Detecting variability in gait kinematics between overground and treadmill walking conditions using the Opal APDM inertial monitoring system.


Mayo School of Heath Sciences

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Background and Purpose: Motorized treadmills are used commonly in biomechanical and clinical studies of human walking. Whether treadmill walking induces identical motor responses to overground walking, however, is equivocal. The purpose of this study was to examine differences in treadmill and overground walking using traditional (mean and SD) and nonlinear methods for analyzing spatiotemporal gait parameters and variability parameters.

Methods and Materials: Twenty healthy participants (age 23.8 ± 1.2 years) completed a 6-minute walk test on a treadmill and overground in a 42m hallway while wearing APDM 6 Opal inertial monitors. Stride length, stride time, stride velocity, cadence, stance phase percentage, and peak sagittal and frontal plane trunk velocities. Mean values were calculated for each parameter as well as estimates of short- (SD1) and long-term variability (SD2) using Poincaré analyses.

Analyses: The mean, SD1 and SD2 values were compared between overground and treadmill walking conditions with paired t-tests (α = .05) and with effect size estimates using Cohen's d statistic.

Results: Mean values for each of the gait parameters were statistically equivalent between treadmill and overground walking (p > .05). The SD1 and SD2 values representing short- and long-term variability, with one exception for long-term variability in stride time (p = .065), were considerably reduced (p < .05) on the treadmill as compared to overground walking.

Conclusions: While differences in mean values for parameters of interest were not found, nonlinear measures of stride to stride variability in stride length, stride time, stride velocity, cadence, stance phase percentage, and peak sagittal and frontal plane trunk velocity were markedly reduced on the treadmill. Further research should include subjects with known pathologies to increase clinical relevance. Implications: In some patient populations, treadmill training may yield invariant gait patterns that pose difficulty in translating locomotor skills gained on a treadmill to overground walking conditions.