyle as OLT treatment had a mean age of 41.3 years (range between 14 and 63 years) and were evaluated with a mean follow-up time of 35.2 months (range between 12 and 65 months). The 16 patients who received osteochondral allograft plugs from a fresh donor talus as OLT treatment had a mean age of 39.7 years (range between 17 and 60 years) and were evaluated with a mean follow-up time of 40.5 months (range between 14 and 77 months).

Table 2. Results.

Preoperative Demographics	Autograft	Allograft
Male : Female	11:9	10:6
Mean (range) age in years	41.3 (14-63)	39.7 (17-60)
Right : Left	8:12	6:10
Workers' Compensation : Not	9:11	10:6
Recurrent : Large OLT	15:5	12:4
Mean (range) preoperative FAAM	54.4/100 (31-88.1)	55.2/100 (36.9-82.1)
Mean (range) preoperative VAS score of pain	7.9/10 (4-10)	7.8/10 (5-10)
OLT location		
Anteromedial	2	2
Anterocentral	1	1
Anterolateral	3	3
Centromedial	7	4
Central direct	1	1
Centrolateral	2	3
Posteromedial	4	2
Posterocentral	0	0
Posterolateral	0	0

Abbreviations: FAAM, Foot and Ankle Ability Measures; OLT, osteochondral lesion of the talar dome; VAS, Visual Analog Scale.

Operative Technique

These procedures were performed under general anesthesia with regional block augmentation. A thigh tourniquet was used for both study groups and kept inflated from the time of leg exsanguination until dressings were applied after skin closure.

At the start of surgery, all study patients received a diagnostic ankle arthroscopy through standard anterolateral and anteromedial skin portals.[13] Arthroscopy was done to confirm the OLT and clarify its nature (primary or recurrent), location at the talar dome, and true size. Following arthroscopy, patients received an open ankle arthrotomy with or without malleolar osteotomy to expose the OLT and prepare it to receive osteochondral plugs.

