How Dance Affects Walking With and Without Music Cues in People With Parkinson’s Disease

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INTRODUCTION

- Parkinson’s disease (PD) is a neurodegenerative disease that does not have a cure. Symptoms include resting tremor, rigidity, bradykinesia, postural instability, and gait disturbances, such as decreased stride length and narrow base of support.
- Although there is not a cure, there are many alternative therapies to reduce symptoms and improve quality of life for people with Parkinson’s disease. Dance is one such potential therapy.
- Research has shown that gait improves after 16 weeks of a ballet dance group. Ballroom dance, specifically tango, has also shown to improve various symptoms of PD. However, no study has investigated the effects of a combined exercise and dance program on gait, and if there are preferred walking conditions, such as walking with music, for those that do dance.

OBJECTIVE

The objective of this study was to compare EMG muscle activity and gait parameters while walking in people with Parkinson’s disease, who do not dance and those who do dance, and compare it to healthy older adults.

We hypothesized that participants with PD who would dance would show similar gait parameters and associated muscle activity that is more similar to healthy older adults compared to participants who do not walk when dancing with a music cue as opposed to the tone or no auditory cue conditions.

METHODOLOGY

Participants completed three walking conditions: 1. Self Pace (SP) 2. Cued (using a metronome) 3. Music *

The participants completed 5 trials for each of the 3 conditions across a 10m long GaitRite mat, shown in Figure 1.

A Metronome App was used for the cued condition. The metronome was set to the participants’ natural pace and they were instructed to walk to the beat.

PitchSwitch was used to set the beat of the preferred music to the participants’ natural pace. The participants were instructed to walk to the beat of the music as well.

Data Collection

- Participants chose their preferred style of music such as “Sweet Home Alabama” or “Hey Jude.”
- The participants completed 5 trials for each of the 3 conditions across a 10m long GaitRite mat, shown in Figure 1.
- A Metronome App was used for the cued condition. The metronome was set to the participants’ natural pace and they were instructed to walk to the beat.
- PitchSwitch was used to set the beat of the preferred music to the participants’ natural pace. The participants were instructed to walk to the beat of the music as well.

Data Analysis

- We used MotionMonitor to mark the EMG data from onset to offset shown in Figure 2.
- EMG data was processed using NetBeans to determine the peak amplitude, area under the curve, time to peak, and peak to offset.
- We used the area under the curve to determine how precise each participant’s step was with the beat of the music.
- The following gait parameters were evaluated and used in the ANOVA: cadence, stride length, and heel to heel (HH) base support.
- A 3x3 ANOVA was completed comparing people with PD who dance, people with PD who do not dance, and healthy older adults. It also compared walking at a self pace, with a metronome cue, and their preferred style of music.

RESULTS

- The area under the curve determines how precisely the participants are walking to the beat. The participants with Parkinson’s disease who do dance have a smaller area under the curve. This may be due to the fact that the participants who dance have experience walking with an external cue. However, because there is no difference between the self paced and the cued condition, we cannot be sure if dance is the reason for the smaller area under the curve.
- Although it was not significant, there is a similar trend in both stride length and base of support. Participants with Parkinson’s disease who dance have a slightly larger stride length and base of support than the participants with Parkinson’s disease who do not dance. The differences in stride length could be due to the fact that the no dance group was made up of only women, who are generally shorter than men. However, people with Parkinson’s disease who dance have a slightly wider base of support than people with Parkinson’s disease who do not dance during the music condition. This could be because dance targets dynamic balance and may influence their base of support when walking.
- One reason that no significance was found could be due to the small sample size of this study. Increasing our sample size increased the chance that the results are not due to chance and are significant. Another reason for finding no significance could be due to the current stage of Parkinson’s disease the participants are at. They may not be showing severe symptoms in their gait, which may be why they are showing similar gait patterns to healthy older adults.

CONCLUSION

Figure 1: GaitRite

Figure 2: EMG

Figure 3: Mean and standard deviation for area under the curve for each group across each condition. Participants with PD who dance had a smaller area under the curve for the tibialis anterior than the group with PD who do not dance and healthy older adults. However, no significant differences were revealed.

Figure 4: Mean and standard deviation for cadence for each group across each condition. No significant differences were revealed.

Figure 5: Stride length for each group across each condition. While stride length was slightly larger for the PD dance group compared to the PD no Dance group, no significant differences were revealed.

Figure 6: Mean and standard deviation for base of support for each group across each condition. Healthy older adults had a wider base of support than the participants with PD. However, no significant differences were revealed.

Table 1: Participant Demographics

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>% Female</th>
<th>% Male</th>
<th>Age (mean ± standard deviation)</th>
<th>Disease Duration (mean ± standard deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants with PD who dance</td>
<td>5</td>
<td>60%</td>
<td>40%</td>
<td>72.4 ± 5.75</td>
<td>10.4 ± 4.04</td>
</tr>
<tr>
<td>Participants with PD who do not dance</td>
<td>5</td>
<td>100%</td>
<td></td>
<td>66.8 ± 4.44</td>
<td>8.4 ± 5.77</td>
</tr>
<tr>
<td>Healthy Older Adults (HOA)</td>
<td>5</td>
<td>60%</td>
<td>40%</td>
<td>73 ± 6.32</td>
<td>--</td>
</tr>
</tbody>
</table>

*Participants chose their preferred style of music such as “Sweet Home Alabama” or “Hey Jude.”