Pediatric Walking vs. Training on Prototype Motor-Assisted Elliptical: Kinematic Comparison at Self-Selected Comfortable Speed

Judith M. Burnfield, PhD, PT1, Thad W. Buster, MS1, Sonya L. Irons, PT, DPT, CCS1, Guilherme M. Cesar, PhD1, Carl A. Nelson, PhD, PE2, Nicholas R. Rech, PT, DPT1, Emilyne M. Nichols1

1 Madonna Rehabilitation Hospital, Lincoln, NE, USA, 2 University of Nebraska - Lincoln, Lincoln, NE, USA

This work supported in part by a grant received from the Department of Education (NIDRR grant number H133G130274) now Administration for Community Living (NIDILRR grant number 90IF0060). Three patents have been issued to Burnfield and Buster for the ICARE technology. The patented technology has been licensed to SportsArt for commercial distribution and any sales could lead to a royalty distribution.

Objective

Compare lower extremity kinematics during walking and device-assisted training to determine how closely device-assisted motion patterns emulated those occurring during gait.

Introduction

Task-specific training has been advocated for improving walking, yet children with physical disabilities often experience barriers accessing therapeutic technologies to improve walking due to expense and/or clinician labor requirements. A commercially available motor-assisted elliptical that promotes a movement pattern similar to walking is being used to address walking deficits in adults who have physical disabilities. Modifications were implemented that enabled children as young as three years old to use the device.

Methods

Participants: 20 children (3-12 years old) without disabilities

Main Outcome Measures:

3D kinematics (12 Qualisys cameras; 120Hz) recorded as participants:

- traversed 10-meter walkway at self-selected comfortable walking velocity (SSC)
- trained on motor-assisted elliptical with motor assistance at self-selected comfortable speed (AAC)
- overrode motor’s assistance (AAC+)

Data Analysis:

- Cycles determined using footswitches (B&L Engineering) for SSC and pedal kinematics for AAC and AAC+
- Minimum of 10 cycles analyzed for each participant and condition
- Coefficient of multiple correlations (CMCs) compared motion profiles between SSC and AAC and AAC+ for hip, thigh (expressed relative to vertical), knee, and ankle

Results

CMCs suggested movement similarities of AAC vs. SSC and AAC+ vs. SSC were greatest for hip (0.93 and 0.91), thigh (0.95 and 0.90), and knee (0.91 and 0.90), and least at the ankle (0.63 and 0.71).

Conclusion

Additional work required to further refine pedal trajectory and enhance similarity of movement pattern while training on prototype pediatric ICARE to gait.

Acknowledgement

This work supported in part by a grant received from the Department of Education (NIDRR grant number H133G130274) now Administration for Community Living (NIDILRR grant number 90IF0060). Three patents have been issued to Burnfield and Buster for the ICARE technology. The patented technology has been licensed to SportsArt for commercial distribution and any sales can lead to a royalty distribution.