THE EFFECT OF ASSISTIVE DEVICES ON GAIT PATTERNS IN PARKINSON'S DISEASE

A PILOT STUDY

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INTRODUCTION

- As suggested by recent studies people with Parkinson's disease (PwPD) experience balance and gait disorders as a consequence of disease progression.[1-5]
- These mobility impairments can cause frequent falls and limitation in activities of daily living (ADL).[5]
- Falls typically occur while a person is turning, initiating gait, and sitting down.[3-5]
- The use of assistive devices (ADs) have proven to be a crucial strategy to maintaining stability during gait and the main form of adjunctive treatment for most individuals.[1-3]
- The information available in the literature on how PwPD modify their gait characteristics when using different ADs is still scarce.[1-3,5]

The purpose of our study is to assess the influence of six different ADs on gait patterns in PwPD.

METHODS

15 Participants

Inclusion Criteria
- ≥ 18 years old;
- Diagnosis of idiopathic Parkinson's disease (IPD);
- Ambulate independently (minimum 10m without assistance);
- Use of anti-parkinsonian medication.

Exclusion Criteria
- Significant cognitive impairment, Mini-Mental State Exame (MMSE) ≤24;
- Psychiatric, neurological, visual or orthopedics disorders that enables participants to perform the required tests.

Equipment and Measures

- Participants were asked to walk across a 2' by 16' Zeno walkway mat. (ProtoKinetics, Havertown, PA)*
- The Zeno walkway is computerized and has 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 of the person's gait, average across all steps for a particular trial.

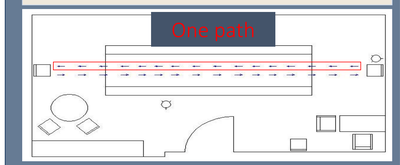
Study Design

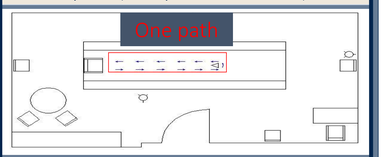
- Prospective, single-center, pilot study;
- Conducted following a Case Report Form (CRF);
- Postural stability was assessed and rated accordingly to the item 3.12 of the Movement Disorder Society-Unified Parkinson's Disease Rating Scale (MDS-UPDRS);
- Order of testing assistive devices (randomized).

Procedures

FIRST COURSE – Straight Line
- Walking at a self-selected, comfortable pace;
- 4 paths: Only the mean of the last 3 paths was calculated and analysed (first path was a trial).

SECOND COURSE – Clinical test*
- Walking fast, to test manoeuvrability around obstacles, performing Timed Up and Go test (TUG);
- 2 paths: Only the second path was analysed (first path was a trial).





*FUTURE WORK

Figure 1. Courses

STATISTICAL ANALYSIS

Dependent Variables	Independent Variables
Parameters of interest included: ○ Stride length; ○ Stride time; ○ Stance phase; ○ Swing phase; ○ Total double support; ○ Velocity; ○ Cadence.	**6 ADs walking conditions:** ○ Aluminium straight cane (Cane); ○ Tripod cane (TCane); ○ Pair of Nordic walking sticks (NWS); ○ Standard walker (StW); ○ Two-wheeled walker (2WW) with fixed wheels; ○ Four-wheeled walker (4WW) with front wheels casters. **Baseline: 'no AD' walking condition**

Statistical Analysis (alpha value was set at 0.05)
- Statistical analysis was performed using IBM SPSS version 20 (SPSS Inc., Chicago, Illinois);
- Demographic data were descriptively summarized (table 1);
- The Wilcoxon nonparametric signed-rank test was used to comparison the means and standard deviations (SD) for each variable based on the averaged values of the trials in each condition.

RESULTS

Resembling previous studies the reported results reflect immediate effects because we did not provide any professional instruction to prevent gait modification from clinician feedback.

