A Comparative Walking Analysis of Traditional and Digitally Fabricated Ankle-Foot Orthoses

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Background

Ankle-Foot Orthoses (AFOs) are L-shaped braces used to assist locomotion and manage impairments [1].

Current Practice: Traditional fabrication process is time consuming and physically demanding.

Emerging Approach: Digital workflows potentially provide a faster, more comfortable alternative [2].

Knowledge Gap: The performance of digitally fabricated AFOs has not yet been well validated.

Research Question

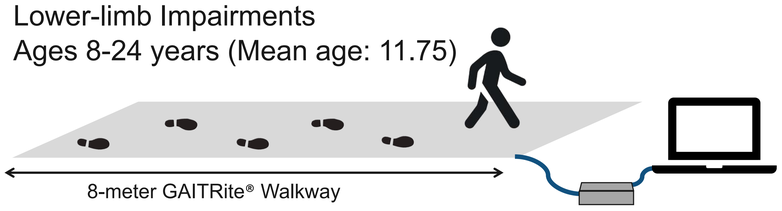
How does **walking performance** differ when using **traditionally versus digitally** fabricated AFOs?

Methods

8 Participants

Lower-limb Impairments

Ages 8-24 years (Mean age: 11.75)



Participants completed 3 walking trials at a self-selected speed wearing each AFO.

Within each participant **walking speed, step length symmetry index,** and **single support symmetry index** values were compared using mean differences between AFOs [3]-[7].

Walking Speed

Metric of overall walking mobility and user confidence [8].

Step Length Symmetry

Metric of symmetric walking.

Single Support Symmetry

Metric of stability [9].

Digitally Fabricated AFOs perform comparable to Traditionally Fabricated AFOs, suggesting a promising shift in a more **patient-centered approach** in orthotic care.

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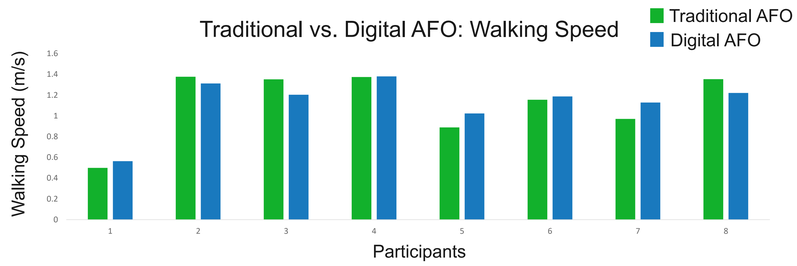
PROPEL lab

Holland Bloorview Kids Rehabilitation Hospital

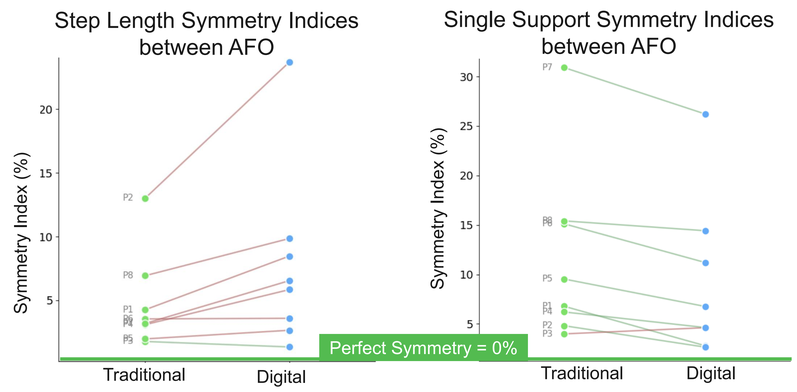
Results and Discussions

Walking Speed: Both AFOs produced comparable values indicating similar overall walking mobility (MD = 0.06 ± 1.1 m/s).



Step Length Symmetry: Traditional AFOs showed a slight advantage in 7/8 participants.

Single Support Symmetry: Digital AFOs showed a slight advantage in 7/8 participants.



We hypothesize that the digital AFO's increased rigidity may explain these symmetry differences, though this remains speculative and warrants further investigation [10].

Relevance to Holland Bloorview

First clinical study to provide objective gait data supporting digital AFO workflows.

Digital workflows have the potential to make orthotic care more convenient through quick, non-contact scanning appointments [11].

"The new scanning approach was easier because it's **faster**. My 3D-printed AFOs are lighter. They **provided the support I hoped for** and are **comfortable** to wear."
- CIHR-funded AFO clinical trial participant, age 12

Conclusion and Next Steps

The future work of this ongoing study aims to:

1. Increase the number of participants
2. Analyze different walking parameters
3. Evaluate long-term implementation