People with Multiple Sclerosis Show Improved Gait with Balance-Based Torso Weighting

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Introduction

Up to 85% of people with multiple sclerosis (PwMS) experience balance and walking impairments related to sensory loss, muscle weakness, ataxia, or spasticity. Walking impairments can cause frequent falls and limitations in activities and participation in daily life. Evidence suggests that sensorimotor control is a crucial parameter for maintaining stability during gait. Balance-Based Torso-Weighting® (BTTW), a non-pharmacological intervention in which patients wear light weights on the trunk, has resulted in improved functional outcomes in PwMS.

The purpose of this study was to document the effects of BTTW on spatio-temporal gait parameters in PwMS.

Methods

32 female volunteers: 20 with MS, 12 controls

<table>
<thead>
<tr>
<th>Variable</th>
<th>People with MS (n=20)</th>
<th>Healthy controls (n=12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years, mean (SD)</td>
<td>49.35 (13.35)</td>
<td>53.58 (11.75)</td>
</tr>
<tr>
<td>Years with diagnosis, mean (SD)</td>
<td>17.75 (8.10)</td>
<td>21.60 (10.70)</td>
</tr>
<tr>
<td>EDSS score equivalent</td>
<td>2.62 (2.5)</td>
<td>1.67 (1.5)</td>
</tr>
<tr>
<td>Number (%) claiming falls in past 6 months</td>
<td>11 (55%)</td>
<td>2 (16%)</td>
</tr>
</tbody>
</table>

Methods:

- Convincing consent
- Physician approval, documented MS dx
- Medical questionnaire
- Recent fall history
- Experienced MS symptoms
- Walking trials
  - Instruction: “Walk as fast as you can safely”
  - Three trials without weight applied to the vest
    - Weighting procedure used the BTTW protocol to determine placement of light weights (< 1% body weight on average)
  - Three trials with weight
    - Healthy controls performed additional trials after the fast walk trials in each condition to attain the averaged velocity walked by the matched participants with MS.

Data collection and analysis

Participants walked across a 24-foot GaitRite instrumented gait mat. The gait mat is computerized with sensors arranged in a grid-like pattern to identify the pressure applied by each foot as it steps. The software program calculates multiple spatio-temporal parameters, averaged across all steps for a particular trial.

Dependent variables

Parameters of interest included velocity, cadence, step length, step width, and the percentage of the gait cycle spent in single and double limb support.

Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>MS Walking without weights (mean ± SD)</th>
<th>MS Walking with weights (mean ± SD)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity (cm/s)</td>
<td>160.75 ± 41.09</td>
<td>167.74 ± 39.53</td>
<td>0.004</td>
</tr>
<tr>
<td>Cadence (steps/min)</td>
<td>141.04 ± 21.61</td>
<td>145.14 ± 20.75</td>
<td>0.014</td>
</tr>
<tr>
<td>Single support (%/GC)</td>
<td>40.23 ± 2.06</td>
<td>40.66 ± 2.16</td>
<td>0.028</td>
</tr>
<tr>
<td>Double support (%/GC)</td>
<td>19.18 ± 4.29</td>
<td>19.28 ± 4.22</td>
<td>0.008</td>
</tr>
</tbody>
</table>

Discussion

Previous studies have shown immediate velocity improvement with BTTW in PwMS with more significant gait impairments (average unweighted fast-walk velocity 110 cm/sec). Our results show immediate increase in velocity with BTTW even in this high functioning sample.

- Improvement in cadence and decreased time in double-limb support indicate greater stability during gait with BTTW.

This low-risk intervention shows promise as an adjunct to pharmaceutical and other rehabilitative protocols for PwMS having balance and gait impairments.

The present study differs from previous research in the following ways:
- Fast walking velocity
- Investigation of effects of an intervention (BTTW) on spatio-temporal gait parameters

Conclusion

Participants with multiple sclerosis show improvements in velocity, cadence, and percent of gait cycle spent in single and double-limb support with balance-based torso weighting. These gait parameters may be associated with greater stability during gait.

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References