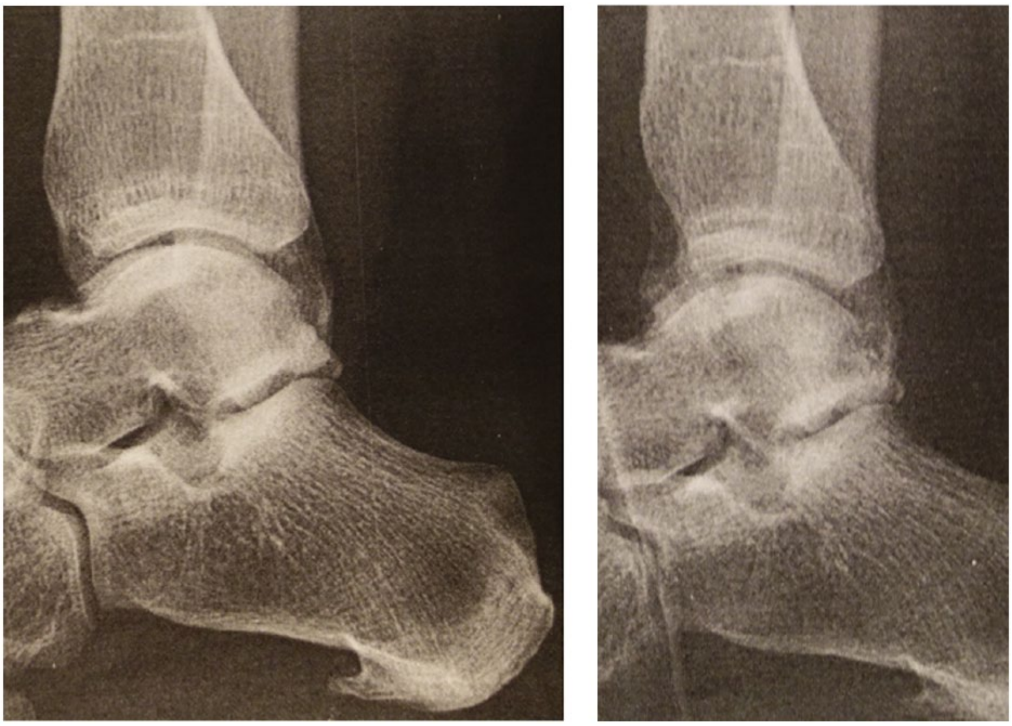

Figure 4. Pre- and postoperative lateral ankle radiographs of a patient with a recurrent central OLT that was treated with talar allograft through an anterior ankle arthrotomy and distal tibial plafond-plasty. Note that the anterior one-fourth of the distal tibial plafond has been resected without causing anterior ankle subluxation.

The specific type of ankle arthrotomy used to visualize and prepare the OLT for osteochondral graft was highly dependent upon the OLT's location at the talar dome. Regions of the talar dome affected were the anteromedial, anterocentral, anterolateral, centromedial, central direct, centrolateral, and posteromedial talar dome. No patients were found to have a posterolateral or posterocentral OLT that necessitated a lateral ankle arthrotomy with malleolar osteotomy or posterior ankle approach, respectively.

OLTs that were anterior (anteromedial, anterocentral, and anterolateral), central direct, or centrolateral were exposed with a standard anterior midline ankle arthrotomy[28] between the tibialis anterior (TA) and extensor hallucis longus (EHL). To fully visualize all anterior and central OLTs, excision of the synovium and osteotomy of the anterior one-fourth of the distal tibial plafond were performed after the capsulotomy (Figure 4). Intraoperatively, a resection of this amount of the anterior distal tibia with an osteotome was found to simultaneously reveal all anterior and central OLTs and avoid anterior ankle impingement and instability.

OLTs that were centromedial or posteromedial were exposed with a chevron-shaped medial malleolar osteotomy which was started with a micro-oscillating sagittal saw and completed with an osteotome.[23] With regard to the osteotomy, its anterior and posterior limbs extended to the anterocentral and posterocentral distal tibial plafond, respectively, to ensure a generous exposure of the entire medial talar dome and its OLT.

Once the OLT was exposed, it was excised by reaming the lesion to its full depth, but at least to 15 mm, with a width choice of 6, 8, or 10 mm reamers (Arthrex, Naples, FL). The size of the OLT determined the size and number of reamers used.

Upon reaming of the OLT and its subchondral bone, size-matched osteochondral grafts were harvested from either the patient's ipsilateral lateral distal femoral condyle or a fresh talar allograft. For patients who were randomly selected to receive osteochondral autograft, they received a longitudinal incision at their anterior knee just lateral to the patella. Osteochondral autograft plugs matched to the size of the reamed OLT were harvested from the extra-articular superolateral distal femoral condyle and then press-fit into the OLT site (Arthrex, Naples, FL). If more than 1 osteochondral autograft plug was needed at the OLT site, they were placed adjacent to each other as a mosaicplasty of plugs.

The allograft itself was a fresh size-matched donor talus (Joint Restoration Foundation, Centennial, CO) in all instances. The graft was utilized within 7 days of its release to minimize time-related loss of viable cartilage.[24] Upon

Figure 5. Initial postoperative radiograph of a patient with a recurrent medial OLT that was treated with talar allograft plugs through a medial ankle approach and malleolar osteotomy. Note that the osteotomy is fixed with 2 oblique parallel screws and 1 screw more horizontal and perpendicular to the osteotomy.

reaming of the OLT and its subchondral bone, osteochondral allograft plugs matched to the OLT's size were harvested from the talar allograft and then press-fit into the OLT site (Arthrex, Naples, FL). If more than 1 osteochondral allograft plug was required at the OLT site, they were positioned next to each other as a mosaicplasty of plugs. Care was taken to avoid excess prominence or subsidence of the osteochondral graft(s).

