

### Three-Dimensional Printing for Large Segmental Bone Defects in the Femur and Tibia: A Case Study and Review of the Literature

*Jon Hammarstedt, MD; Edward Ryan Westrick, MD*

*Allegheny Health Network, Pittsburgh, Pennsylvania, UNITED STATES*

**Purpose:** Segmental bone loss presents a substantial reconstructive challenge to the orthopaedic surgeon. Recently, 3-dimensional (3-D) printing technology has been employed for the development of implants used for reconstruction of these defects. We present 2 cases of 3-D printed implants used to reconstruct segmental defects in the femur and tibia with follow-up of 24 months and 6 months, respectively.

**Methods:** Two separate cases of segmental bone loss in the tibia and femur were treated with custom 3-D printed femoral and tibial implants using laser powder bed fusion (L-PBF) medical grade titanium alloy (Ti6Al4V ELI).

**Results:** Both patients achieved radiographic evidence of union and demonstrated excellent functional outcomes at long-term follow-up.

**Conclusion:** We describe here 2 cases involving the successful use of 3-D printed implants employed in a reconstructive strategy for segmental bone loss with latest follow-up of 1 year. Future cases with similar features may benefit from the precision of 3-D printed implants for reconstruction in segmental long bone defects, particularly in cases where other traditional limb salvage techniques have failed or are contraindicated. This technology remains new to the field of orthopaedics, thus further research is warranted and the use of 3-D printed technology should be employed judiciously.



Figure XXXXX: Two year post op AP and lateral of the right knee after open reduction and internal fixation with custom 3d printed distal femur (Restor3d, Durham, NC) and retrograde nail (DJO Global, Lewisville, TX).

The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device they wish to use in clinical practice.