Outcomes of osteochondral autografts in chondral lesions of talus

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Abstract

Background
chondral lesion of the talus is a common condition associated with ankle injury that carries challenges in the diagnosis and treatment. manifestations related to this condition are nonspecific including pain, swelling, stiffness, and mechanical symptoms of locking and catching. While the natural history of these chondral lesions is not well understood, surgical treatment is often required especially in chronic cases and acute cases with displaced articular fragments. biologic restoration techniques in the form of osteochondral autograft have role .

Patients and Methods
Between 2015 and 2018, 12 patients underwent autologous osteochondral transplantation for management of chondral lesion of the talus. The mean patient age at the time of surgery was 31.27 years (range, 19-45 years). All patients were followed for a minimum of 1 year after surgery. The mean follow-up time was 18.5 months (range, 12-36 months). Patient-reported outcome measures were taken preoperatively and at final follow-up using the Foot and Ankle Outcome Score (FAOS) were used in all cases.

Results
The mean FAOS scores improved from 49 43.points preoperatively to 84.62 points postoperatively (range, 75-95 points). One patient reported donor site knee pain after surgery, and one patient required refixation of medial malleolar osteotomy.

Conclusions
According to this study, Autologous osteochondral transplantation is a reproducible and primary treatment strategy for large osteochondral lesions of the talus.

Key words
talus; chondral lesions; Osteochondral fracture; OATS
Level of evidence: IV

Introduction

Osteochondral defects of the talus are common injuries and are becoming increasingly recognized with ever-improving cartilage-sensitive imaging modalities. It is estimated that up to half of acute ankle sprains and fractures will develop some form of osteochondral injury. Traditional treatment strategies have included repair and replacement of the damaged cartilage. Reparative techniques include debridement and bone marrow stimulation techniques, including microfracture and micro drilling. The short- to medium-term outcomes of these techniques have been good, particularly in association with smaller lesions.[1,2]

Replacement techniques include osteochondral autologous transplantation techniques) OATS .(These techniques are typically reserved for large or cystic Osteochondral defects, as well as failed primary repair procedures. While short- to medium-term follow-up studies have shown good outcomes and an advantage of implanting hyaline cartilage, potential complications exist including subchondral cyst formation and donor site knee pain.[3-5]

Osteochondral autologous transplantation (OATS),is a procedure in which viable hyaline cartilage and its underlying subchondral bone are harvested from the knee and transplanted to the site of the defect in the talus.[6-8]

This method has been used to treat large and cystic osteochondral lesions or after failed index surgery. Although OATs restores normal hyaline cartilage, it does have disadvantages, including considerable donor site morbidity, the formation of subchondral bone cysts, poor healing potential of the cartilage interface of the graft, the need for complex rehabilitation, sometime matching of articular surface to restore congruity of articular surface and a long recovery time .[8,9]

The current study presents the functional outcomes of

12 patients after autologous osteochondral transplantation of the talus, while placing a stress on the diagnosis, surgical technique, post-operative follow up to demonstrate how this technique can offer a reproducible primary treatment strategy for large OCLs of the talus.

Patients and Methods

Between 2015 and 2018, 12 patients underwent autologous osteochondral transplantation for management of chondral lesion of the talus. Patients were recruited from Menoufia University Hospital outpatient clinic and were operated in Menoufia University hospitals. The mean patient age at the time of surgery was 31.27 years (range, 19-45 years).

Inclusion and Exclusion Criteria

The criteria of inclusion were stable joint, absence of extensive joint degeneration (defined as radiographic changes of grade 2 or higher according to the grading system of Kellgren and Lawrence[10] ,and those with axial malalignment or chronic ankle instability were excluded, as were those with inflammatory or diabetic arthropathy. None of the patients were lost to follow-up during the study periods.

