Developing a variable friction-based swing phase controller to improve gait kinematics in physically active children and youth with lower-limb amputations

Project Summary

Centre for Leadership in Innovation

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SHARING OUR WORK

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WHAT WAS THIS STUDY ABOUT?

Most lower-limb prostheses can only provide the basic functions needed for some degree of mobility, such as slow walking, and a limited ability to bypass obstacles such as curbs, stairs, or uneven surfaces. While advanced prostheses with complex computer-controlled systems can provide superior performance, these devices are too large and bulky for use in the pediatric population. Children often must compromise between simple systems that provide good stability but little knee motion (swing-phase) control, or good knee control and little to no stability.

The PROPEL lab has been developing a new and exciting swing-phase control system to be used with the All-Terrain Knee. This device is lightweight and requires minimal maintenance, making it ideal for use with pediatric knee prostheses. The goal of our research is to optimize this system to achieve natural walking motions in active children.

WHAT DID WE DO?

We created a computer simulation to recreate the walking patterns of able-bodied individuals and those using the All-Terrain Knee prosthesis. Using this model, we predicted how people walking with an old prosthesis would compare to people walking with different combinations of our new design. Our results show that the new design may be the first of its kind to help people with above-knee amputations walk with near-typical knee motions at slow, medium, and fast speeds.

A pilot study at Holland Bloorview is currently ongoing to evaluate how well the new system works in the clinical population.

IMPACT FOR CLIENTS, FAMILIES AND CLINICAL PRACTICE

By showing that low-cost and lightweight friction-based controllers can perform well across mobility levels, this research is opening the door for future innovations in prosthetic control, and providing opportunities for children with amputations to perform at their full mobility potential

WHAT DID WE LEARN?

- Our novel variable friction and two-spring controller design is the first friction-based knee prosthesis to allow near-typical walking patterns over multiple walking speeds.
- These near-typical patterns can be achieved without the user adjusting their hip movements to make sure they do not trip or fall.
- The computer model we developed is a valuable tool for predicting how people will walk with different prosthesis designs, and for helping identify which designs provide the best performance.

NEXT STEPS?

Currently we are continuing to optimize the design of our new swing-controller by choosing the combination of springs and friction that provides the closest to able-bodied walking.

We are also are improving our computer model to better predict walking in children using prosthetic knees. Using this model, we will be able to adapt the current swing-controller design to work with the Pediatric AT-Knee.

TO LEARN MORE ABOUT THIS STUDY, PLEASE CONTACT:

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WHO ARE WE?

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Clinical Team
Sandra Ramdial: Certified Prosthetist
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THANK YOU!

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