MDS-ES Gait Disturbances in PD: What PTs have to know to treat patients

VIRTUAL COURSE PROGRAM

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Disclosure information:

Nothing to declare

Session

PHYSIOTHERAPY INTERVENTIONS FOR GAIT DISTURBANCES IN PD

Topic

Evidence for rehabilitation of gait disturbances in PD in the middle phase
In the middle stage of PD, gait characteristics varied among patients and can be influenced by several factors:

1. PD SUBTYPES
2. POSTURAL DEFORMITIES
3. DYSKINESIA
4. NON-MOTOR SYMPTOMS
5. FOG
6. FALLS
7. CO-MORBIDITY
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\[ e^{i\pi} + 1 = 0 \]

Create personalized treatment

Choice EB interventions for each patient
Evidence for exercise of gait disturbance in PD in the middle phase

Clinical reasoning process and treatment plan
1. Clinical gait evaluation

GAIT ASSESSMENT IN THE CLINICAL SETTING REQUIRED TIME!!

1. Talking to patients

2. Clinical tests or scales (TUG, 10mwt, 2mwt, DGI) - Usual walking
   - DT conditions
     - motor – DT
     - cognitive – DT

3. Clinical test for Balance (Pull test, tandem gait, Romberg test)
   - Balance
     - Minibest
     - BBS

4. Assess muscle strength (limb and trunk)

5. Assess Falls, FOF and FOG
   - Falls
     - ABC – FES(i)
     - Falls diary

6. Evaluate functional abilities related to gait and fatigue
Evidence for exercise of gait disturbance in PD in the middle phase

1. Ask the patient
2. Clinical tests or scales (TUG, 10mwt, 2mwt, DGI) - Usual walking
3. Clinical test for Balance (Pull test, tandem gait, Romberg test)
4. Assess muscle strength (limb and trunk)
5. Assess Falls, FOF and FOG
6. Consider the impact of posture abnormalities and other risk factors (e.g., dyskinesias) on gait
7. GAIT ANALYSIS

for having a complete picture of gait disturbances of our patients
2. Knowledge of training rationale

An intervention could be applied with a different training rational during the course of the disease.
3. Select PT treatments that fit the best for our patients
EBM PT interventions for Gait disorders in PD

Develop a tailored PT intervention
EBM PT interventions for Gait disorders in PD

Develop a tailored PT intervention

Cueing
Aerobic Resistance
Multi-modal Exercise
Virtual Reality
Dual Task
TT

+ NON-PT
Dance
Yoga
Tai-Chi
Nordic Walking
Results from scientific evidence

- Cueing
- Aerobic Resistance
- Dual Task
- Multi-modal Exercise
- Virtual Reality
- TT

Develop a tailored PT intervention
Cueing defined as using external temporal, spatial or somatosensory stimuli to facilitate movement (gait) initiation and continuation, has been extensively used for improving gait in PD.

The type of cues most used for gait training in PD are:

a. Visual
b. Auditory
c. Visual + Auditory
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The type of cues most used for gait training in PD are:

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b. Auditory  
c. Visual + Auditory  

**EBM**
- Improvements in spatiotemporal gait parameters (step length, cadence, gait speed)  
- Dynamic control of balance  
- Intensive training based on cues could induce motor learning  
- Might have the potential for improvement in complex walking
Develop a tailored PT intervention

- Gait performance deteriorate under dual task conditions in PD patients
- Dual task training is an essential part of PT treatment focus on improving gait
- Dual task training consist in applying a secondary task while patients is walking

DT Gait is classified
a. Motor DT (walking avoiding obstacle)
b. Cognitive DT (walking and talking)

DT Gait Training aims at improving dual task ability and walking in real life circumstances
To set up an effective training we have

1) to test residual neural capacity of each patient

2) to choose DT modality that are effective in improving gait (e.g. consecutive or integrated approaches)
Develop a tailored PT intervention

The overall number of studies on the effect of cueing on gait performance is high and the overall quality is quite good.