All patients had been assessed and were analyzed using the American Orthopaedic Foot and Ankle Society (AOFAS) All patients were evaluated before operation and were reviewed after 3, 6 and 12 months and then yearly afterwards. The overall clinical results were categorized according to the criteria suggested by other clinical studies using the AOFAS score (excellent, 90-100; good, 80-89; fair, 70-79; and poor, \70). Treatment failure was defined as persistent or recurrent symptoms, additional surgical treatment, or an AOFAS score lower than 80.[11-14]

At the time of initial examination, standard radiography and magnetic resonance imaging (MRI) were performed on all 12 patients and revealed no arthritic changes in any patient

Seven patients had right ankle joint involvement and five left. The mode of injury was twisting injury in all patients. On initial clinical evaluation, Full radiographic ankle assessment of all patients included anteroposterior, Mortis and lateral views (Fig. 1). Preoperative ankle MRI scans were performed to settle the diagnosis, reveal the magnitude of cartilage damage and exclude any associated collateral ligaments injury (Fig. 2). The mean time from trauma to operation was 12 (range 6-18) months. Patients' characteristics are presented in Table 1.

Fig 1: Preoperative plain X-rays showing the osteochondral fragment

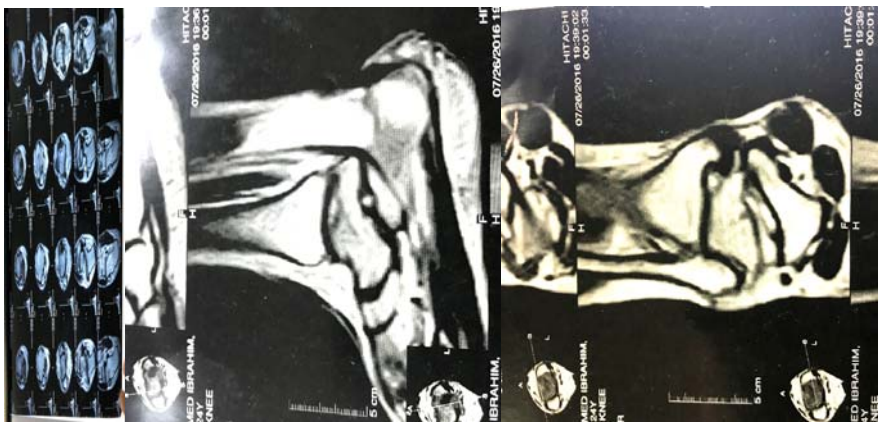

Fig 2: Preoperative MRI showing the chondral lesion with subchondral cyst

Table 1: Patients characteristics

Characteristic	1	2	3	4	5	6	7	8	9	10	11	12
Age (Years)	30	23	34	25	19	35	36	25	24	35	34	25
Gender	F	M	M	M	F	M	M	F	M	M	M	M
Side	Rt.	Rt.	Rt.	Lt.	Lt.	Rt.	Lt.	Rt.	Rt.	Rt.	Lt.	Lt.
Mech. Of inj.	Tw.	Tw.	Tw.	Tw.	Tw.	Tw	Tw.	Tw.	Tw.	Tw.	Tw.	Tw.
Inj.-Surg. (mo)	10	12	11	13	12	12	11	6	7	9	11	13
FU (months)	16	12	24	30	14	18	18	12	30	26	22	20

In the operative room, stability of ankle joint was examined under anesthesia before preparation and draping. A diagnostic ankle arthroscopy was done to evaluate chondral defect and surrounding cartilage. Small fragments were recognized and removed.

Surgical Technique:

Osteochondral Autologous Transplantation. After initial arthroscopic inspection and debridement of the ankle joint, the lesion was approached through a small longitudinal incision in the joint capsule. Debridement of subchondral bone of the defect. The osteochondral grafts (6 and 8 mm) were harvested from the non-weight bearing zone of the lateral femoral condyle using a special chisel (OATS; Arthrex, Naples, Florida, USA). The recipient lesions were debrided and prepared for the grafts. The donor cylinders were implanted by use of a press-fit technique (Figure 3). A mean of 1.5 osteochondral plugs (range, 1-2 plugs) were used in each patient. In patients with medial osteochondral lesion in the dome of talus, medial malleolar osteotomy was necessary for appropriate exposure of the talus lesion. For osteotomy of the medial ankle, 2 drill holes were made and check under C arm fluoroscopy and oblique chevron osteotomy was performed at the transition between the pilon and the medial malleolar joint surface. After OAT, the medial ankle was fixed with four 4.0-mm screws.

