

No.10757

Implantation of Customized 3-D Printed Titanium Prosthesis in Limb Salvage Surgery: a Case Series and Review of the Literature

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Background: Although the modular prosthesis is commercially available to meet requirements in most limb salvage surgeries, customized prosthesis is still needed. In contrast to traditional complex procedures, rapid prototyping (RP) technique can directly manufacture customized titanium prosthesis.

Purposes: The objective of this study was to describe the workflow of this technique and show the follow-up results of patients.

Patients and Methods: Three patients with clavicle Ewing's sarcoma (ES), scapular ES, and pelvic chondrosarcoma (CS) were scanned by computer tomography (CT). The images were segmented and reconstructed for surgical planning and prosthesis design. Then, the data of design were imported into electron beam melting system to manufacture implants. These patients received tumor excision and prosthesis implantation. They were followed up to evaluate survival rate, functional outcome, and complication.

Results: All patients were alive with no evidence of disease. The Musculoskeletal Tumor Society (MSTS) scores were 93%, 73%, and 90% for patients with clavicle ES, scapular ES, and pelvic CS, respectively. There were no complications such as limb length discrepancy, screw loosening, and implant breakage.

Conclusions: EBM is a useful method to directly manufacture customized titanium prostheses. It might improve the safety and effectiveness of limb salvage surgery for sarcomas in unusual site.