3-Dimensionally Printed Surgical Instruments in Otolaryngology

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ABSTRACT

Objectives: Standard and innovative surgical approaches frequently call for modifications of traditional surgical instrumentation based upon specific patient anatomic factors. Contemporary design and manufacture of surgical instruments, however, is time intensive, expensive, and necessitates commercial manufacturing support. 3-dimensional (3D) printing allow for the rapid prototyping and production of individualized constructs using robust materials. Herein, we describe how common otolaryngology surgical instruments can be rapidly designed, modified and prototyped using 3D printing technology.

Methods: Dimensions for surgical instruments were measured using existing equipment and reference measurements obtained from catalogs. Instruments were designed using Autodesk Inventor 2016 and 123D (Autodesk, San Rafael, California). Files were exported in stereolithography form and printed with polylactic acid. FlashForge Creator Pro 3D-printer has a resolution of 100 microns and a build volume of 15x14.5x22.5cm.

Results: Given the modular nature of Autodesk, instruments can be rapidly modified. FlashForge Creator Pro manufactured prototypes with high resolution, allowing for subtle changes to delicate equipment. 3D printed instruments included an army-navy retractor, scalpel handle, straight clamp, Adson forceps, and skin hooks. Hinged instruments can be printed and assembled using a standardized open screw set.

Conclusion: In this proof of concept study, surgical instruments were rapidly designed, modified, and prototyped using 3D printing techniques. This study has implications for the development of novel surgical instruments. Further, 3D printed instruments may result in decreased equipment costs allowing increased access in underserved areas. Future studies will include a trial of sterilized 3-D printed instruments in the operating room.

REFERENCES


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