THE EFFECT OF A 6-WEEK SIDEWAYS WALKING INTERVENTION ON GAIT BIOMECHANICS IN COMMUNITY-DWELLING OLDER ADULTS

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INTRODUCTION

One-third of older adults aged 65+ are susceptible to falling, mostly during walking [1]. We propose that older adults with age-related gait abnormalities can improve walking patterns by performing sideways walking training.

METHODS

Fourteen older adults aged 65+ (3m; age: 70 ± 3 yrs.; height: 166.1 ± 10.9 cm; mass: 72.6 ± 12.6 kg) were recruited for this study. Inclusion criteria were (i) ≥ 65 years, (ii) be independently residing in the community, and (iii) ability to walk independently. Participants were not eligible if they (i) had neurological disorder or progressive neurologic condition, (ii) had a musculoskeletal disorder or injury that could affect gait, (iii) had surgery within the past 6 months, (iv) had history of cardiovascular event, and (v) were participating in any other interventional trial that involves walking, balance or exercise training.

Data were collected at the Biomechanics Research Building facility at baseline, postintervention, and retention period (6-week following completion of the intervention), from November 2017 to September 2018. The facility featured a 3D motion capture system with 17 high-speed Raptor cameras (Motion Analysis Corporation, Santa Rosa, CA, USA) synchronized with 8 imbedded force plates (AMTI, Watertown, MA). Upon arrival at the Biomechanics Research Building for the baseline assessment, the participants changed into a tight-fitting suit. Then, retroreflective markers were placed at anatomical locations to gather three-dimensional kinematics (sampling rate @100Hz) and dynamics data (sampling rate @1000Hz) during sideways walking. Retroreflective markers were placed to anatomical landmarks to define a fifteen-segment (left and right: foot, shank, thigh, forearms, upper-arms, and pelvis, trunk, head) mechanical model of the human body. In addition, clusters of rigid reflective tracking markers were placed on the lateral surfaces of each participant's thigh and shank segment. After obtaining a static calibration trial, only the clusters and the tracking markers left on.

The participants performed 10 trials of sideways walking on a 10 m walkway on their preferred speed. The three-dimensional net forces and moments at the right and left ankle, knee and hip joints were estimated by solving the dynamical equations of a free body diagram. Inverse dynamics computations were carried out using the Visual3D software (Germantown, Maryland, US). The three-dimensional coordinates of the digitized markers, ground reaction forces, and center of pressure, were smoothed with quintic splines according to the "Generalized, Cross-Validation" criterion [2]. Center of mass locations, masses, and moments of inertia were estimated using a gender-dependent anthropometric model [3]. For comparisons, the results were normalized by subjects' body mass, while time was expressed as percentage of total gait cycle duration.

Following baseline assessment, the participants underwent an overground lateral stepping training three times a week for six weeks, resulting in 18 sessions. Each session consisted of 30 minutes of lateral stepping. Participants stepped laterally across a 10m section on an indoor track, changing direction at the ends thus alternating lead and lag legs. Three minutes of lateral stepping was alternated with at least one minute of rest. They informed that they could increase their pace at the start of each session but may not decrease it at the next session. This promoted continued learning and prevent any plateau effect. Similar to the baseline assessment, three-dimensional kinetics data were collected after completion (post) of the training, and six-weeks following completion (retention). Self-selected speeds were used for all trials at each assessment.

RESULTS AND DISCUSSION

Sideways walking training can significantly affect the mechanical characteristics of gait in older adults. This has implications for walking balance training in older adults, which could be directed to exploit the mechanical features of gait dynamics, such as motion-dependent torques, which are not sensitive to age-related deficiencies of active control or the lack thereof.

CONCLUSIONS

Our 6-week sideways walking is a potential exercise intervention to improve walking patterns in community-dwelling older adults.

REFERENCES

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