Two Conditions of Administering the Six-Minute Walk in Persons with Multiple Sclerosis

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Introduction

The six-minute walk (6MW) is a valid and reliable measure of walking performance in persons with multiple sclerosis (MS). The 6MW has been undertaken by walking laps within a single corridor and performing 180 degree turns or by walking around a rectangular hallway with four corridors and performing 90 degree turns. It is unknown if the conditions of 6MW administration result in similar total distance traveled and energy expenditure in persons with MS.

Purpose

This study compared the total distance walked and energy expenditure between two conditions of administering the 6MW in persons with MS.

Participants

The total sample included 160 persons with MS, divided into two groups (Straight-line group: n=82 and Rectangular group: n=78; Table 1).

Measures

Six-Minute Walk Test: The 6MW is a valid and reliable test of endurance walking performance in persons with MS. For both conditions of the 6MW, participants were instructed to walk as fast as possible for 6 minutes, and when necessary, participants were permitted to use an assistive device. During the test, one researcher followed approximately 3 ft. behind the participant with a measuring wheel (Stanley MW30, New Briton, CT) and recorded total distance traveled.

Oxygen Consumption: VO2 was measured breath-by-breath during the 6MW using a commercially available portable metabolic unit (K4b2 Cosmed, Italy). The O2 and CO2 analyzers of the portable metabolic unit were calibrated using verified concentrations of gases, and the flow-meter was calibrated using a 3-L syringe (Hans Rudolph, Kansas City, MO). VO2 was calculated as 30-second averages over the 6MW.

Walking Performance: The Multiple Sclerosis Walking Scale-12 (MSWS-12) and Timed 25-foot walk (T25FW) were used as additional measures of walking performance in both samples.

Disability Status: Patient Determined Disease Steps (PDDS) scale (Hadjimichael et al., 2007): the PDDS was developed as an inexpensive surrogate for the Expanded Disability Status Scale (EDSS), and contains a single item for measuring self-reported neurological impairment on an ordinal level, ranging from 0 (normal) through 8 (bedridden).

Procedure

One group of participants completed a 6MW while wearing a portable metabolic unit (K4b2 Cosmed, Italy) in a rectangular hallway with four corridors that were 100 ft in length. Another group completed a 6MW while wearing the same metabolic unit in a single corridor that was 75 ft long. Additionally, all participants further performed the T25FW and completed the MSWS-12 and PDDS.

Measures (continued)

Data Analysis

Data were analyzed using PASW Statistics 18 (SPSS Inc., Chicago, IL). Independent-samples t-tests were performed to analyze group differences for total distance walked during the 6MW. Repeated-measures ANCOVA was performed on 30-second VO2 averages over the course of the 6MW to compare energy expenditure between hallway conditions, while controlling for resting metabolic rate as a covariate.

Results

Samples did not differ in age (t=55, p=59), sex (t=65, p=58), height (t=09, p=93), weight (t=29, p=77), disability status (t=39, p=70), Multiple Sclerosis Walking Scale-12 (MSWS-12) scores (t=72, p=47), or timed 25-ft walk performance (t=02, p=88).

Results (continued)

Participants undertaking the 6MW in a single corridor walked 35 ft (2.5%) farther (1382 ft) than those undertaking the test in a rectangular hallway with four corridors (1347 ft), but this difference was not significant (t=-49, p=62). Importantly, those completing the 6MW in a single corridor did expend more energy than those completing the 6MW in the rectangular hallway with four corridors (F=3.35, p<01; Figure 1).

Figure 1: Energy expenditure in 82 and 78 persons with MS over the duration of the 6MW under straight-line and rectangular hallway conditions, respectively

Table 1: Demographic characteristics of 160 persons with MS completing two different conditions of the Six-Minute Walk

<table>
<thead>
<tr>
<th>Variable</th>
<th>Straight-line (n=82)</th>
<th>Rectangular (n=78)</th>
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<tbody>
<tr>
<td>Age (years)</td>
<td>50.3 (9.7)</td>
<td>49.5 (8.7)</td>
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<tr>
<td>Sex (% female)</td>
<td>66.80%</td>
<td>60.76%</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>168.9 (9.1)</td>
<td>169.1 (8.3)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>82.1 (21.0)</td>
<td>81.3 (22.8)</td>
</tr>
<tr>
<td>PDDS (median, range)</td>
<td>3.0 (0-6)</td>
<td>3.0 (0-6)</td>
</tr>
<tr>
<td>MSWS-12</td>
<td>45.0 (28.0)</td>
<td>41.9 (28.0)</td>
</tr>
<tr>
<td>T25FW (s)</td>
<td>6.8 (3.2)</td>
<td>6.8 (3.5)</td>
</tr>
</tbody>
</table>

Note: Data are presented as mean (SD) unless noted otherwise: PDDS=Patient Determined Disease Steps scale; MSWS-12=Multiple Sclerosis Walking Scale-12; T25FW=Timed 25-ft walk

Conclusions

Energy expenditure, but not total distance, differs when the 6MW is administered in a single, straight-line corridor with 180 degree turns compared with a rectangular hallway with four corridors and 90 degree turns. Either protocol is acceptable, but researchers should be aware of the additional physiological demands when administering the 6MW in a single corridor with 180 degree turns.

Acknowledgments

This study was funded by grants from the CSF Foundation and National Multiple Sclerosis Society.