

PROSTHETIC KNEE FOR BURKINA FASO



School of Science,
Engineering and Health
Symposium (Spring 2018)
Bryson Boettger, Vaughn
Chambers, Shane Curry, &
Jenna Kelsey

Introduction & Problem Statement

Client: Centre for the Advancement of the Handicapped in Mahadaga, Burkina Faso

- There are many amputees (estimated at about 50 out of a population of 5000) in Mahadaga, Burkina Faso mainly due to infection
- Amputees without a prosthetic cannot provide for themselves
- Terminated supply of donated prosthetic knees created a need for a locally manufacturable prosthetic knee
- Challenges
 - Lack of materials
 - Not enough highly-trained prosthetists
 - Need to tailor prosthetics to cultural factors

Group Mission

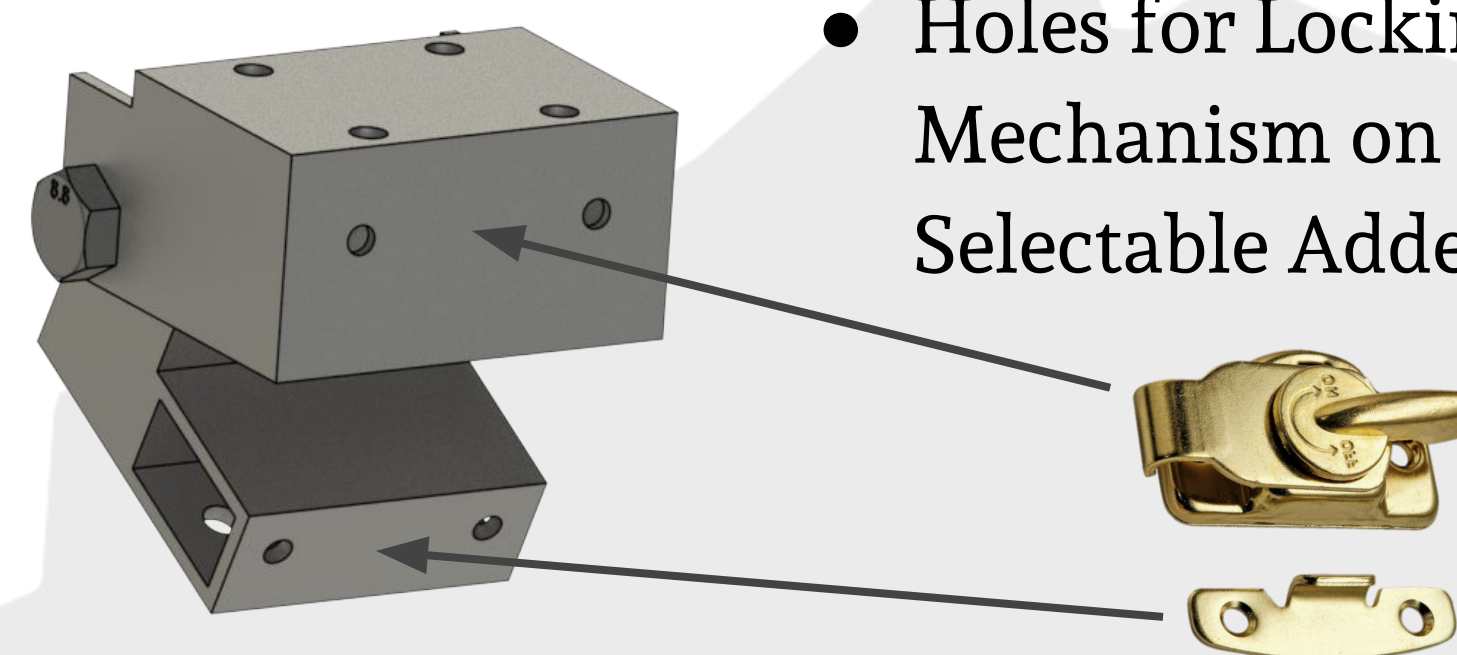
This project aims to aid individuals with physical disabilities by providing a solution to their limitations through the production of a fully functional, low cost (\$20) prosthetic knee that will eventually be integrated to a readily available transfemoral prosthetic leg available in Mahadaga, Burkina Faso.