If distal femoral autograft was used for patients, the harvest sites were packed with demineralized bone matrix. If a medial malleolar osteotomy was performed for autograft or allograft patients, the malleolus was fixed with 2 oblique and 1 horizontal 4.0 mm partially threaded cannulated cancellous screws (Synthes, Paoli, PA; Figure 5). If patients received an anterior ankle arthrotomy, bone wax was applied to the site of the anterior-most distal tibia that was resected for hemostasis.

A posterior plaster splint was applied to the leg at neutral flexion. If patients' surgery involved distal femoral osteochondral autograft, the knee was wrapped in Webril cast padding and an ACE bandage but not rendered immobile. After surgery, patients were prohibited from weightbearing to their affected ankle for 6 weeks with the first 2 weeks in the splint and then transitioned to a CAM boot. If patients had an osteochondral autograft harvested from their ipsilateral lateral distal femoral condyle, they were encouraged to begin regular active and passive range-of-motion (ROM) exercises to their knee.

At 6 to 8 weeks, patients were allowed to progressively bear weight in increments of 50% of body weight in their CAM boots every 3 weeks. They were also allowed to begin active and passive ROM exercises to their ankle at this time. At 12 weeks after surgery, patients were started in physical therapy, weaned from their CAM boots and increased their level of activity as tolerated. At 16 to 20 weeks after surgery, patients were allowed to return to any type of athletic activity without restrictions. Ankle radiographs were performed at each of these early postoperative visits and assessed for progression of osteochondral graft healing.

Follow-Up Evaluation

Patients were seen at 2 weeks, 6 weeks, 12 weeks, 6 months, and 1 year after surgery. In addition to regular ankle radiographs during visits, all patients received a CT scan to assess healing of the osteochondral graft at 6 months after surgery. All patients were further invited for a final follow-up just before the article was written. Both preoperative and final postoperative radiographs were assessed for osteochondral healing and ankle joint congruency. Preoperative and final postoperative function was scored according to the validated FAAM. A validated 10-point VAS assessed preoperative and final postoperative pain. Postoperative complications including problems with graft healing, progression to degenerative joint disease (DJD), and the need for revision surgeries were documented. For those patients who received osteochondral autograft from their lateral distal femoral condyle, their knees were clinically assessed at final follow-up. Observed complications at the knee including pain, stiffness, and instability were recorded.

Data Analysis

The Statistical Package for the Social Sciences (version 11.0; SPSS, Chicago, Illinois) was used for the statistical analysis of data. ANOVA (analysis of variance) was performed. A P value of less than .05 was defined to be statistically significant.

Results

Of the 20 patients who received a distal femoral osteochondral autograft, 15 patients received treatment for a recurrent OLT whereas the other 5 patients had a large OLT greater than 1.5 cm^2. The mean size of the OLT for this patient group measured 1.6 cm^2. Nine patients had an anterior or central OLT that was exposed with an anterior ankle approach whereas the other 11 patients had a posteromedial OLT that was addressed through a medial ankle incision and malleolar osteotomy. The mean tourniquet time from the skin incision to closure was 92 minutes. None of these patients developed any intraoperative problems. One patient (5%) that received an anterior ankle approach for a central OLT developed postoperative superficial wound blistering that resolved with nonoperative, topical wound care. The mean FAAM score increased from 54.4 preoperatively to 85.5 at the time of final follow-up. The mean VAS pain score decreased from 7.9 preoperatively to 2.2 at final follow-up. By 6 months after surgery, 18 of 20 patients (90%) achieved full osteochondral healing on radiographic and CT imaging. At the time of final follow-up, no patients who received osteochondral autograft developed ankle degenerative changes.

