Introduction

- Every year, over 795,000 people in the US experience a stroke[1].
- Stroke is a leading cause of serious long-term disability. Stroke reduces mobility in more than half of stroke survivors [1].

Rehabilitation: Exoskeletons to Combat Reduced Mobility

- Typically, exoskeletons are custom-built to fit one person because of the anthropometric differences among human subjects. An ill-fitted human-robot interface will cause a patient discomfort and reduce the effectiveness of transmitting an actuator’s torque to the subject.
- To determine the effectiveness of the interface for ComEx 1, human subjects will take a survey as part of an IRB approved study.

ComEx 1 – Human Trials

- Survey constructed as part of a study run by a PhD Student
- Able-bodied subjects (n=3) wearing ComEx 1 for unpowered acclimation period, followed by 5 min. powered treadmill walking
- Subjects filled out survey, which rates comfort level of different interface elements
- Survey results display which elements need improvement
- Elements are rated from 1 to 5, unsatisfactory to satisfactory
- Error bars represent standard deviation

ComEx 2 – Knee Actuated Exoskeleton

- The results of the human subject trial prove that ComEx 1 is adequately comfortable for able bodied users of various sizes.
- Comex 2 is ready to begin testing

ComEx 1 – Knee/Ankle Actuated Exoskeleton

ComEx 1 utilizes four attachments and eight adjustments to secure the exoskeleton to the subject in approximately five minutes and remove it in under thirty seconds.

ComEx 2 utilizes three attachments, six adjustments and one dynamic degree of freedom to secure the exoskeleton to the subject in approximately two minutes and remove it in under twenty seconds.

Future Work

ComEx 1
- Improve method for adjusting toe-out mechanism to reduce stress on knee joint
- Add silicon interface to thigh attachment to reduce slippage
- Weight reduction of oversized components
- Conduct more human trials to expand data pool

ComEx 2
- Begin conducting human trials and implement design changes based on results

Summary

- The results of the human subject trial prove that ComEx 1 is adequately comfortable for able bodied users of various sizes.
- Comex 2 is ready to begin testing

References


Acknowledgements

Human trials were conducted as part of a study run by Nikhil Divekar. Also, I would like to thank Sara Borboa and Calvin Stence for all their support during this project. This work is supported by NIH, NSF, Burroughs Wellcome Fund, and the Philip P. Jonsson Foundation.