Photographed from Left to Right: Shane Curry, Ashley Hah, Bryson Boettger, Kaleb Burch, Marissa Kuhns, Jenna Kelsey, Vaughn Chambers & Dr. Jamie Williams

Current Design

- Holes for Standard Pyramidal Attachments on Top and Bottom
- Posterior-Shifted Axis for Added Stability
- Made of Steel on using only Cutting, Drilling and Welding
- Magnet for Additional Extension Assist
- Holes for Locking Mechanism on Front for Selectable Added Stability
- Costs Less Than \$20 to Manufacture

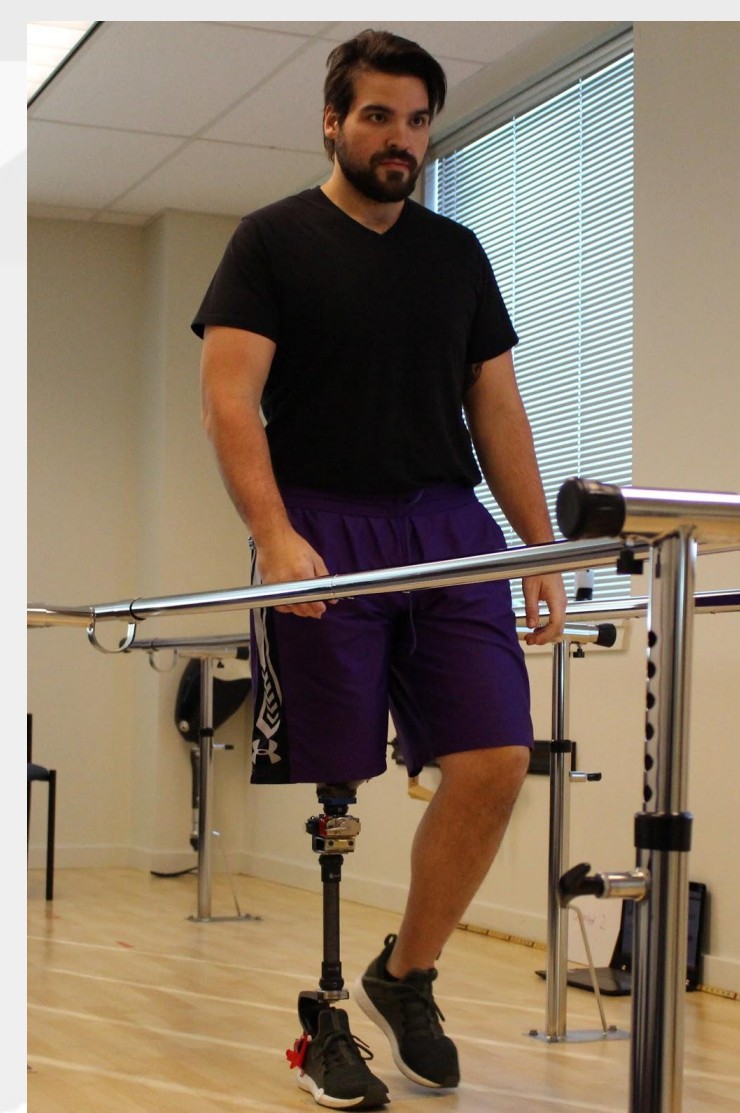
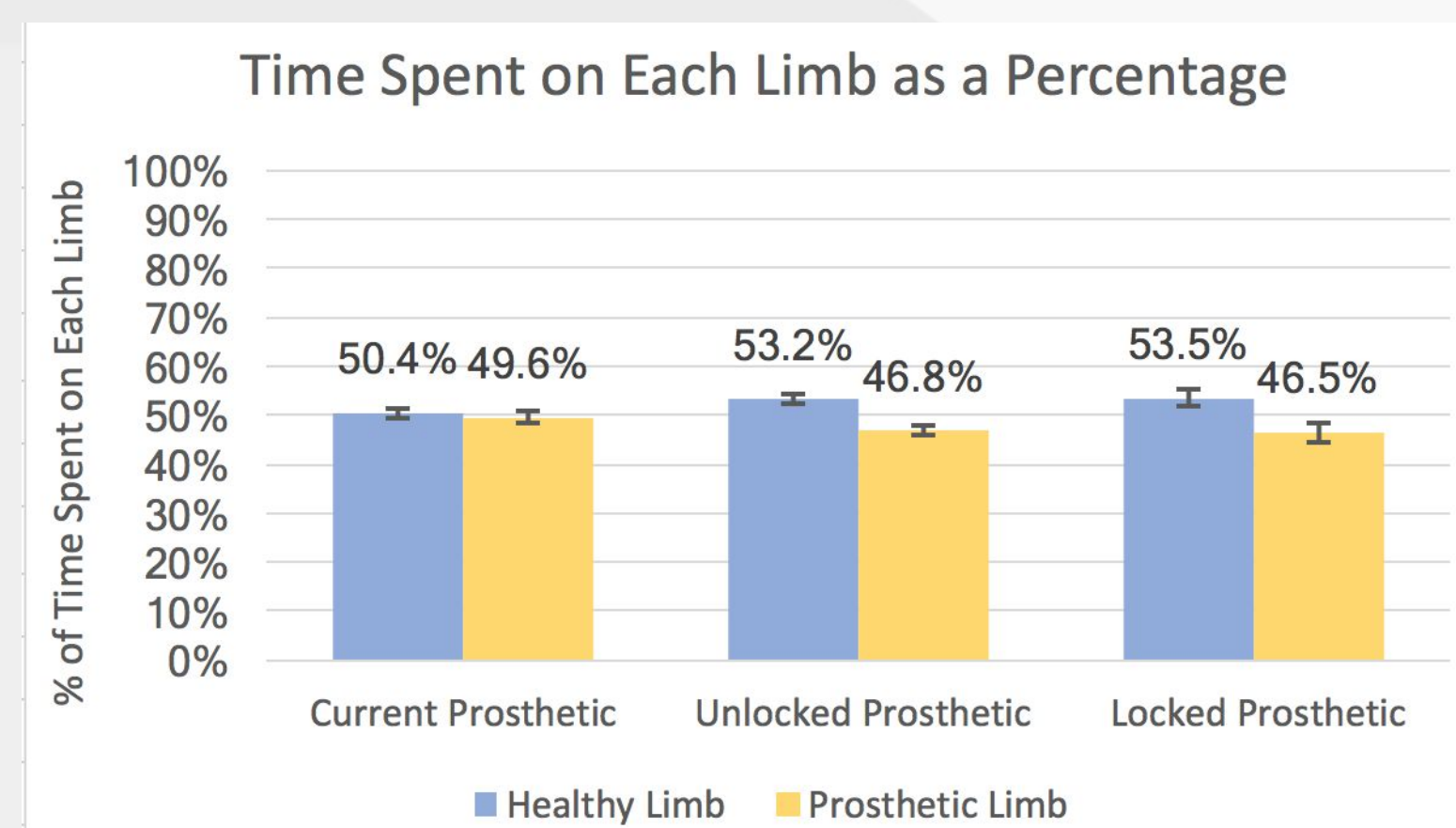


Testing with Volunteer Amputee

With the help of Eric Shoemaker (MS, CPO) and Ability Prosthetics & Orthotics we were able to test our prototype with an amputee (Andrew) in November of 2017.

