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Title

Do persons with chronic stroke benefit from using the microprocessor stance and swing control orthosis C-Brace?

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Summary

In a study with 14 subjects with chronic stroke using the C-Brace, 11 subjects (78%) benefitted in terms of clinically meaningful improvements in walking endurance (100%), self-selected walking speed (36%) or balance (18%). The C-Brace may have an assistive or therapeutic or a combined effect.

Introduction

Gait impairment is one of the common causes leading to long-term disability and decreased quality of life in persons with stroke. Orthoses are often prescribed to facilitate walking for persons with lower limb weakness and prevent loss of structural integrity of the knee joint. A microprocessor stance and swing control orthosis, C-Brace®, that permits controlled knee flexion during weight-bearing for reciprocal uneven terrain ambulation, slope and stair descent as well as controlled swing including stumble recovery has been developed and used by persons with lower limb weakness, such as polio and spinal injuries (Schmalz, et al, 2014). The purpose of this study was to explore the subject characteristics of the person who respond and did not respond to locomotor training with the C-brace® in persons with stroke.

Methods

Fourteen subjects with chronic stroke (9 males and 5 females; 58.3 ± 8.8 years old; 45.3 ± 37.4 months post stroke) with mild, moderate or severe gait impairment (determined by gait speed) were enrolled. Subjects underwent a baseline assessment of gait speed (10m walk test), endurance (6-minute walk test [6MWT]) and Berg Balance Scale (BBS) followed by 12 sessions of device training and a post-training assessment with and without using the C-Brace.

Subjects could then use the device in their everyday routine for 6 weeks and underwent a follow-up assessment with and without the C-Brace.

Data Analysis: Descriptive analyses of dependent variables were performed to explore changes between assessments. A subject was considered a “responder” if he/she demonstrated a clinically meaningful improvement in either gait speed (>0.13 m/s), endurance (>15 m in 6MWT) or balance (>4 points in BBS) while walking with (assistive effect) or without (therapeutic effect) the C-Brace.

Results

There were no systematic changes in the outcome measures for the whole study group. However, at the individual subject level, 11 of the 14 subjects (78%) benefitted from using the C-Brace with clinically meaningful improvements in at least one outcome measure. Two of the 4 subjects (50%) with mild gait impairment benefitted, with one subject demonstrating improved endurance in the 6MWT when using the C-Brace (assistive effect) while the other subject showed a therapeutic effect of the C-Brace with improved self-selected gait speed and endurance when walking without the device. All 7 subjects (100%) with moderate gait impairment were found to benefit from using the C-Brace, with 3 subjects (43%) showing an assistive effect with improved endurance when using the C-Brace, and 4 subjects (57%) demonstrating a therapeutic effect with improved endurance when walking without it. One subject each also benefitted from improved self-selected gait speed or improved balance, respectively. Of the three subjects with an assistive effect, two also displayed a therapeutic effect with improved endurance or improved self-selected gait speed and balance when not using the device. Two of the three subjects (67%) with severe gait impairments had a therapeutic effect of using the C-Brace with improved endurance during free ambulation. One of the two also benefitted from improved self-selected gait speed.

Conclusion

Persons with chronic stroke may benefit from using the C-Brace to improve endurance, self-selected walking speed and/or balance. The orthosis may have an assistive effect when using it, or a therapeutic effect with improved free ambulation after having used the C-Brace for some time. Subjects are more likely to benefit if they suffer from moderate to severe gait

impairment. All responders demonstrated improved walking distance in the 6MWT, which may be considered an indicator for improved community ambulation capability. As the training provided in the study was solely aimed at enabling subjects to proficiently use the device functions rather than improving gait and ambulation performance, the therapeutic effect found in 64% of the responders may mostly be attributed to the use of the C-Brace with presumably increased ambulation activity in everyday life. Thus, the C-Brace may be an interesting orthotic option to improve ambulation of subjects with gait impairment after stroke.

References

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