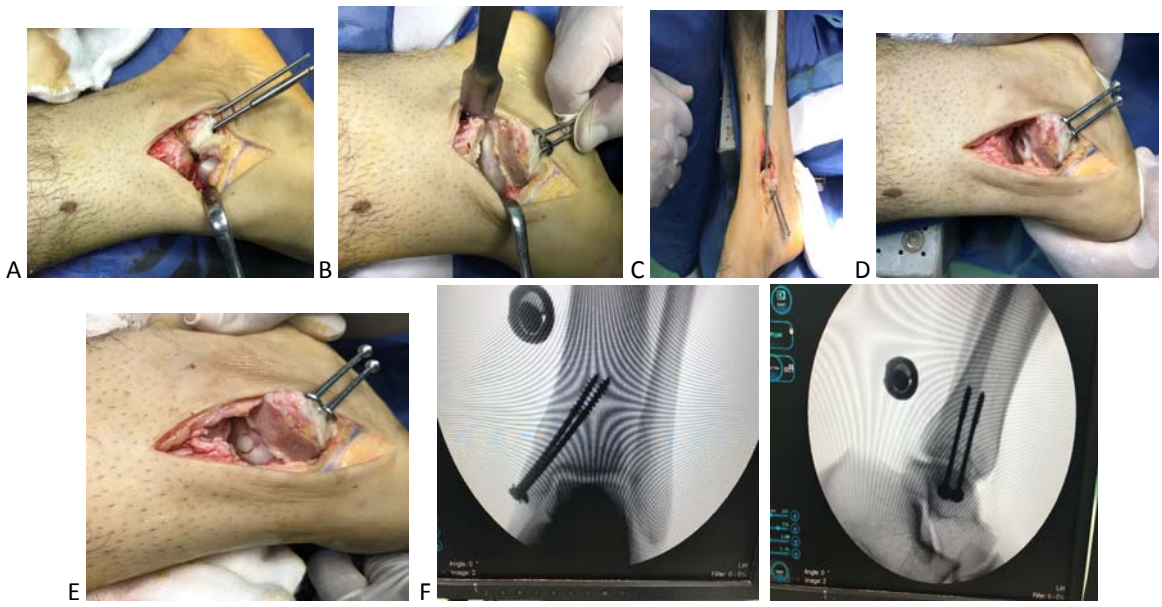

Fig 3 A: Medial approach and lining osteotomy site and predrilling of screws .**B:** Medial malleolar osteotomy and exposure of chondral lesion. **C:** preparation of recipient site with special harvester tube .**D:** After preparation of recipient site with special harvester tube .**E:** After insertion of osteochondral plug harvested from knee. **F:** C-Arm image of both AP and Laterl views.

Post-op Protocol:

Post-operative care consists of prophylactic antibiotics and pain management in the hospital. passive exercise of the ankle with limited range of motion and active isometric training were initiated immediately. Toe-touch ambulation with crutches was allowed, and physical therapy was prescribed. Gradual progression from partial to full weightbearing activity was allowed beginning 6 weeks after surgery after follow-up radiographs confirmed good incorporation of the osteochondral graft (Figure 4)

Fig 4 8 weeks post-operative plain X-ray showing complete healing of osteochondral fragment without significant arthritis

Bone healing and incorporation of the osteochondral plugs to the recipient bed was assessed using plain radiographs monthly after surgery for six months and ankle MRI scan done at 6 months post-surgery. Preoperatively and at the 3rd month, 6th month and after a year follow up visit, the patients were requested to complete the American Orthopaedic Foot and Ankle Society (AOFAS) form to evaluate the result.

Statistical analysis

American Orthopaedic Foot and Ankle Society (AOFAS) scores were expressed in medians. A non-parametric equivalent for paired t-test, Wilcoxon Signed Ranks test, was used to assess the difference significance in (AOFAS) scores between preoperative and follow up measurements. A non-parametric equivalent for t-test, Mann-Whitney test, was used to assess the difference significance in (AOFAS) scores pre and post-operative. The p-value was set at 0.05 so that p-values ≥ 0.05 are statistically non-significant (ns), p-values < 0.05 are significant (s), and p-values < 0.01 are highly significant (hs).

