Walking Impairment and Gait Variability in Multiple Sclerosis

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Introduction

- Gait impairment is common in persons with MS.1
- Walking speed, cadence, step length and double-support5,4.
- Gait variability has garnered increasing scientific scrutiny in recent years.6
  - Potentially sensitive to different aspects of gait dysfunction than average parameters4.
- There is limited documentation of gait variability in MS compared to controls:
  - Coefficient of variation (CV) of spatiotemporal gait parameters3,8.
  - Standard deviation (SD) of hip, knee, and ankle angles16.
  - No information concerning how walking impairment influences gait variability in persons with MS

The purpose of this investigation was to determine differences in gait variability between samples of persons with MS who walk independently and those who require assistance while walking.

Variability of Spatiotemporal Gait Parameters

<table>
<thead>
<tr>
<th>CV [%]</th>
<th>Independently Ambulatory</th>
<th>Ambulatory w/ Assistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step time</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>Step length</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Step width</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

- Significant group differences for variability of all 3 gait parameters:
  - Greater step time and step length variability in assistive device users.
  - Greater step width variability in independently ambulatory group.

Methods

- 64 participants with MS
  - 2 groups:
    - Independently ambulatory (No assistive devices) (n=30)
    - Ambulatory with Assistance (Used cane or walker) (n=34)
  - Underwent neurological exam to determine Expanded Disability Status Scale, EDSS5.
  - Walked across a 7.9 meter GAITRite™ walkway twice at self-selected, comfortable pace.
  - Gait speed determined
  - Gait variability indexed by coefficient of variation (CV=SD/ Mean * 100%) of step time, step length, and step width.

Statistical analysis

- Analysis performed with SPSS 19.0 software (SPSS Inc., Chicago, IL).
- Group differences in gait variability determined with a one-way ANCOVA.
- Controlled for age.
- Significance assumed for p<0.05.

Results

- CV values congruent with literature in MS.
- Potential explanations for greater step time and step length variability in assistive device users include:
  - Muscle strength
  - Neuromuscular signal noise
- Variability of step width was greater in the independently ambulatory group.
  - Assistive device potentially constrain mediolateral motion.
  - More impaired individuals potentially walk closer to their stability boundary.
- Different motor control processes could underlay step timing and step width variability.
- Propulsion (step length/time) versus stability (step width) constructs?
- Future research concerning gait variability in MS is warranted to examine:
  - Mechanisms driving gait variability.
  - Consequences of gait variability in MS.
  - Gait variability is associated with falls in older adults16

Discussion

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References


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Figure 1. Gait and Balance Lab at the University of Illinois.

Figure 2. Example of a footfall pattern from GAITRite™ electronic walkway.