Postural Sway and Spatio-temporal Parameters of Gait in Multiple Sclerosis

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Introduction

There is evidence of alterations in postural sway and gait in persons with multiple sclerosis (MS). Postural sway has been associated with gait and gait variability (i.e., fluctuations in gait parameters between steps measured by standard deviation [SD] and co-efficient of variation [CV]) in older adults. This is important as postural sway might represent a target for mitigating impairments in gait and its variability as two metrics of fall risk in people with MS.

Purpose

This study examined the association between average and variability metrics of spatio-temporal parameters of gait with antero-posterior (AP) and medio-lateral (ML) sway in older adults with MS and a fall history.

Participants

The sample included 33 participants with MS who were recruited through the North American Research Committee on Multiple Sclerosis patient registry. Table 1 provides the demographics of the sample.

Table 1. Demographic data of the participants (n = 33).

VARIABLE	*MEAN (SD)*	*RANGE*
Age	*60 (6)*	*51-74*
Sex (n/ % female)	*28/74*	-
Type of MS (n/ % RRMS)	*22/58*	-
Self administered Kurtzke (MDN)	*5.5*	*3.5-6.0 (IQR)*
AD (none [n/%] ,cane[n/%], walker[n/%])	*14/37%,11/29%, 8/21%*	-

Measures

Self-adminstered Kurtzke: The self-administered Kurtzke is a survey instrument for classifying disability. This scale has 8 items rated based on the degree of difficulty (none, minimal, moderate and severe). The item scores are transformed into an overall EDSS of 0-9.

GAIT: Participants completed 2 walking trials on a 16-foot instrumented GAITRite™ (CIR systems, Inc) mat at a self-selected pace. The GAITRite™ software program calculated the average and the absolute variability (SD) of step length, step width and the step time. The relative variability (CV) of step length, step width and step time were calculated by hand by taking the average of SD by mean.

Measures (continued)

Balance: Participants underwent a postural sway measurement by standing on a 15 cm thick foam surface (eyes open) as still as possible for 30 seconds while wearing a sway meter. The sway meter allows postural sway to be indexed by sway length along the antero-posterior (AP) and medio-lateral (ML) axes.

Procedure

The procedure was approved by an IRB and all participants provided written informed consent. On a single testing session, the participants provided demographic information, completed the self-administered Kurtzke, performed walking on the GAITRite™ (CIR systems, Inc) mat and balance on the foam surface .

Data Analysis

Descriptive and inferential data analyses (Bivariate correlation analysis) were performed in SPSS, version 21 (SPSS Inc, Chicago, IL).

Results

The descriptive statistics for average, absolute variability (SD), relative variability (CV) of the spatio-temporal parameters of gait and the AP and ML sway are in Table 1. The correlations of the average, absolute variability (SD) and relative variability (CV) of spatio-temporal parameters of gait with balance indexed by AP and ML sway are in Table 2. The correlational data indicates that AP postural sway had significant correlations with the average step time and variability of spatio-temporal parameters indexed by SD and CV in terms of step length and step time. There were no significant correlations between ML postural sway and gait metrics.

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Results (Continued)

Table 2. Mean, standard deviation and range of spatio-temporal parameters of gait and balance (AP and ML sway) in 33 persons with MS.

Variables	Mean	Range
Step length_Mean (cm)	52.19 (9.64)	31.57- 70.81
Step time_Mean (s)	0.67 (0.22)	0.46 - 1.44
Base of support_Mean (cm)	11.82 (3.72)	5.71 - 19.47
Step length_SD (cm)	4.54 (9.79)	0.92 - 58.28
Step time_SD (s)	0.04 (0.04)	0.01 - 0.22
Base of support_SD (cm)	2.18 (1.04)	0.95 - 5.13
Step length_CV (%)	9.08 (20.02)	1.64 - 119.26
Step time_CV (%)	5.87 (4.51)	1.67 - 23.16
Base of support_CV (%)	20.49 (12.58)	7.19 - 63.49
AP sway (mm)	37.48 (21.77)	12 - 110
ML sway (mm)	51.24 (45.89)	15 - 207

Table 3. Bivariate Spearman Rho rank-order correlation of the average, absolute variability (SD) and relative variability (CV) of spatio-temporal parameters of gait with balance indexed by AP and ML sway.

		Sway AP	Sway ML
Step length (cm)	Mean	-0.117	-0.081
	SD	**0.310***	0.162
	CV	**0.307***	0.153
Step time (s)	Mean	**0.349***	0.158
	SD	**0.483****	0.265
	CV	**0.498****	0.265
Base of support (cm)	Mean	-0.287	-0.152
	SD	-0.103	-0.013
	CV	0.143	0.095

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Conclusions

The data suggests that AP postural sway is associated with gait variability. This indicates that subsequent interventions might target AP postural sway or gait variability as a approach to reduce falls in older adults with MS who have a fall history.