Two patients (10%) in the autograft population developed a painful nonunion at the graft site. Specifically, this involved 1 patient who had a recurrent OLT of 1.3 cm^2 and 1 patient who had a primary OLT of 2.0 cm^2. Both of these patients ultimately failed nonoperative treatment for their graft nonunion and had their autograft converted to talar allograft plugs as revision operative treatment. By 6 months after this revision surgery, both patients achieved full osteochondral healing on radiographic and CT imaging.

With respect to the knee joint, 14 (70%) patients who received osteochondral autograft from their distal femur experienced postoperative knee problems at final follow-up. These patients displayed a full range of painless and stable motion and function to their involved knee compared to their contralateral, uninvolved knee. However, the remaining 6 patients (30%) reported varying degrees of postoperative knee complications at their latest follow-up. Three of these patients described occasional episodes of knee stiffness or "catching and popping," but denied pain or instability that interfered with daily activities. Two patients expressed moderate knee pain and swelling after prolonged standing and walking, which then resolved after a period of rest. One patient reported moderate to severe knee pain, swelling, and stiffness after moderate weightbearing activities, which has necessitated that he work in a sedentary capacity. Of note, this particular patient developed a large OLT after a work-related injury and required two 10-mm osteochondral autograft plugs for treatment.

Of the 16 patients who received osteochondral allograft plugs, 12 patients received treatment for a recurrent OLT whereas the other 4 patients had a large OLT greater than 1.5 cm^2. The mean size of the OLT for this patient group measured 1.8 cm^2. Ten patients had an anterior or central OLT that was exposed with an anterior ankle approach whereas the other 6 patients had a posteromedial OLT that was addressed through a medial ankle incision and malleolar osteotomy (Figure 6). The mean tourniquet time from the skin incision to closure was 76 minutes, which was significantly less compared to the autograft population ($P < .05$). None of these patients developed any intraoperative or immediate postoperative problems, such as wound complications. The mean FAAM score increased from 55.2 preoperatively to 80.7 at the time of final follow-up. This postoperative score is lower than that of the osteochondral autograft group but not to a statistically significant degree ($P = .25$). The mean VAS pain score decreased from 7.8 preoperatively to 2.7 at final follow-up. This postoperative score was higher than that of the osteochondral autograft group but not to a statistically significant degree ($P = .15$). By 6 months after surgery, 13 of the 16 patients (81.2%) achieved full osteochondral healing on radiographic and CT imaging. Of note, this rate of allograft healing was lower than osteochondral healing seen among the autograft patients. At the time of final follow-up, 1 (6.3%) allograft patient developed asymptomatic anterior ankle arthritis upon radiographs.

Figure 6. Preoperative and final postoperative radiographs of a patient with a large medial OLT that was successfully treated with talar allograft. Note that both the talar dome and its cystic changes have resolved. Note that the malleolar osteotomy is also healed with 3-screw fixation.

Table 3. Final Results With Statistical Correlation.

Postoperative Demographics	Autograft		Allograft
Anterior : medial operative approach	9:11		10:6
Mean (range) surface area of OLT in cm^2	1.6 (0.7-2.4)		1.8 (0.7-4.2)
Mean (range) tourniquet time in minutes	92 (57-120)		76 (63-98)
Student *t* test		$P < .05$	
Mean (range) of follow-up in months	35.2 (12-65)		40.5 (14-77)
Mean (range) postoperative FAAM	85.5/100 (56-97.6)		80.7/100 (56-95.2)
Student *t* test		$P = .25$	
Anterior: medial operative approach	81.8: 88.5		82.2:78.3 (79.3:83.0)
Student *t* test	$P = .15$		$P = .25$
Mean (range) postoperative VAS	2.2/10 (0-8)		2.7/10 (1-8)
Student *t* test		$P = .15$	
Anterior : medial operative approach	2.6:1.9		2.9:2.4 (2.6:2.9)
Student *t* test	$P = .15$		$P = .20$
Rate of graft nonunion	2/20 (10%)		3/16 (18.8%)

Abbreviations: FAAM, Foot and Ankle Ability Measures; OLT, osteochondral lesion of the talar dome; VAS, Visual Analog Scale.

