SHAPE & ROLL FOOT

Developing World Prosthetics

2/10/10
Motivation and Concept of Shape&Roll Design (Northwestern University)

Limitations of Jaipur Foot:
- Lacks toe support, leads to shortened step length and increased loading on contralateral side
- Discontinuous change in material from keel to surrounding foam/rubber leads to “drop-off” experience and may contribute to early deterioration
- Approximately 800g

Goals:
- Introduce roll over shape (radius varies with height) of biological ankle-foot system
- Reduce weight without compromising durability

Jaipur Foot

Biological Foot

Image of Jaipur Foot courtesy of Dr. Pooja Mukul, Bhagwan Mahaveer Viklang Sahayata Samiti - Jaipur Foot Organization, Jaipur, India.
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Design

• Cuts in forefoot
• Shock absorption in heel
• Stiffness varied by varying thickness of bottom plate (independent of roll over shape)
• Allows force-induced bending

Images of Shape and Roll Foot designs removed due to copyright restrictions.
Material

- 97% polypropylene, 3% polyethylene copolymer
- High fatigue resistance
- Acceptable stiffness
- Easily thermoformed
- Water resistant
- Low cost
- Lightweight (230g for size 10 foot)
Manufacturing Process

• Pieces of copolymer polypropylene-polyethylene plastic are melted in oven
• Pieces then compressed using lever-molding machine used to make “blank” foot that can be customized for right and left feet of various size (22-29cm)
• Size and shape drawn on blank using templates, lines drawn on forefoot depending on height. Circle drawn to indicate location of hole for bolt
• Cuts made and aluminum insert pressed inside foot to strengthen attachment

Shape & Roll Redesign, DWP 2009

• Development of attachment to interface foot to exoskeletal prostheses (previously Shape & Roll only tested for endo-skeletal prostheses)

• Design for extreme dorsiflexion (to enable squatting)
Cosmetic Covering: Making a negative mold of a foot using clay

Cosmetic Covering: examples of foot shells

• The polyurethane can be dyed to reflect different skin tones.
• The cost of the mold is estimated to be $35-60, while the cost of the prosthetic shell is about $5.

Project Goal: Improving Cosmetic Covering for the Shape&Roll Foot

- Maintain functionality of roll-over shape (cuts)
- Better toe support
- Smoothness between keel and rubber
- Resistant to water and wear
- Inexpensive, available materials
References


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