Characteristics	Mean ± SD
Age (years)	65,2±7,9
Height (m)	1,62±0,08
Weight (kg)	72,59±13,83
BMI (kg/m^2)	27,5±3,6
Years of PD (years)	8,5±4,4
MMSE	28±1

Tabel 1. Participants characteristics
15 participants: 9 males; 6 females, with self-identified gait or balance problems

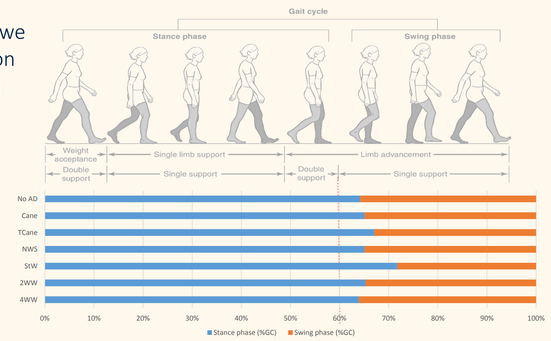


Figure 2. Gait cycle

Analysis of differences between ADs and baseline walking conditions showed that:
- 4WW was the only AD that showed no impact in gait measures and was also the only one that actually improved the relation between stance and swing phase;
- NWS and Cane were the ones that followed, respectively:
  - Both did not show significant differences in stance and swing phase;
  - Both resulted in different velocity and cadence, but NWS also differed in stride time (p=0,025) while Cane differed in total double support (p=0,034).
- 2WW and TCane differed in almost all gait parameters with exception of stride time and cadence for 2WW, and stride length for TCane;
- StW showed the highest variability with differences in all gait measures.

Note: This results consider only the first course analyze.

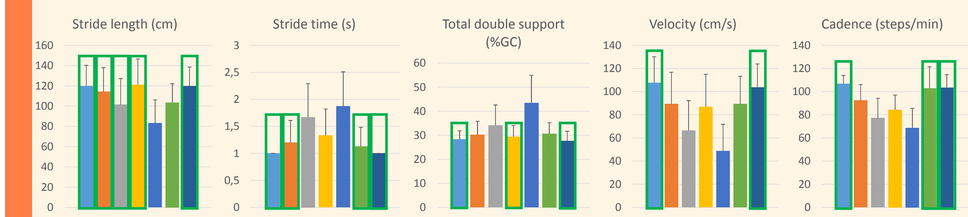


Figure 3. Gait measures across all walking conditions: means (SD)

DISCUSSION

- Based on previous findings we hypothesize that[1,5]:
  - Wheeled walkers should be favored when compared to non-wheeled walkers because they are easy to manipulate and do not require stopping and lifting the walker forward.
- Our results were in agreement with previous findings that[5]:
  - Demonstrate 4WW as the AD with least impact in gait pattern on individuals' abilities to walk at their usual speed;
  - Showed StW as the AD producing the slowest and most variable gait pattern of all ADs when walking straight.
- Our study confirms that use of 4WW, NWS and Cane in PwPD resulted in a closer reach to the normal values of gait velocity and quality when compared to the others ADs in study.

CONCLUSION

- Our data provide insight regarding the gait measures that change along with the use of different ADs in PwPD even when they have minimal gait dysfunction.
- This study provides evidence that when walking with a 4WW gait pattern is more similar to the individuals' spontaneous pattern with 'no AD' condition. This AD does not decrease velocity or causes such meaningful differences as did the others ADs.

However, it is important to emphasize that although 4WW seems the most advisable choice when it becomes necessary to acquire an AD, it requires an effective trunk control to be able to stop and lock the walker when needed. Also note that it does not promote the waist dissociation or stimulate the neuromotor coordination as it happens with NWS. The acquisition of a unilateral AD as a Cane must take to consideration that it favours the ipsilateral weight transfers.

The impact of different ADs in gait patterns should be considered when prescribing ADs to PwPD. The knowledge of how ADs influence the walking patterns need to be taken more seriously because it should influence how professionals provide additional gait training. Thus, certain lead to a more cautious clinical practice in gait rehabilitation using ambulatory ADs.

FUTURE WORK

- Include the analyze of recorded freezing episodes; anxiety and/or panic attack; stumbles and/or falls; patient level of satisfaction; perception of feeling safe and the second course data.
- Enlarge the sample to observe more in depth effects.
- Design a study to observe gait changes after a considerable period of specific training when walking with these ADs and with a laser AD.

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*http://protokinetics.com/

ACKNOWLEDGEMENTS

CNS CAMPUS NEUROLÓGICO SÉNIOR

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