Three patients (18.8%) in the allograft population developed a symptomatic nonunion at the graft site. This occurred in 2 patients with recurrent OLTs less than 1.5 cm^2 and 1 patient with a primary OLT of 2.2 cm^2. Two of these 3 patients ultimately failed nonoperative treatment for their graft nonunion and had their allograft converted to osteochondral autograft plugs harvested from the ipsilateral superolateral distal femoral condyle as revision operative treatment. By 6 months after this revision surgery, both revision operative patients achieved full osteochondral healing on radiographic and CT imaging.

Both the osteochondral autograft and allograft study populations were subdivided into patients where their OLT was exposed through an anterior distal tibial plafondplasty or medial malleolar osteotomy. From the autograft group, 9 and 11 patients received an anterior or medial operative approach, respectively. Among the 9 autograft patients who required an anterior arthrotomy, the mean FAAM and VAS scores were 81.8 and 2.6, respectively, at final presentation. With regards to the 11 autograft patients who necessitated a medial arthrotomy, the mean FAAM and VAS scores were 88.5 and 1.9, respectively, at latest evaluation. Patients who required a medial ankle exposure trended toward better postoperative functional and pain scores, but this was not found to be statistically significant ($P > .05$). From the allograft group, 10 and 6 patients received an anterior or medial operative approach, respectively. For the 10 allograft patients who received an anterior arthrotomy, the mean FAAM and VAS scores were 82.2 and 2.9, respectively, at final follow-up. Among the 6 allograft patients who had a medial arthrotomy, the mean FAAM and VAS scores were 78.3 and 2.4, respectively, at latest follow up. Patients who received an anterior ankle exposure had higher postoperative functional and pain scores, but this was not found to be statistically significant ($P > .05$). A summary of the final results with statistical correlation can be found in Table 3.

Discussion

Treatment of recurrent and/or large OLTs remains a challenge. Although arthroscopic treatment with microfracture can be done for these types of OLTs with low morbidity, favorable postoperative outcomes are not predictable. Savva et al performed revision ankle arthroscopy in 12 patients with recurrent OLT and reported a 91.6% success rate at long-term follow-up.[31] Yet with a larger patient population, Yoon et al found patients' function and pain to worsen and approach preoperative levels with long-term follow-up.[40] They attributed this complication to be due to poor survivorship of the fibrocartilage that forms at the OLT site after marrow stimulation. Akin to recurrent OLTs, large primary lesions do not fare well with arthroscopic treatment. Several authors have conducted large retrospective studies and found that OLTs larger than 1.5 cm^2 are at higher risk for healing complications than those that are smaller than 1.5 cm.[2,8,9]

Current operative options that are more successful in treating recurrent and/or large OLTs are osteochondral grafts through an open ankle arthrotomy and malleolar osteotomy as needed. One type of graft is an osteochondral autograft plug(s) from the lateral distal femoral condyle. However, most literature regarding the use of osteochondral autografts at the talar dome is limited to non-comparative, retrospective studies. Kreuz et al performed an osteochondral autograft transplant in 35 patients with recurrent OLTs and achieved full cartilage healing in all of their patients at long-term follow-up.[22] Other authors have performed an osteochondral autograft transplant for large OLTs with similar high success rates. In 2001, Schottle et al published one of the earliest reports on treating large OLTs with osteochondral autograft.[33] Although they acknowledged a learning curve to the OATS procedure, they reported high rates of cartilage healing with low rates of complications. More recently, Kim et al retrospectively treated 52 patients with large OLTs and obtained 95% healing of cartilage with single or multiple osteochondral autograft plugs.[21] However, it is currently accepted that harvesting osteochondral autograft from the distal femur has shortcomings. Such potential problems primarily include the risk of donor-site complications and inferior cartilaginous properties of the knee joint.

