Reconstruction of the Talus and Calcaneus Using a 3D Printed Custom Implant Following a Gunshot Wound: A Case Report

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Background / Significance
Trauma to the foot and ankle is a cause of significant morbidity and disability [1]. In the event of severe and complex injuries, traditional surgical techniques may not provide adequate functional and structural reconstruction, leading to chronic pain and reduced mobility [2]. Advances in three-dimensional (3D) printing technology have provided new opportunities for the creation of custom implants that can be tailored to the individual needs of patients with complex foot and ankle injuries [3-8].

Purpose / Goals / Objectives
The aim of this case report is to describe the successful use of a 3D printed custom implant for the reconstruction of the talus and calcaneus following a gunshot wound. This case report demonstrates that custom implants created using 3D printing technology can be a viable option for the reconstruction of complex foot and ankle injuries.

3D implant just prior to and just following implantation

Case Presentation

Indication
A 15-year-old male presented to the clinic non weightbearing with external fixation in place due to a history of a self-inflicted gunshot wound to the right hindfoot two months prior. The patient had sustained multiple fractures of the talus and calcaneus, resulting in significant loss of articular surface and displacement of fragments. After several surgeries at an outside facility, he was referred to our institution for a second opinion on bone grafting versus amputation due to bone loss and malunion. The patient and his family opted to go with the limb salvage procedure. Following a thorough clinical evaluation and imaging studies, the patient was deemed to be a candidate for reconstruction of the talus and calcaneus using a 3D printed custom implant. A detailed 3D image of the patient’s foot was obtained using computed tomography (CT) scans, which was used to create a custom implant tailored to the patient’s unique anatomy.

Procedure

Surgery 1: External fixator placed at Kendall Regional & Antibiotic Spacer placed
Surgery 2: External fixator removed, medially based free flap, lateral propeller flap and fibrotic bone and fibrous material debrided off calcaneous and talus. Tobramycin and vancomycin antibiotic cement and wound irrigated.
Visit 1: Sutures removed and patient received oral antibiotics
  2 weeks postop: Sutures removed, cultures negative, patient placed in a CAM walker boot and begins partial weightbearing.
Surgery 4: Fusion surgery with intramedullary nail and 3D printed implant custom made (Paragon-28).
  2 weeks postop: Sutures removed and patient placed into a short leg nonweightbearing cast.
  4 months postop: Cam boot given at 6 weeks postop and patient began partial weightbearing with CAM boot at 4 months progressing over 4 weeks
  5 months postop: Full-weightbearing for patient begins
12 months postop: Patient ambulates fully weightbearing with slight discomfort secondary to an ankle contracture (a fixed, slight plantarflexion of right foot)

Discussion
In conclusion, the present case illustrates the successful use of a 3D printed custom implant for the reconstruction of the talus and calcaneus following a gunshot wound. This technology has the potential to revolutionize the field of foot and ankle orthopedic surgery, allowing for precise and tailored reconstruction of severe and complex injuries. While the use of 3D printing technology is not without potential complications, the success of this case highlights the potential benefits of this approach in the field of orthopedic surgery.

References