Designing 3D Printed Transtibial Prosthetic Sockets

Castillo, P.¹, Gean, C.¹, Cabrera, I.², Lin, A.² & McKittrick, J.³
University of California, San Diego, Department of Mechanical and Aerospace Engineering

Background

- 95% of amputees in developing countries do not have access to prosthetic care¹
- Creating a high quality, well-fitted prosthetic socket is a labor-intensive process that takes several months and thousands of dollars to develop
- The shape of the residual limb also undergoes many changes throughout the amputee’s lifetime, so the cost of getting an artificial limb is unsustainable

Objectives

- Our aim was to be able to use 3D residual limb models created from cell phone photogrammetry to create an affordable, well-fit prosthetic socket
  ➢ Become familiar with Autodesk Meshmixer
  ➢ Come up with design iterations from literature
  ➢ 3D print and test socket designs
  ➢ Come up with a final design and write a procedure

Results

3D Printed Sockets

- Used polyactide (PLA) to 3D print
- Half-scale model took 5 hours (grey)
- Full-scale model took 60 hours (blue)
- Scaling was slightly small
- Extended sides could be more even

Cloud Compare

- Compared prosthetist’s socket to our own
- Interior mostly within 5mm
- Our socket was slightly smaller

Conclusions & Future Work

- Socket design printed well with minimal support material
- The size of our socket model matched close to the professional socket
- In the future, we want to
  ➢ Integrate a suspension system to keep the socket on the limb
  ➢ Test fit and comfort of the socket on the user

References