Evaluation of a hip passive assistive device to support locomotion in patients with impaired gait

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Introduction

Impaired gait is often associated to several pathologies affecting the neuromotor and musculoskeletal system, which severely impact their quality of life and independence.

Robotic devices to enhance gait performance[1] have been proposed as an emerging interesting technology to overcome this issue. Unfortunately, currently these devices have several limitations such as weight, cost, encumbrance, which limit their applicability and daily use.

The aim of this study was to evaluate the efficacy of a passive wearable device (Exoband) which stores and releases mechanical energy during gait, thus assisting the hip flexors in the later part of gait.

Methods

- Seven patients (4 male and 3 female, age 70.1±18.0 yo, height 1.68± 0.06 m, weight 68.5 ± 9.9 kg) with impaired gait due to various diseases (stroke, sclerosis, poliomyelitis, lumbar spinal stenosis) were involved in the study and tested on two separate days.

- Exoband is a passive assistive device that stores mechanical energy generated during the first phase of gait and then releases it in the second phase of gait. It assists the wearer to propel the leg forward acting together with hip flexors' action.

- Day 1: patients walked on a 60 m corridor to accomplish a 6 minute walk test[2], under two conditions in a randomized order: wearing the Exoband (EXO_ON) and not wearing the Exoband (NO_EXO); Fig. 1a.

- Day 2: patients were asked to walk on a 10 m straight walked for 4 times while trunk dynamic stability was evaluated by means of a portable inertial system (Gyko, Microgait, BZ, Italy), under the same two conditions of the first day (EXO_ON and NO_EXO); Fig. 1b.

Fig. 1 (a) Exoband worn by a patients during testing (b) Testing setup of day 2.

Results

- Patients walked significantly more (p = 0.03) in the EXO_ON condition with respect to the NO_EXO condition (266.2±119.1 and 252.1±113.3 m, respectively), which resulted in an increase in speed of 5.5%; Fig. 2.

- A significant increase in dynamic stability (p = 0.03) was reported in the EXO_ON condition, as highlighted by a -17.5% reduction of the overall breadth of the movement of the trunk; Fig. 3.

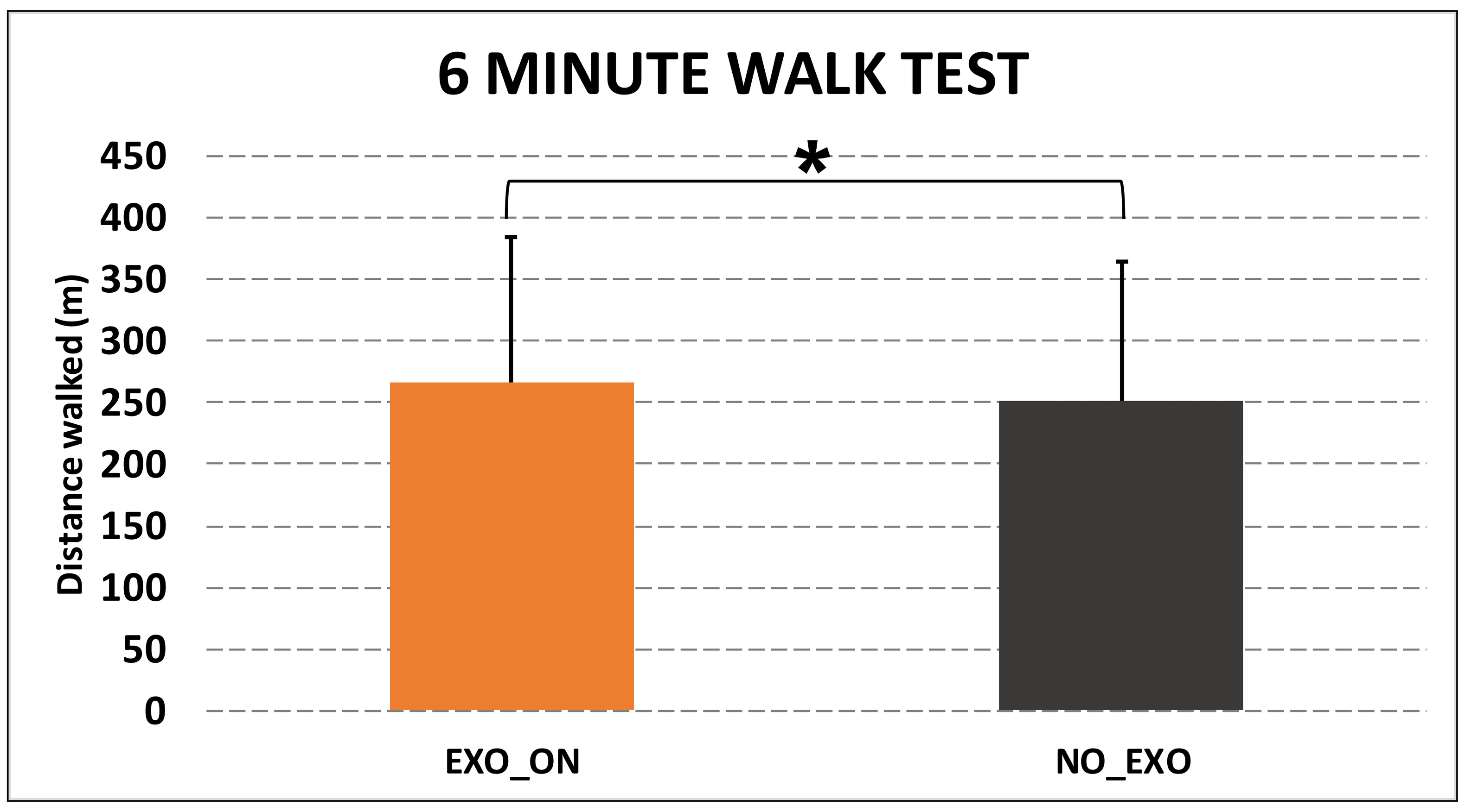

Fig. 2 Distance covered by the patients during the 6 minute walk test, wearing the Exoband (EXO_ON) and not wearing it (NO_EXO). Data are means ± S.D.

Fig. 3 Evaluation of trunk dynamic stability on the two axes which highlights an increased stability while wearing the Exoband

Conclusion

Patients were able to walk for a longer distance using the Exoband, thus indicating that this device can enhance their walking capacity and improve their quality of life.

Further, the improved dynamic trunk stability is an additional positive sign[3] in these impaired patients, which suggests that the device can be adopted in gait rehabilitation protocols.

These findings indicate that the Exoband could be a promising device to assist impaired gait and improve gait function. Further, its simplicity of use can extend its applicability to daily use.

References

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