Clinical Results Using 3D-Printed Titanium Cages Combined with the Masquelet Technique for the Reconstruction of Massive Segmental Femoral Defects

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Purpose: Our objective was to evaluate the efficacy of using 3D-printed patient-specific titanium cages (scaffolds) in carefully selected patients, in conjunction with the Masquelet technique, to address massive posttraumatic segmental femoral bone loss.

Methods: A retrospective cohort study design identified patients with massive (>8 cm) posttraumatic segmental bone loss treated at our institution with this technique between July 2015 and January 2018. Eligible patients were: consenting adults, posttraumatic, with massive segmental femoral defects >8 cm in length, minimum follow-up 36 months, managed under a 2-stage protocol, with an interim antibiotic PMMA (polymethylmethacrylate) spacer. Definitive reconstruction was completed with exchange to a 3D-printed custom titanium cage/scaffold filled with bone graft, stabilized with either an intramedullary nail or a lateral locked plate.

Results: Patient-specific 3D-printed titanium cages/scaffolds were used in 9 patients to reconstruct posttraumatic segmental femoral defects. The mean interval between stages was 125.2 days (range, 83-312), 132.7 mm (83-186), and the mean bone defect volume measured 121.2 cc (66-239). The mean length of follow-up was 58.6 months (36-74). There were no incidences of fractures, nerve injuries, loss of alignment, or failure to achieve bony incorporation, at both proximal and distal host/implant junction identified during the period of follow-up. One patient required revision surgery with augmentation of the proximal junction with additional autologous bone graft. All of the patients ultimately achieved bony incorporation at both host/implant junctions clinically and radiographically.

Conclusion: This study confirms that use of a patient-specific 3D-printed custom titanium cage, inserted into an induced membrane in a 2-stage protocol, can achieve very acceptable clinical outcomes in selected cases of massive posttraumatic femoral segmental defects. Patient-specific 3D-printed titanium cages, used in conjunction with the Masquelet technique, are a promising new treatment option for managing complex trauma patients with femoral bone loss.