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Effects of group physical therapy on the walking speed in patients with Parkinson's disease

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Abstract

Background. Parkinson's disease is a progressive neurologic disorder characterized by motor impairments which alter the walking capacity, and lead to reduced walking speed, decreased stride length and increased double support time. Physical therapy interventions are an important part of the non-pharmacological treatment for Parkinson's disease.

Aims. The purpose of this study was to assess whether there is a different outcome regarding improvement of walking speed, when applying a physical therapy program in an individual or in a group manner.

Methods. A prospective, observational, cohort type study on 60 patients with Parkinson's disease was carried out between November 2014 - July 2017, in the Clinical Rehabilitation Hospital in Cluj-Napoca, Cluj county, Romania. Patients were randomly divided into 2 groups, and were prescribed either individual (1 patient and 1 physical therapist) or group physical therapy (6 patients and 1 physical therapist). The treatment protocol included 10 sessions of physical therapy, in the same room setting, and patients performed the same routine of exercises, except for the 3 breaks during the sessions in the group therapy for informal socialization. Walking speed was measured by two validated instruments, the 6-minute walk test and the 10-meter walk test, before and after treatment.

Results. There was an increase in both groups regarding gait speed after treatment (all $p<0.05$), except for the values obtained by the 6-minute walk test in the individual therapy group, which did not improve significantly. The 6-minute walk test scores after treatment showed significantly higher values of gait speed in the group therapy, compared to individual therapy ($p=0.002$).

Conclusions. Patients with Parkinson's disease could benefit more from a group physical therapy program, as gait speed increased significantly. The group approach facilitates interactions and is cost-effective, as it requires only one therapist and more patients.

Key words: Parkinson's disease, physical therapy, walking speed

Introduction

Parkinson's disease (PD) is a progressive neurologic disorder characterized by the cardinal motor signs of bradykinesia, tremors, rigidity, and postural instability. These motor impairments are the main reasons for alterations in the walking capacity that lead to decreased stride length, increased double support time, and reduced walking speed compared to healthy subjects (Morris et al., 2001; Sofuwa et al., 2005).

Gait disturbances are among the primary symptoms of PD and have a huge impact on a patient's quality of life, functionality and independence. The PD gait pattern is typically characterized by hesitant, shuffling steps which are short and quick, flexed forward posture with limited natural arm swing and difficulty in initiating gait. Also, PD patients are unable to generate proper stride length, which they compensate by an increased gait cadence. As the disease progresses, movement is impaired and the walking pattern becomes slower (Jankovic et al., 2001; Morris et al., 1996).

Treatment for gait disturbances due to PD includes the standard drug regime, but in addition to this, non-pharmacological interventions are required to help manage the disease. Among them, the most common treatment

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prescribed for gait disturbances in PD is physical therapy (PT) (Giladi et al., 2001).

The PT program for gait rehabilitation in a patient with PD can consist of conventional PT or can be aided by different sensory cues (auditory, visual). One of the most interesting features of PD, which was the basis of the cueing technique, is that patients are sometimes able to perform complex movements almost normally under certain conditions, despite the motor symptoms. The classic example is a patient with PD that will inexplicably freeze while walking through a doorway, but will have no trouble at all climbing a flight of stairs (Giladi et al., 2001). This is why sensory cueing was implemented in PD treatment guidelines, as they appear to be a powerful way of stimulating and improving gait and walking speed, as shown in multiple studies (Rubinstein et al., 2002; Suteerawattananon et al., 2004; Herman et al., 2007).

Among the gait parameters, walking speed or gait velocity strongly correlates with functional ability and is a discriminating factor in determining the potential for rehabilitation (Perry et al., 1995; Goldie et al., 1996). Also, it has the ability to predict future health status and functional decline and has been used as a predictor and outcome measure across multiple diagnoses (Studenski et al., 2003; Purser, 2005; Brach, 2002; Meyer-Heim, 2007; Lee et al., 2007).

Short-distance walking speed tests are recommended clinical screening and monitoring tools of functional capacity and safety for all patients with disability (Fritz & Lusardi, 2009). The 10-meter walk test is commonly used to assess the walking speed, as it is easy to perform and it only requires a 20-m path that includes 5 m for acceleration and deceleration (Peters et al., 2013). The 6-minute walk test is used to measure the maximum distance that a person can walk in 6 minutes and is a useful instrument due to its ease of use (Steffen, et al., 2002).