### Motor-Cognitive Dual-Task Training in Persons With Neurologic Disorders: A Systematic Review

**Note.** E. Fett, PT, DPE, NCS, PhD, Fern M. Chock, MALS, and Deborah S. Nickle-Larson, PT, PhD.

<table>
<thead>
<tr>
<th>Component Treatment</th>
<th>Outcome Measure</th>
<th>Mean Difference</th>
<th>Effect Size (95%)</th>
<th>Forest Plot</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Exercise</strong></td>
<td>Gait (DTC velocity)</td>
<td>8.11</td>
<td>0.56 (0.40 to 1.71)</td>
<td><img src="image1" alt="Forest Plot for Gait (DTC velocity)" /></td>
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<tr>
<td></td>
<td>Gait (DTC stride length)</td>
<td>7.80</td>
<td>0.00 (0.00 to 0.00)</td>
<td><img src="image2" alt="Forest Plot for Gait (DTC stride length)" /></td>
</tr>
<tr>
<td><strong>Null Control</strong></td>
<td>Gait (DT velocity)</td>
<td>6.11</td>
<td>1.52 (0.30 to 2.74)</td>
<td><img src="image3" alt="Forest Plot for Gait (DT velocity)" /></td>
</tr>
<tr>
<td></td>
<td>Gait (DT stride length)</td>
<td>8.32</td>
<td>0.53 (0.29 to 1.78)</td>
<td><img src="image4" alt="Forest Plot for Gait (DT stride length)" /></td>
</tr>
<tr>
<td></td>
<td>Gait (DT stride length)</td>
<td>8.34</td>
<td>0.53 (0.29 to 1.78)</td>
<td><img src="image5" alt="Forest Plot for Gait (DT stride length)" /></td>
</tr>
<tr>
<td></td>
<td>Gait (DT stride length)</td>
<td>8.53</td>
<td>0.57 (0.32 to 1.81)</td>
<td><img src="image6" alt="Forest Plot for Gait (DT stride length)" /></td>
</tr>
<tr>
<td></td>
<td>Balance (BMI)</td>
<td>4.06</td>
<td>0.57 (0.32 to 1.81)</td>
<td><img src="image7" alt="Forest Plot for Balance (BMI)" /></td>
</tr>
<tr>
<td></td>
<td>Cognitive (FA)</td>
<td>3.90</td>
<td>0.59 (0.35 to 0.83)</td>
<td><img src="image8" alt="Forest Plot for Cognitive (FA)" /></td>
</tr>
<tr>
<td></td>
<td>Cognitive (FA)</td>
<td>8.08</td>
<td>1.59 (1.00 to 2.18)</td>
<td><img src="image9" alt="Forest Plot for Cognitive (FA)" /></td>
</tr>
<tr>
<td></td>
<td>Cognitive (Memory Span &amp; Tracking Task)</td>
<td>6.75</td>
<td>0.57 (0.32 to 1.81)</td>
<td><img src="image10" alt="Forest Plot for Cognitive (Memory Span &amp; Tracking Task)" /></td>
</tr>
</tbody>
</table>

**Parkinson Disease.** Compared with null controls, individuals with PD had significantly improved DT gait speed and stride length, maintained at follow-up. In test-retest designs, there were also significant improvements in DT gait speed and stride length, maintained at follow-up. Interestingly, Yoge-Seligmann et al. reported improvements in gait speed and stride time variability during an untrained DT, suggesting that transfer of training might be possible.

Training effects in DT gait were noted even after short-term training programs. A single 30-minute session of DT training and three 30-minute sessions of DT training resulted in significant increases in stride length and gait velocity that were maintained at a delayed retention.

Yen et al. reported improvements in DT balance during conditions 5 and 6 of the SOT in both the VR group and the conventional balance group, whereas individuals in the control group declined in these conditions.

