Infant Hand Prosthesis with TPE Shell

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Abstract
Infants develop a majority of upper limb neuromuscular control before reaching twelve months of age, making early exposure to a prosthesis critical to successful long-term outcomes for infants with upper limb deficiencies[1]. Current infant hand prosthesis options maintain either cosmesis or functionality, failing to simultaneously address both issues. The goal of our research is to develop a functional hand prosthesis with sufficient cosmesis to improve parent-patient compliance by encasing the functional components in a durable cosmetic shell.

Research Questions
- Is it achievable to 3D print a hand prosthesis at a size suitable for an infant as young as three months?
- Does the functionality of the prosthesis improve by implementing a 3D printed articulating endoskeleton?
- Will a 3D printed thermoplastic elastomer shell encasing the endoskeletal components of the prosthesis maintain the safety and durability of the of the design?

Project Activities or Findings
Completed:
• Preliminary endoskeleton design 3D printed with PLA in separate components and snapped together to form joints capable of passive grasping.
• Preliminary shell of finger 3D printed with FilaFlex to verify the feasibility of using TPE.

Ongoing work:
• 3D print entire prosthesis shell from 3D scan of toddler hand downsized to infant proportions.
• Refine endoskeleton design to fit inside TPE shell.
• Test design’s ability to hold objects and its stability when simulating the compressive force of sitting up.

Citations