Results

The mean FAOS scores improved from 49.43 points preoperatively to 84.62 points postoperatively (range, 75-95 points). The average follows up period was 24 (range, 12-36) months .

Four patients were competing at some level of athletic sport prior to surgery and they return to the previous level of sporting activity by the end of follow up. The mean time of return to sporting activity was 16 weeks (range, 12-20 weeks). No surgical complications were reported .

Follow up X-rays showed complete consolidation of osteochondral plugs within 8-12 weeks with no significant arthritis at the last follow-up visits in any patient. Postoperative MRI scans confirmed the fragments consolidation with congruent intact articular cartilage surfaces with minor areas of thinning but no areas of full-thickness loss. One patient requested screw removal because of pain 2 years after surgery. requiring hardware removal, the hardware was removed, and the patient reported being pain free at final follow-up. No sign of ankle infection was noticed in any patient.one patient had non united malleolar osteotomy requiring revision by tension band wiring and bone graft from the distal tibia and improved by the end of follow up. One patient reported donor site knee pain after surgery and improved by the end of follow up.

Discussion

The advantages of replacing “like with like” at the site of cartilage repair are becoming increasingly recognized and may ultimately afford the ankle joint increased longevity over time.

This study results are quite satisfactory and similar to many recent studies concerned with managing such injury. Comparing the preoperative and postoperative medians of The FAOS scores improved from 49.43 points preoperatively to 84.62 points postoperatively (range, 75-95 points). for the[12] patients demonstrated highly significant improvement ($P = 0.002$). In the study done by Kennedy et al., The mean FAOS scores improved from 52.67 points preoperatively to 86.19 points postoperatively (range, 71-100 points). The mean SF-12 scores also improved from 59.40 points preoperatively to 88.63 points postoperatively.[15]

Osteochondral autograft transplantation has been proven to be a successful method with significant improvement of functional outcomes and the mean AOFAS scores were improved 5.7 to 27 points post-

operatively [16,17]. Hangody et al. studied[11] patients who underwent mosaicplasty autogenous osteochondral technique through arthrotomy of the ankle joint in 1997, with 82 percent of the patients reporting good results using Hannover Ankle/Bandi Knee Morbidity Scores [18]. In addition, Scranton et al. reported 90 percent of patients (45 of 50 patients) having good/excellent results and satisfied with the surgery with mean average of follow-up of 36 months 5. Moreover, Sammarco et al. studied 12 patients after using ipsilateral talar autograft, reporting significant improvement of AOFAS scores from 64.4 to 90.8 at a follow-up of 25.3 months[19] .

In current study there was only one case experienced knee pain (8%) which improved by the end of follow up. In study of Kennedy et al., does not demonstrate a significant concern in harvesting from a non-weight bearing aspect of the lateral femoral condyle. Three patients (4%) reported donor site knee pain after surgery, 2 of which were treated with a simple steroid injection, and reported complete relief of pain at final follow-up. A single patient reported a click- ing sensation postoperatively in his knee joint and required an arthroscopic resection of scar tissue formation at the lat- eral aspect of the knee joint. The low percentage of donor site morbidity can potentially be explained in 2 ways. First, the senior surgeon of the current study utilizes a synthetic bone void filler that acts as a scaffold to bone and cartilage infill. This may improve the quality of tissue infill and also prevent excessive bleeding after harvest, thereby reducing potential scarring. Second, bathing the synthetic scaffold in BMAC prior to implantation may potentiate the improved quantity and quality of bone and cartilage infill at the defect site.[15]

This study has some limitations, including the small patients' number and the relatively short-term follow up with an average of 24 months that may not reveal mid- to long-term outcomes to draw significant conclusions. Further studies with a larger patients' number and extended periods of follow up are needed. Another shortcoming of this study is the potential need of metal hardware removal. However, the relatively higher cost of other modalities of treatment such as Biodegradable pins and ACI is in favor of metal screws use. In addition, synovitis or foreign body response may be associated with biodegradable pins, as reported in the literature. [20]

Conclusion

According to this study, the treatment of patients with full thickness and osteochondral defect in talus with osteochondral autografting gave significant improvement with a relative efficacy, safety and cost-effectiveness. Studies with larger patients' number and longer follow up are still required to properly assess the profits of this management protocol.

