

The Feasibility of Customized Implant Production for Acute Fracture Fixation

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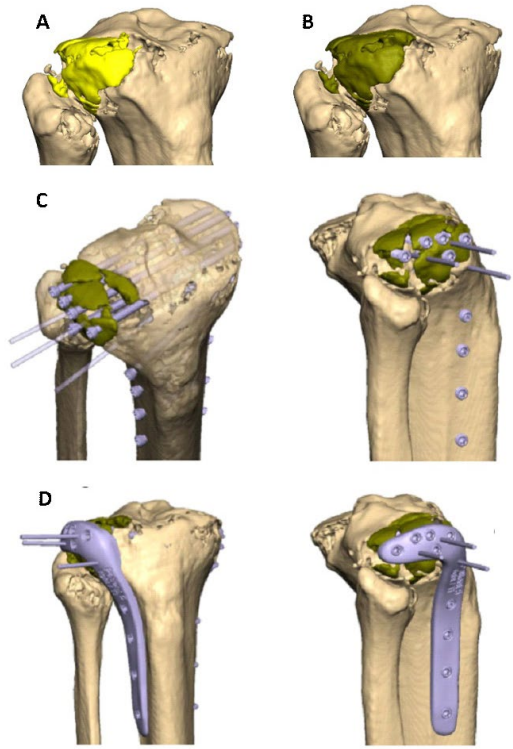
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Purpose: Use of customized implants for 3-dimensional (3D) printing has largely been limited to elective, non-urgent settings due to the lead time required for implant production. The aim of this study was to assess the feasibility of 3D printing a customized implant at the point of care for acute fracture fixation, from a manufacturing and logistics perspective. We hypothesized that customized plate production would be possible within a clinically relevant time frame of 72 hours using currently available technology.

Methods: This study uses 6 cadaveric lower limbs to simulate real-life surgical patients. Split-depressed lateral tibial plateau fractures were created in an identical fashion in the cadaveric lower limbs. CT scans of the fractures were obtained and digital reconstructions were used to design customized patient and fracture-specific 3D-printed plates. These were subsequently printed in medical grade stainless steel 316L and post-processed at a local additive manufacturing center. Surgical fixation of the fractures was then carried out using these plates, following which postoperative radiographs were obtained. The time taken for each step in plate production from the initiation of preoperative CT scan to the completion of the postoperative radiograph was recorded.

Results: Six customized proximal tibia locking plates were produced with accompanying surgical drill guides. The mean total time taken for plate fabrication from completion of CT scan was approximately 24 hours and 7 minutes, with a maximum of 28 hours and 46 minutes.

Conclusion: Production of patient-specific 3D-printed plates for fixation of proximal tibia fractures at the point of care is achievable within a clinically acceptable time frame provided adequate manufacturing facilities and skilled manpower are in place. Implant production time is likely to decrease further with streamlining of processes and optimization of production workflows.



TECHNICAL TRICKS AND TIPS

See the meeting app for complete listing of authors' disclosure information. Schedule and presenters subject to change.