

## The Use of Patient-Specific 3D Printed Titanium Implants for Complex Foot and Ankle Limb Salvage, Deformity Correction, and Arthrodesis Procedures

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**Introduction/Purpose:** Large lower extremity bony defects, complex foot and ankle deformities, and high-risk arthrodesis situations can be difficult to treat. These challenging pathologies, often require a critical-sized and/or shaped structural bone void filler which may not be available with allograft bone. The advancement of 3D printing technology has allowed for the use of custom designed implants for foot and ankle surgery. This study reports on the radiographic and functional outcomes of a case series of patients treated with patient-specific 3D printed titanium implants.

**Methods:** Seven consecutive patients who were treated with custom designed 3D printed implant cages for severe bone loss, deformity correction, and arthrodesis procedures were included in this study. A minimum of 1-year follow-up was required. No patients were lost to follow-up. Patients completed preoperative and most recent follow-up VAS for pain, FAAM, and SF-36 outcomes questionnaires. All patients had post-operative radiographs and CT scans to assess bony incorporation.

**Results:** The mean age of these patients was 54.6 (35-73 years of age). The mean follow-up of these seven patients was 17.1 months (range 12 to 31). Radiographic fusion with cage ingrowth and integration occurred in all seven patients verified by CT scan. There was statistically significant improvement in all functional outcome score measures (VAS for pain, FAAM, and SF-36). All patients returned were satisfied with surgery. There were no failures. Case examples are demonstrated in Figure 1.

**Conclusion:** This cohort of patients demonstrated the successful use of custom 3D printed implants to treat complex large bony defects, deformities and arthrodesis procedures of the lower extremity. These implants offer the surgeon a patient specific approach to treat both pain and deformity that is not necessarily available with allograft bone.

Figure 1. Three example patients that received 3D printed titanium implants for bone loss and/or deformity correction.

