Treatment of Osteochondral Defects of the Talus Utilizing Patient Specific Instrumentation and Implants

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Statement of Purpose

Osteochondral lesion of the talus (OLT) is a broad term used to describe a defect in the cartilage and subchondral bone of the talus[1]. Medial OLT are not only more common than their lateral counterpart, but they are larger in surface area and significantly deeper[2]. thought to be unstable, often requiring surgical intervention. We present two patients with medial talar shoulder OLTs who were treated using patient specific instrumentation and custom implants.

Figure 1A. Preoperative CT scan reveals a Stage 2b medial OLT according to Ferkel and Sgaglione's CT classification system. **Figure 1B**. Demonstrates similar findings on MRI. This lesion would be considered stage 2a according to Hepple's MRI classification.

Literature Review

OLT represent a spectrum of injuries to the articular cartilage and subchondral bone of the talar dome. There are six characteristics used to describe a lesion including: size, location, stability, containment, displacement, and lesion type[1], many of which carry treatment and prognostic value. With the exception of acutely displaced fragments, many authors advocate for a period of non-operative management, some up to 3-6 months in length[1]. Despite this recommendation, over half of all lesions may require surgical intervention[3]. Described surgical treatment includes microfracture, osteochondral autograft, osteochondral allograft and autologous chondrocyte implantation[1,4]. Despite the traditional belief that the majority of these lesions lie either anterolateral or posteromedial on the talar dome[5], Raikin et al showed that the great majority of OLT lie on the equator, and most often on the medial portion[2]. This can be a difficult area to access and a medial malleolar osteotomy is often required for surgical exposure of the lesion[6]. However, osteotomy through the tibial articular surface

Literature Review

could trigger a rise in inflammatory cytokines, leading to further joint or lesion deterioration[7]. Using metal grafts for resurfacing OLT has been described with high satisfaction and 95% survivorship at midterm follow up[8]. However, a high reoperation rate was reported most commonly to remove screws used to fixate the medial malleolar osteotomy[8]. With the advent of three-dimensional (3D) printing, custom, patient specific instrumentation and implants can obviate the need for medial malleolar osteotomy and ensure a direct anatomic fit.

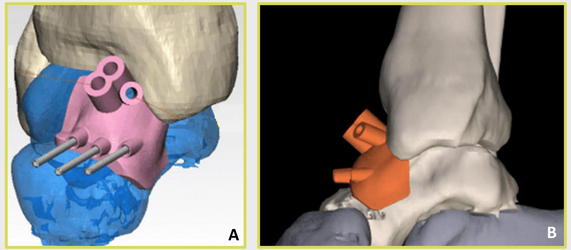

Figure 2A, 2B. 3D rendering of the custom cut guide. This patient specific instrumentation allowed the lesion to be approached from anterior, obviating the need for a medial malleolar osteotomy.

Case Study

Two patients presented to the senior author with medial talar shoulder OLTs (see Table 1). Both patients reported a traumatic injury to the involved ankle. Patient one had conservative treatment consisting of a cortisone injection to the ankle which afforded relief of her symptoms, but for a minimal amount of time. She then underwent partial talar resurfacing utilizing a custom, 3D printed implant. Patient specific cut guides were also utilized which allowed access to the lesion from an anterior approach. Patient two had previously undergone two surgical interventions including arthroscopy with microfracture, as well as injection of a flowable calcium phosphate. Both of these procedures failed to relieve her symptoms and ultimately, she underwent partial talar resurfacing with a custom, 3D printed implant from a medial approach which required a medial malleolar osteotomy. At 12 month follow up, patient 1 was

Case Study

ambulating unassisted with minimal discomfort. Her VAS score was 2/10 and her AOFAS score was 77. At 36 month follow up, patient 2 was ambulating unassisted with minimal discomfort. Her VAS score was 3/10 and her AOFAS score was 80. Both patients were satisfied with the procedure and stated they would undergo it again.

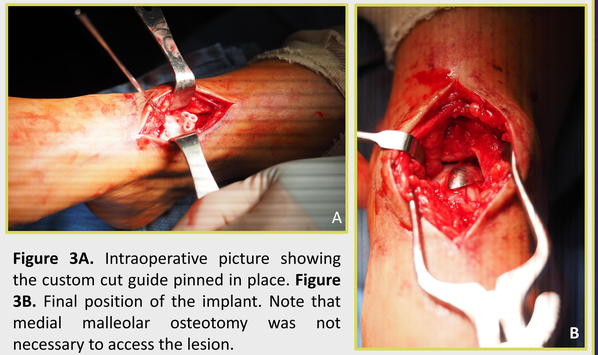

Figure 3A. Intraoperative picture showing the custom cut guide pinned in place. **Figure 3B.** Final position of the implant. Note that medial malleolar osteotomy was not necessary to access the lesion.

Analysis & Discussion

Up to 70% of ankle sprains and fractures are accompanied by an OLT. The vast majority of these lesions occur on the medial portion of the talar dome, and tend to be larger, deeper, and more unstable than their lateral counterparts. Operative intervention, often necessary for these lesions, ranges from debridement with microfracture to osteochondral autograft or allograft transplantation. Patient specific instrumentation and implants can obviate the need for medial malleolar osteotomy which may be an additional source of morbidity when treating medial lesions. We were able to achieve satisfactory results treating two medial talar shoulder OLTs using patient specific

Patient	Sex	Age	Medial Malleolar Osteotomy	Follow Up (Months)	VAS*	AOFAS*
1	F	27	No	12	2	77
2	F	45	Yes	36	3	80

*Scores collected at final follow up

Table 1. Patient demographic and follow-up data.

Analysis & Discussion

instrumentation and implants, one of which was able to be performed from an anterior approach. An additional benefit of the anterior approach, besides the obvious of avoiding a medial malleolar osteotomy, is that conversion from hemi-resurfacing of the talus to a total ankle or total talus replacement can be performed through the same incision. Future research should compare outcomes of patient specific implants and instrumentation to commercially available implants. Another area of research should evaluate outcomes of lesions approached via medial malleolar osteotomy versus no osteotomy. This information would be beneficial to surgeons in planning the approach which would result in the best outcome for their patients.

Figure 4A. Radiographic follow up showing custom partial talar resurfacing approached through a medial malleolar osteotomy. **Figure 4B** Radiographic follow up showing partial talar resurfacing using a custom implant. This was implanted from an anterior approach without medial, malleolar osteotomy.

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None