Long Pants Design: RipStop

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Introduction:

Lower limb amputees face habitual issues when wearing long pants such as ripping and tearing of pants around the knee area due to the sharp edges of the prosthesis. The possibility of material entangling in the prosthetic knee joint is prevalent as well. Currently, there are only short-term alternatives such as sewing patches inside pants and/or purchasing expensive, durable pants which still may break down with wear and tear over time. The goal of RipStop is to prevent pant entanglement with comfortability and ease of mind for the customer.

Customer Needs & Requirements:

The following are a list of specifications to design RipStop:

- Lightweight – weigh less than 3 lbs.
- Water resistant- pass or fail test
- Elasticity – using ASTM D638-14
- Universal Fit – fits more than 60% lower limb amputee
- Durable – using fatigue tester
- Anti-abrasive – sandpaper test
- Simple attachment– takes less than 30 seconds to attach
- Access to charging port- pass or fail test
- Inexpensive- unit cost less than $15 to make

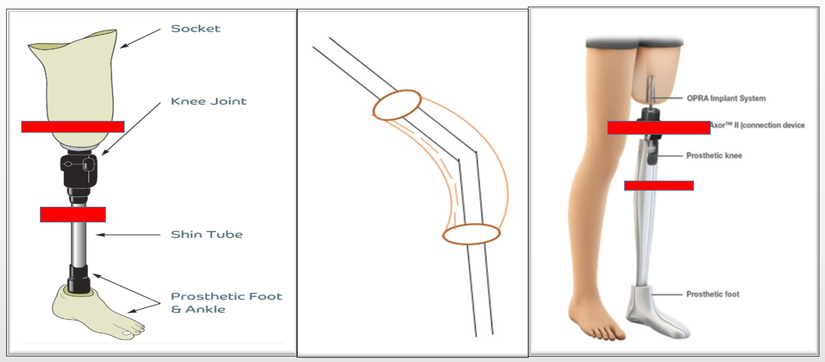
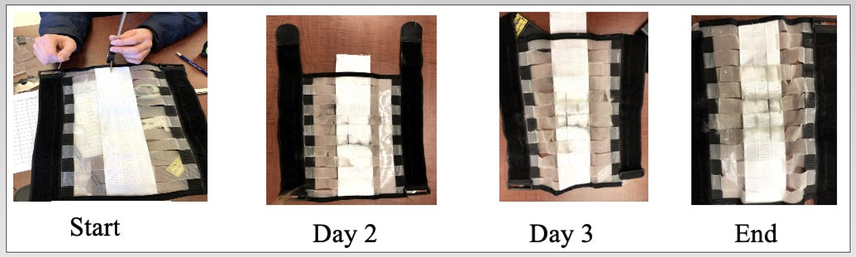


Figure 1: Attachment to socket prosthetic, RipStop sketch, and attachment to osseointegrated prosthetic

Attachment

- Attachment varies from customer to customer. Black connectors of device are on the backside of prosthetic and front side is completely mesh. Secure device by velcroing top strap to thigh area or thigh prosthetic. Velcro bottom portion to calf portion of limb. If more security is needed add rubber inserts to top portion of the limb where Velcro strap was placed. Secure tightly and move around, if it feels like adjustments need to be made then do so, if not then the customer is ready to put pants on over prosthetic limb and device.



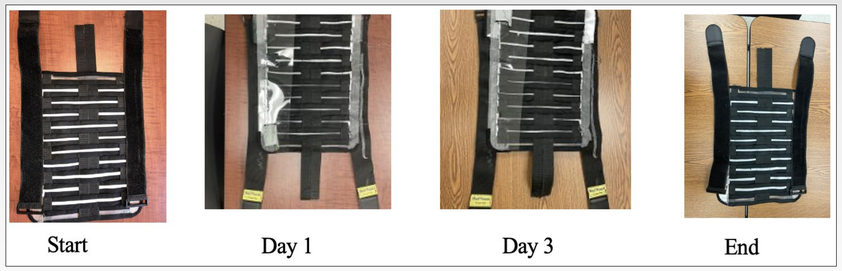


Figure 2: Fatigue test comparison of prototype to final design

Design Solution:

- Fits both osseointegration and socket prosthetics
- Mixture of previous ideas
- Adjustable sizes
- Low production cost
- Very simple and fast attachment
- Materials used:
  - Polycarbonate mesh base
  - Polycarbonate back
  - Velcro straps
  - Bias tape

Figure 3: Final Design of RipStop, shown closed to see how it looks when attached to prosthetic.

Testing and Validation:

- Methodologies: Material testing was completed to validate material strength and identify weaknesses
- The INSTRON machine was used for tensile and tear testing of the polypropylene mesh
- Fatigue testing was completed using an originally designed testing apparatus
- VICON motion capture ensured no significant changes to gait

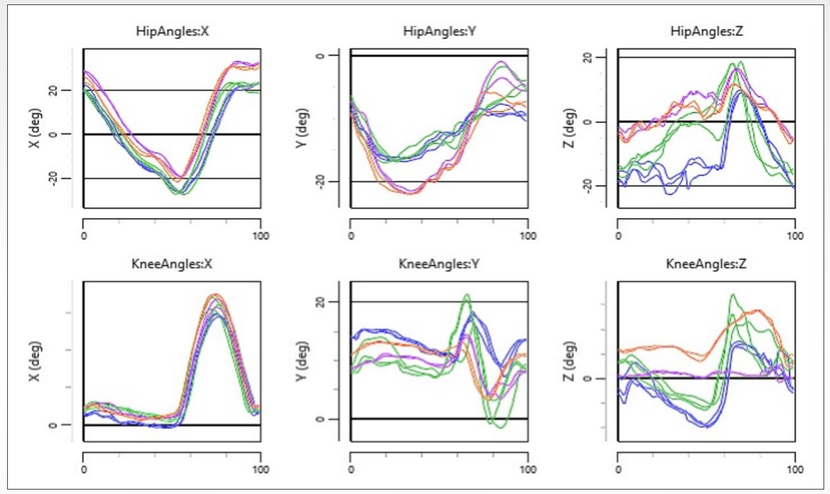


Figure 3: VICON data shows no significant changes in gait while wearing RipStop

Future Work:

- The group plans on entering in the Elevate Nexus Challenge this summer to raise funds towards a patent
- The goal is to have a strong marketing plan and be able to mass market the product in the future
- Create a website and social media platform after obtaining the patent to see if our product has potential

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