References

1. Chuckpaiwong B, Berkson EM, Theodore GH. Microfracture for osteochondral lesions of the ankle: outcome analysis and outcome predictors of 105 cases. *Arthrosc J Arthrosc Relat Surg*. 2008;24(1):106-112.
2. Guo Q, Hu Y, Chen J, Yu C, Ao Y, HAO X. Arthroscopic treatment for osteochondral lesions of the talus: analysis of outcome predictors. *Chin Med J (Engl)*. 2010;123(3):296-300.
3. Zengerink M, Struijs PAA, Tol JL, Van Dijk CN. Treatment of osteochondral lesions of the talus: a systematic review. *Knee Surgery, Sport Traumatol Arthrosc*. 2010;18(2):238-246.
4. Hangody L, Vásárhelyi G, Hangody LR, et al. Autologous osteochondral grafting—technique and long-term results. *Injury*. 2008;39(1):32-39.
5. Scranton Jr PE, Frey CC, Feder KS. Outcome of osteochondral autograft transplantation for type-V cystic osteochondral lesions of the talus. *J Bone Joint Surg Br*. 2006;88(5):614-619.
6. Wodicka R, Ferkel E, Ferkel R. Osteochondral lesions of the ankle. *Foot ankle Int*. 2016;37(9):1023-1034.
7. Becher C, Thermann H. Results of microfracture in the treatment of articular cartilage defects of the talus. *Foot ankle Int*. 2005;26(8):583-589.
8. Hangody L, Dobos J, Balo E, Panics G, Rudolf Hangody L, Berkes I. Clinical experiences with autologous osteochondral mosaicplasty in an athletic population: A 17-year prospective multicenter study. *Am J Sports Med*. 2010;38(6):1125-1133.
9. Spatt JF, Frank NG, Fox IM. Transchondral fractures of the dome of the talus. *J Foot Surg*. 1986;25(1):68-72.
10. Kellgren JH, Lawrence JS. Radiological assessment of osteo-arthrosis. *Ann Rheum Dis*. 1957;16(4):494.
11. Choi WJ, Kim BS, Lee JW. Osteochondral lesion of the talus: could age be an indication for arthroscopic treatment? *Am J Sports Med*. 2012;40(2):419-424.
12. Choi WJ, Park KK, Kim BS, Lee JW. Osteochondral lesion of the talus: is there a critical defect size for poor outcome? *Am J Sports Med*. 2009;37(10):1974-1980.
13. Lee K-B, Bai L-B, Yoon T-R, Jung S-T, Seon J-K. Second-look arthroscopic findings and clinical outcomes after microfracture for osteochondral lesions of the talus. *Am J Sports Med*. 2009;37(1_suppl):63-70.
14. Saxena A, Eakin C. Articular talar injuries in athletes: results of microfracture and autogenous bone graft. *Am J Sports Med*. 2007;35(10):1680-1687.
15. Kennedy JG, Murawski CD. The treatment of osteochondral lesions of the talus with autologous osteochondral transplantation and bone marrow aspirate concentrate: Surgical technique. *Cartilage*. 2011;2(4):327-336.
16. Kreuz PC, Steinwachs M, Erggelet C, Lahm A, Henle P, Niemeyer P. Mosaicplasty with autogenous talar autograft for osteochondral lesions of the talus after failed primary arthroscopic management: a prospective study with a 4-year follow-up. *Am J Sports Med*. 2006;34(1):55-63.
17. Scranton Jr PE, McDermott JE. Treatment of type V osteochondral lesions of the talus with ipsilateral knee osteochondral autografts. *Foot ankle Int*. 2001;22(5):380-384.
18. Hangody L, Kish G, Karpati Z, Szerb I, Eberhardt R. Treatment of osteochondritis dissecans of the talus: use of the mosaicplasty technique—a preliminary report. *Foot ankle Int*. 1997;18(10):628-634.
19. Sammarco GJ, Makwana NK. Treatment of talar osteochondral lesions using local osteochondral graft. *Foot ankle Int*. 2002;23(8):693-698.
20. Fridén T, Rydholm U. Severe aseptic synovitis of the knee after biodegradable internal fixation: a case report. *Acta Orthop Scand*. 1992;63(1):94-97.