The Use of 3-Dimensional (3D) Printing in Orthopaedic Resident Education: Enhanced Understanding of Triplane Fractures

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PURPOSE

The purpose of this study was to evaluate the ability of 3D printing to improve orthopaedic resident education.

BACKGROUND

- With the advancement of medical imaging, software and three-dimensional printers, there is an evolving role for 3D printing in the medical profession, including:
  - Surgical planning
  - Customized implant design
  - Anatomy education
- Because of their complexity, triplane fractures of the distal tibia can be challenging to teach orthopaedic residents to visualize.
- 3D printed models allow trainees to utilize the sense of touch when creating mental replicas of fractures, which likely enhances their understanding of complex inter-fragmentary spatial relationships.
- Triplane fractures therefore offer an ideal opportunity for investigating the use of 3D printing as an educational adjunct for orthopaedic residents.

HYPOTHESIS

The study hypothesis was that the use of 3D printed models as part of a comprehensive educational program would result in improved orthopaedic resident confidence and performance treating transitional ankle injuries such as triplane fractures in adolescent patients.

METHODS

- 16 orthopaedic residents were randomized to either study or control group.
- Each participant took a written test designed to assess knowledge of transitional ankle fractures.
- Evaluation of residents was performed in a simulated fracture clinic setting, where the residents were given 3D printed models of representative triplane fractures.
- All residents were asked if they felt the opportunity to attend lectures, read a comprehensive review of CT imaging of triplane fractures, and the study group had the additional opportunity to manually manipulate 3D-printed models provided.
- All participants re-took the self-assessment tests.
- The study group additionally had the opportunity to manually manipulate 3D-printed models of representative triplane fractures.
- Completed sawbones were graded by 3 pediatric orthopaedic surgeons.
- Paired t-tests were used to determine between-groups differences for performance on written and practical assessments and Likert responses.

RESULTS

- Both study and control groups demonstrated significant improvement in testing scores following the educational session (p<0.01).
- There were trends toward greater improvement in testing scores and higher sawbones scores for the study group, although these did not achieve statistical significance.
- Only residents in the study group demonstrated statistically significant increases in Likert scores (p<0.05).

CONCLUSIONS

- The use of 3D printed models of pediatric transitional ankle fractures as part of a teaching module for orthopaedic residents resulted in significant improvements in self-reported confidence managing these complex injuries.
- Enhancing resident education in this fashion, 3D printing may ultimately result in improvements in the safety, quality and value of care provided to patients with triplane fractures.

ACKNOWLEDGEMENTS

We would like to acknowledge the following supporters, without whom this project would not have been possible:

- Yale University Department of Orthopaedics and Rehabilitation
- Yale University Department of Radiology
- Yale University Department of Orthopaedic Surgery
- The Yale University Department of Radiology

REFERENCES


