

Pilot Project: Feasibility of Using 3D Printing to Create an Ear Simulator

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ABSTRACT

Three-dimensional (3D) printing has been used in medical education to create models and simulation opportunities. Audiology students could practice hearing aid fitting skills on an ear simulator. The purpose of this project is to pilot the process of using 3D printing to create an ear simulator. Photogrammetry was used to scan an ear impression. Resultant files were converted to STL for 3D printing. FDM and SLA 3D printers created final models, which were compared for print time, quality, and materials.

INTRODUCTION

- 3D printing is an innovative technology used in health professions education¹.
- Audiology students must master hearing aid fitting skills, such as making ear impressions and conducting probe-microphone measures².
- Use of an ear simulator allows students to practice skills on a realistic model – without potential harm to patients³.
- An ear/head simulator is available⁴, but may not be affordable to some. The purpose of this project is to pilot the process of using 3D printing to create an ear simulator.

METHODS

Five steps are needed to create a 3D printed object⁵. Methods are shown in figure 1 below.

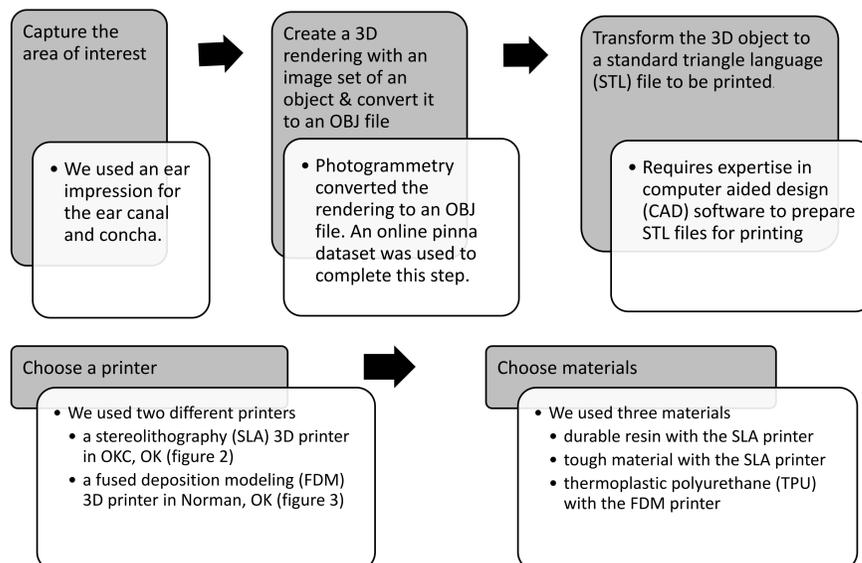
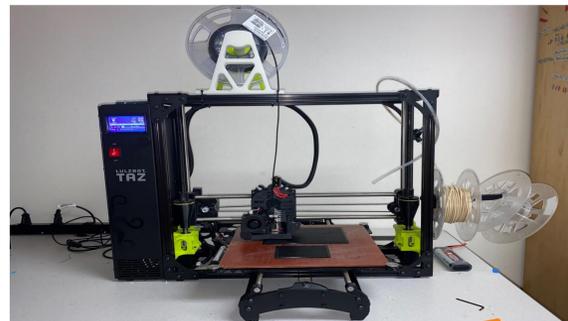


Figure 2 SLA printer using durable resin and tough (blue) materials.



Figure 3 FDM printer using thermoplastic polyurethane material.



RESULTS

- We used three materials: 1) durable resin, 2) tough (blue) material, and 3) thermoplastic polyurethane (TPU).
- Print quality was the best for the TPU material. However, TPU was judged to be more rigid than we expected.
- Print time for each material is shown in figure 4 below. Print time is shortest for the TPU (best quality) material.
- Figures 5-7 show printed objects. Figure 8 shows the ear simulator with the TPU ear.

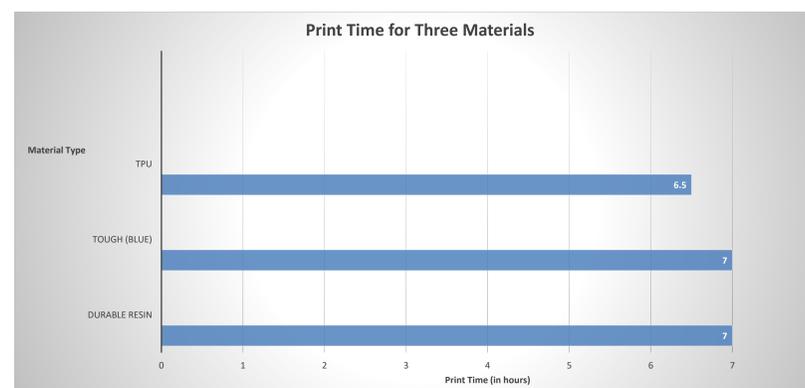


Figure 5 Durable Resin



Figure 6 Tough Material



Figure 7 TPU Material



Figure 8 Simulator with TPU Material



CONCLUSIONS

- It is feasible to create an ear simulator using 3D printing.
- Printing was completed over night, and print time was acceptable. The overall process was time intensive. The cost for materials was reasonably low.
- Print quality was judged to be acceptable for the TPU material, but not the tough material or durable resin.

IMPLICATIONS TO ALLIED HEALTH

- Interprofessional teaming with the MIRS 3D Printing Lab, Emerging Technologies Lab, and audiology was crucial to the success of this project.

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