Another type of osteochondral graft that has been used more recently to treat recurrent and/or large OLTs is a fresh talar allograft plug(s). The advantages of using talar allograft over distal femoral autograft are the avoidance of a knee incision and sacrifice of cartilage there, shorter operative times, and replacing the OLT with talar cartilage. Prior to this study, no authors have reported the use of an osteochondral talar allograft to treat recurrent OLTs. Most existing studies involving the use of talar osteochondral allograft are regarding its role in treating large OLTs. In 2001, Gross et al published one of the earliest reports on treating large OLTs with fresh osteochondral allograft.[15] Among 9 patients who received talar allograft, only 6 (66.7%) achieved graft healing whereas the other 3 experienced graft fragmentation. More recently, El-Rashidy et al performed an osteochondral talar transplant in a larger patient population with large OLTs.[12] Among the 38 patients in this retrospective study, 34 patients (89.5%) achieved graft healing with significant improvement in pain and function. Although patient populations and success rates with talar allograft have increased with time, documented graft healing rates still do not seem as high as healing rates with the use of osteochondral autograft. One explanation for some lower reported healing rates with the use of osteochondral allografts might be due to the allogeneic nature of these grafts when used for patients. However, differences in previously published healing rates between osteochondral autografts and allografts may have been inaccurate because few of these studies were prospective and none were comparative.

Our research was randomized, prospective, and comparative between the use of osteochondral plugs of either distal femoral autograft or fresh talar allograft for managing recurrent and/or large OLTs. Both study groups had similar preoperative OLT dimensions and functional and pain scores. At final follow-up, both the autograft and allograft groups had large improvements in functional and pain scores. Although the autograft population had mean postoperative functional and pain scores that were higher than the allograft population, these differences were not statistically significant. Operative times were significantly less for the allograft than the autograft group. Although there was a higher percentage of osteochondral graft nonunion seen among the allograft population, it is difficult to assess this difference for significance because of the limited population between the 2 study groups. Ultimately, either the use of osteochondral autograft or allograft to treat recurrent and/or large OLTs resulted in a high rate of return to function, pain relief, and chondral healing.

We acknowledge the limitations of this study. As patients were not blinded for their surgery, they may have had preconceived notions regarding differences between a patient's own osteochondral autograft and an unknown donor's fresh talar allograft. If this was the case, this may have an effect on patient-reported outcomes between the study groups. To truly blind both patient populations, all of the allograft patients would have required a knee arthrotomy and harvesting of distal femoral osteochondral plugs that would not have been used. We did not feel such actions to be ethical. We acknowledge that the autograft and allograft populations were limited in size. In fact, 4 patients from the allograft group were excluded from the final data because they had OLTs that involved the shoulder of the talar dome and required more of a hemitalar transplant with internal fixation. A larger number of patients for both the autograft and allograft populations are needed to confirm or refute our results. In addition, it can be argued that both patient populations require longer follow-up than the medium term to fully assess their final clinical and radiographic outcomes. In time, distal femoral osteochondral autograft plugs may wear down because of its lower proteoglycan and higher water content than native cartilage at the talar dome. It remains to be seen if fresh talar osteochondral allograft plugs will resorb in the long term because of their allogenicity.

Conclusion

We compared treating recurrent or large OLTs with osteochondral autograft and allograft. The use of allograft avoided the risk of knee complications. Osteochondral healing rates between autograft and allograft were not found to be statistically different in this research. This study showed that using fresh talar osteochondral allograft provided results that were comparable to the use of distal femoral osteochondral autograft for treating recurrent or large OLTs. Using either autograft or allograft to treat these conditions resulted in a high rate of improved ankle function and pain relief. Studies with a larger patient population may be needed to further confirm these differences when using osteochondral autograft or allograft to manage these conditions.

Declaration of Conflicting Interests

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