**EBM**

- Improvements in spatiotemporal gait parameters (speed, step length, stride time variability during usual and DT walking)
- Transfer learning (improvements on un-trained DT)
- Long-lasting effects
Patients with gait disturbances benefit of TT

**EBM**
- Improvements in gaits speed and stride length
- Dynamic control of balance

**Summary of main results**

The aim of this review, which included 18 trials with a total of 623 participants, was to evaluate the effects of treadmill training on gait in patients with PD. We found evidence that the use of treadmill training may improve gait parameters, such as gait speed and stride length, of patients with PD at Hoehn Yahr stages one to three. However, walking distance and cadence did not improve [BJ1] significantly. Additionally, it is not known how long gait improvements after treadmill training may last. Adverse events and drop-outs did not occur more frequently in people receiving treadmill training than control interventions and were not judged to be clinically serious adverse events.

There are gaps that still need to be filled!

a) intensity and duration

b) frequency of sessions

c) speed
VR has emerged as a promising tool both for studying and treating gait impairments in PD population. The goal of VR is to foster brain and behavioural responses in the virtual world that are analogous to those that occur in the real world.

There are several options of VR system for PD rehabilitation:

- **Non-immersive** (Nintendo®, XBox®, Caren®: GaitBetter®)
- **Immersive** (Oculus®, HTC Vive® devices)
Despite being an emerging approach in PD rehab, the evidence on VR training are quite strong.

**EBM**
- Improvements in spatiotemporal gait during usual walking
- DT gait performance
- Long-lasting effects
Develop a tailored PT intervention

Addition of a non-immersive virtual reality component to treadmill training to reduce fall risk in older adults (V/TIME): a randomised controlled trial

Joel Welborn, Lynne Hester, Matthew Smith, John O’Driscoll, Jacques van der Walt, Jessica E. Pinner, Garcian Amat, Wei-Chih Lin, and the V/TIME Study Group.

<table>
<thead>
<tr>
<th>6 months before training</th>
<th>6 months after training</th>
</tr>
</thead>
<tbody>
<tr>
<td>All participants</td>
<td>People with depressive fall</td>
</tr>
</tbody>
</table>
| Total falls | Treadmill training | 14 (6) | 105 | 12 | 1096 | 85 | 47 | 26 | 904 | 49 | 44%
| | Treadmill training plus VR | 16 (6) | 105 | 24 | 1096 | 85 | 47 | 26 | 904 | 49 | 44%
| People with a fall | Treadmill training | 16 (6) | 105 | 25 | 1096 | 85 | 47 | 26 | 904 | 49 | 44%
| | Treadmill training plus VR | 16 (6) | 105 | 25 | 1096 | 85 | 47 | 26 | 904 | 49 | 44%

Incident rate of falls (per 1000)

<table>
<thead>
<tr>
<th>Treadmill training</th>
<th>Treadmill training plus VR</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 months before training</td>
<td>3.2 (1.6)</td>
</tr>
<tr>
<td>6 months after training</td>
<td>2.1 (1.1)</td>
</tr>
</tbody>
</table>

Table 2: Falls in 6 months before and after training

Note: Data are n (%); Data are not shown for participants with falls; whether a participant had a fall was determined prior to analysis; VR = virtual reality.
Multimodal training could be defined as PT intervention combining different approaches.

Examples:

a. Aerobic + strengthening + general flexibility + motor coordination + gait + balance training.
b. “general” exercise” (strengthening and stretching)
c. Cognitive exercises + PT interventions

OVERALL RESULTS on gait:

- Gait speed
- Improvement in gait performance (TUG, endurance)
- No Meta-analysis

the limit of this type of intervention is that the rehab protocol is a mere mix of several approaches often without any prior hypothesis!
Evidence for exercise of gait disturbance in PD in the middle phase

Be up to date with new scientific evidence

Essential steps towards a PERSONALIZED PT treatment
Non-EB interventions can represent an useful therapeutic adjunct to PT treatment.
1. Gait performance in the middle stage has many facets. Further research is needed to better understand gait pathophysiology.

2. Gait assessment is not simple. Multidisciplinary team.

3. Multiple aspects of PD patients should be considered. Move towards a personalized treatment.

4. Physiotherapy is a key element for treating gait disturbances. The optimal dosage and long-term delivery need to be determined.

5. Innovative strategies are promising. Better investigating underlying mechanisms and their effects.