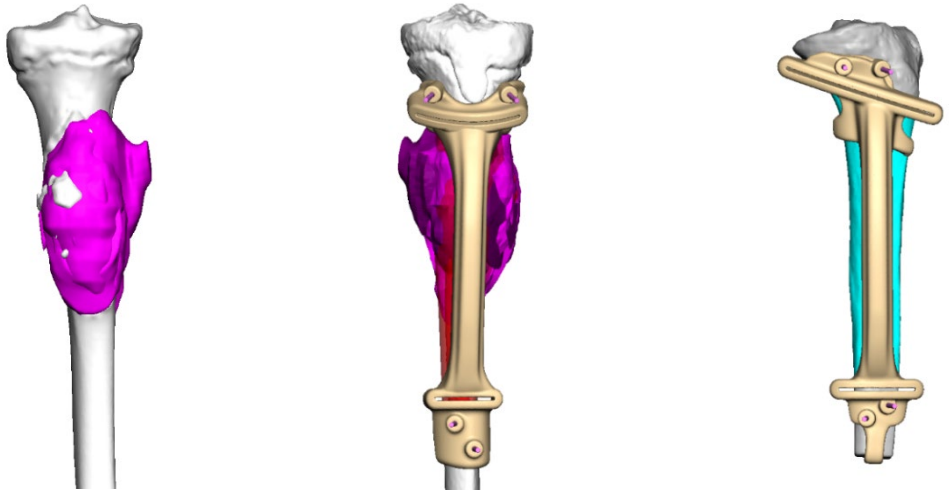
3D PRINTING & Training Center | Clarkson College

CASE STUDY:

Point-of-Care Surgical Planning and Patient-Specific Surgical Guides in Orthopedics Oncology Procedures



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- Dr. Sean McGarry, MD, The University of Nebraska Medical Center

Background

Clarkson College partnered with 3D Systems to establish The 3D Printing and Training Center of Excellence (COE) on campus in Omaha. The goal is to bring technology closer to point-of-care and make patient-specific devices workflows accessible to clinicians and healthcare facilities across the region. A broad range of patient-specific devices are offered through the COE which includes diagnostic anatomic models, surgical guides for orthopedic oncology procedures and radiotherapy accessories. This case study involves utilizing the COE and on-site capabilities for surgical planning and surgical guides design for a complex orthopedic oncology procedure.

About the Case

The patient was diagnosed with osteosarcoma from a proximal tibial bone lesion which required resection and reconstruction with an allograft. Since the tumor was in proximity with the joint and the physis, the surgeon resorted to surgical planning and 3D printed surgical guides for an accurate resection and reconstruction to achieve desired patient outcomes. The surgeon had the following priorities for this patient.

1. Achieve safe and appropriate tumor margins with surgical planning and surgical guides
2. Preserve patient's joint and physis
3. Plan reconstruction with an allograft and provide surgical guides for reconstruction
4. Provide a plate bending template of the planned reconstruction to save time in the OR

The Solution

> Our on-site trained 3D Systems Clinical Engineer accurately segmented the patient anatomy from medical imaging data and verified the segmentation with the clinical team.

> After segmenting the patient anatomy, the 3D Printing administrator, clinical engineer and the surgeon met in person for surgical planning which involved planning for resection of the tumor as well as planning for reconstruction of the defect using an allograft.

> After the planning, patient-specific surgical instruments were designed on-site and later reviewed and approved by the surgeon for manufacturing using 3D printing.

> The models, surgical guides and templates were manufactured from 3D Systems ISO 13485:2016 certified manufacturing facility in Littleton, Colorado and shipped along with appropriate labeling for the devices to be sterilized and used in the OR.

One of the most impactful purposes of providing anatomical models in orthopedic oncology procedures is to reference the placement of the guides as per the plan and to prebend reconstruction plates to save time in the OR. The surgeon in this case utilized the reconstructed model to prebend the plate as shown below.

Surgeon bending reconstruction plate using 3D printed model

Conclusion and Outcomes:

> The case was successful with the surgeon accurately resecting the tumor with appropriate margins as well as reconstructing the defect with an allograft as per the plan.

> The surgeon Dr. Sean McGarry, M.D., Musculoskeletal Oncology Chair at University of Nebraska Medical Center, affirmed, “We were able to significantly reduce operative time with the use of custom cutting blocks for both tumor resection and allograft reconstruction.”

> The on-site collaboration between the surgical team and the COE team at Clarkson College proved to be of immense value for such complex case where collaboration and communication between engineers and clinical team is of utmost importance for a successful outcome. Dr. McGarry stated, “Additionally, I was able to make the cuts with confidence knowing that they would be accurate based on the collaboration between the onsite clinical Engineer and myself.”

> Having a manufacturing partner like 3D Systems who has the expertise and appropriate quality systems to execute manufacturing of such devices and ensure safety, effectiveness and performance as intended proved to be critical to provide the devices in a compliant manner.