We collected Accelerometer Data and Slow Motion 2D Video for the following 3 setups:

- Andrew's Current Prosthetic Knee (\$115,000 X3 Ottobock Microprocessor Knee)
- Our Low-Cost Knee in the Unlocked Position
- Our Low-Cost Knee in the Locked Position



Acknowledgments

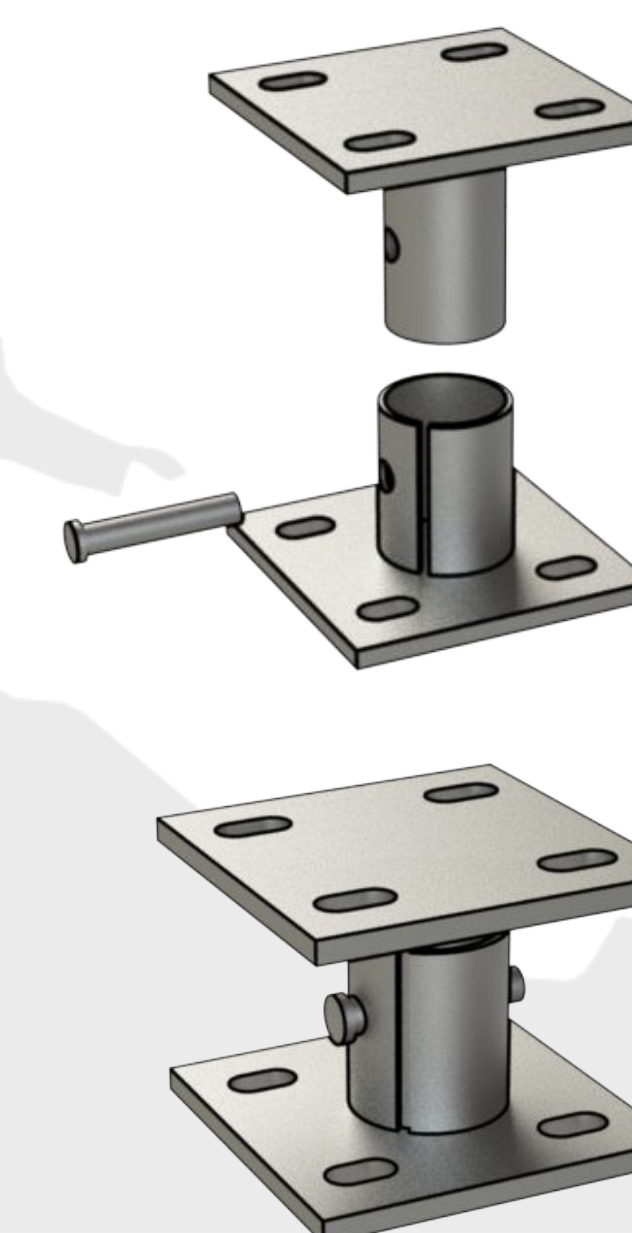
We want to thank the following people for their assistance and guidance:

- Kaleb Burch, Ashley Hah, & Marissa Kuhns- Team Members
- Dr. Jamie Williams- Project Manager and Consultant
- Dr. Emily Farrar- Project Founder and Consultant
- Eric Shoemaker (MS, CPO)- Professional Consultant
- John Meyer- Manufacturing Assistance
- Dr. Timothy Van Dyke- Finite Element Analysis Assistance

And an extra special thanks to Andrew for generously volunteering to test with us

Prosthetic Adapters

The Pyramid Adapters (right) are universally used to connect prosthetic limbs together. They connect to both the top and bottom of our knee design. These cost about \$50/adaptor used on Ebay.



This is not practical for a prosthetic knee that costs less than \$20. Our project has taken on the task of designing adapters (left) that could be made locally in Mahadaga for very cheap. We hope that this design would have a widespread impact since they could replace the universal pyramidal attachment everywhere.

Conclusion

Testing:

- Testing was a success as Andrew was able to walk without fail for about an hour and our knee data compared well to his advanced microprocessor knee
- **Andrew even said that our knee felt similar to prosthetic knees that he has used in the past**
- Our only drawback was that Andrew is stronger and a more experienced prosthetic user than our future patient in Burkina Faso

Moving Forward (Main Goals for Next Year):

- Write a rehabilitation protocol for amputees in Burkina Faso that will increase their strength and range of motion
- Strength and fatigue test the adapter design
- Reduce amount of noise the knee makes upon extension