Hypothesis

Besides motor symptoms, depression and social isolation are common findings in a PD population, resulting in a low quality of life (Herman et al., 2007). From a physical therapy point of view, treating PD patients as a group could be of further benefit than the classical one-on-one therapy in terms of functionality and/or well-being, but more research is needed in this area.

The objective of the present study was to assess whether there is a different outcome regarding walking speed values when applying a PT program for PD patients, in an individual or in a group manner.

Material and methods

All subjects were informed of the characteristics of the study and were required to sign an informed consent document approved by the Ethics Committee of the "Iuliu Hatieganu" University of Medicine and Pharmacy (approval no. 130/11.04.2014). The study was registered on *clinicaltrials.gov* (NCT04187963).

Research protocol

a) *Period and place of the research*

The current study is prospective, observational, cohort type, and it was carried out during November 2014 - July 2017, in the Clinical Rehabilitation Hospital in Cluj-Napoca, Cluj county, Romania.

b) *Subjects and groups*

A total of 60 subjects diagnosed with typical, idiopathic PD participated in this study. All patients met the following inclusion criteria: (1) stable medication usage; (2) Hoehn and Yahr stage 2, 3 or 4; (3) ability to walk independently or by using an assistive walking device; (4) age 50 to 70 years; (5) no severe cognitive impairments (Mini-Mental State Examination - MMSE score, ≥24); (6) no other severe neurologic, cardiopulmonary or orthopedic disorders; and (7) not having participated in a PT or rehabilitation program in the previous 2 months.

The patients were randomly divided into 2 treatment groups: group physical therapy – GPT (n=30) and individual physical therapy – IPT (n=30). The treatment protocol for each group included 10 sessions of physical therapy, each 1.5 hour long, on a daily basis, for 2 weeks. All treatment sessions were conducted at the same time of the day throughout the study, in the morning, 60-90 minutes after intake of pharmaceutical treatment for PD. For the GPT, there were groups of 6 patients, supervised by 1 physical therapist. The group sizes were kept small to promote efficiency and motivation. The patients undertaking IPT were alone with the physical therapist during the sessions. Both groups were treated in the same physical therapy room setting.

The rehabilitation protocol for IPT consisted of cardiovascular warm-up activities, stretching exercises, strengthening exercises, functional, gait and balance training, recreational games, and ended with relaxation exercises. In addition, the GPT protocol followed the exact same pattern, except for 5-10 minute breaks for informal socialization between participants, at the beginning of the session, mid-session and at the end of the session.

Also, both groups had access to external cues, which were applied during a variety of tasks and environmental situations, such as gait initiation and termination, heel strike and push-off, sideways and backwards stepping, walking while dual tasking, and walking over various surfaces and long distances. There is evidence in the literature to support each of the components contained in the intervention (Thaut et al., 1996; Schenkman et al., 1998; Scandalis et al., 2001; Dam et al., 1996; Mohr et al., 1996; Schenkman et al., 2000; Protas et al., 1996). In order to facilitate initiation and speed of movement, most activities employed visual and auditory cues as triggers. Visual cues were looking at and following the therapist's movements in the IPT group or the other group member's movements in the GPT group. A mirror was also used. Auditory cues were music with regular rhythm and verbal suggestions and reinforcement from the therapist in the IPT group, or from the therapist and other participants in the GPT group.

c) *Tests applied*

All patients were evaluated at the beginning and at the end of the physical therapy program. The evaluation included the 6-minute walk test and the 10-meter walk test. Gait speed for each participant was calculated as the ratio between the walked distance and the time unit, and it was measured in meters/seconds.

