Impact of 12 weeks of robotic walking on contracture and spasticity in children with cerebral palsy

Kiran M. Isapure[2], Benjamin M. Norman[4], Christa M. Diot[1], Jessica L. Youngblood[4,3] Matthew Richardson[3], Kelly A. Larkin-Kaiser[1,4,5], Elizabeth G. Condliffe[1,2,4,5]

[1]Alberta Children's Hospital Research Institute, [2]Biomedical Engineering, [3]Schulich School of Engineering, [4]Department of Clinical Neurosciences, Cumming School of Medicine, University of Calgary, Calgary, Canada, [5]Hotchkiss Brain Institute, University of Calgary, Calgary, Canada

Introduction

Cerebral palsy (CP) is the most common cause for physical disability in children and is a result of a lesion of the developing brain [1]. Most children with CP have muscle contracture and spasticity. Spasticity is defined as a velocity-dependent increase in tonic stretch reflexes to phasic stretch, in the absence of voluntary activity and contracture is defined as a pathological condition that causes stiffness, resistance to movement and reduced range of motion in joints [2]. Both contracture and spasticity contribute to resistance to movement.

Recently robotic devices have increasingly been utilized to provide the experience of walking [3]. In doing so, they provide repeated voluntary or passive knee extensions and thus may help reduce contracture and/or spasticity.

We aim to evaluate the impact of 12 weeks of robotic walking on muscle contracture and spasticity in children with CP.

Methods

Six participants (3 females, 3 males, age 5-24 years) with severe CP (Gross Motor Function Classification System IV-V), who were unable to walk independently, underwent 12 weeks of robotic walking. Passive ramp-and-hold knee extensions were performed at two speeds (10°/sec and 30°/sec) using a Biodex dynamometer before and after training.

Limb weight at each position was measured during 10°/sec stretches that had no muscle activity. The limb weight was subtracted from the torques recorded at 30 deg/s.

Torque at 30° knee flexion was measured. Muscle Stiffness was calculated as change in torque/degree from 60° to 30° knee flexion.

Results

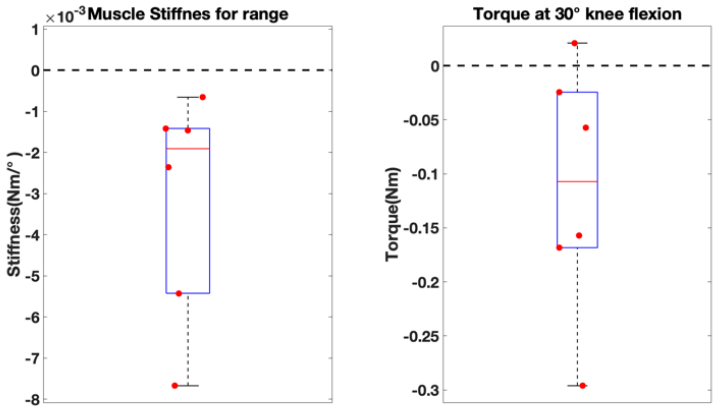

Figure 1: Change in Muscle stiffness and Torque at 30° knee flexion.

After 12 weeks of robotic walking, participants showed significant reduction in muscle stiffness($p=0.031$). While a consistent reduction in torque at 30° knee flexion was observed, it did not reach statistical significance($p=0.0625$).

Conclusion

Our results suggest that robotic walking may show reductions in spasticity and contracture in children with CP. Additional testing should be completed to make conclusions.

References

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