For each subject, all assessment sessions were performed in the morning, by the same person and all tests were performed in the same order, to control for variations in performance because of the medication cycle. All assessments were conducted in the "on" state for the subjects experiencing motor fluctuations.

d) *Statistical processing*

Patient data was entered in the Microsoft Office Excel 2010 program and statistical analysis was performed using MedCalc Statistical Software version 17.9.7 and SPSS for Windows, version 20. Quantitative data were tested for normality of distribution and expressed as mean±standard deviation or median and interquartile range (IQR), whenever appropriate. Qualitative data were expressed as frequency and percent. Comparison between groups was performed using the Student t-test, Mann-Whitney test or chi-square test, whenever appropriate. Correlations between two groups were tested using the Spearman's rho correlation coefficient. A p-value <0.05 was considered statistically significant.

Results

A total of 60 patients met the inclusion criteria, of which 31 were female and 29 were male. The mean age was 64.77 (± 4.65) years in the GPT group, and 64.43 (± 5.41) years in the IPT group, respectively. Based on the PD stage, in GPT, 20% of the patients were in stage 2, 56.6% were in stage 3 and 23.3% were in stage 4. In IPT, 16.6% of the patients were in stage 2, 63.3% were in stage 3 and 20% were in stage 4. There were no significant differences between groups based on gender, age, MMSE score, use of walking aid or PD stage (all p>0.05) (Table I).

Table I

Clinical characteristics of the patients included in the study.

	n=60	Group PT (n=30)	Individual PT (n=30)	p-value
Gender	Female (n=31)	16	15	0.8
	Male (n=29)	14	15	
Age (years ± SD)		64.77 ± 4.65	64.43 ± 5.41	0.88
MMSE (score ± SD)		28.6 ± 1.59	28.13 ± 1.53	0.22
Walking aid (%)	Yes (n=40)	21 (52.5%)	19 (47.5%)	0.12
	No (n=20)	9 (45%)	11 (55%)	
PD stage (%)	2	6 (20%)	5 (16.6%)	0.7
	3	17 (56.6%)	19 (63.3%)	
	4	7 (23.3%)	6 (20%)	

There was an increase in both groups regarding gait speed after treatment (all p<0.05), as measured by the two instruments, except for the values obtained by the 6-minute walk test in the IPT group, which did not improve significantly (p=0.07) (Table II).

There were no differences between the 2 groups regarding initial gait speed, as measured by the 10-meter or 6-minute walk tests (all p>0.05). In the group therapy, the 10-meter walk test at normal speed showed higher gait speeds than in the individual therapy group, but it did not reach statistical significance (p=0.06). The 10-meter walk test at maximum speed showed no statistically significant difference between the treatment groups (p=0.72). The 6-minute walk test scores after treatment showed significantly higher values of gait speed in the group therapy compared to individual therapy (p=0.002) (Table III).

Table III

Comparison between groups before and after treatment

Gait speed (m/s)	Test	Group PT (n=30)	Individual PT (n=30)	p-value
BASELINE (mean ± SD)	10-meter walk - normal speed	0.89 ± 0.2	0.85 ± 0.15	0.51
	10-meter walk maximum speed	1.06 ± 0.2	1.05 ± 0.2	0.98
	6-minute walk	0.69 ± 0.11	0.66 ± 0.22	0.49
AFTER TREATMENT (mean ± SD)	10-meter walk - normal speed	1.06 ± 0.2	0.97 ± 0.16	0.06
	10-meter walk maximum speed	1.21 ± 0.21	1.18 ± 0.16	0.72
	6-minute walk	0.85 ± 0.13	0.72 ± 0.17	**0.002**

Discussion

It is now a known fact that rehabilitation is one of the most important parts of the multidisciplinary therapy approach to PD. One of the most affected motor tasks in PD is gait, due to a deficit of internal rhythmic signals, which interferes with motor performance (Azulay et al., 1999). PD is the most common neurological disorder leading to gait disturbance and falls. Despite advances made regarding pharmacological treatments, gait and balance deficits still persist, and are associated with loss of independence and mobility and high costs for the healthcare systems. Therefore, rehabilitation approaches that complete the current pharmacological options are important to manage these problems (Grimbergen et al., 2004; Nieuwboer et al., 2007).

The positive effect of a physical therapy program on the motor and functional performance of patients with PD has been previously demonstrated in several studies (Formisano et al., 1992; Comelia et al., 1994; Schenkman et al, 1998). The main objective of physical therapy interventions is to decrease impairments and functional limitations evolving from the disease. This is achieved by teaching the patients strategies to bypass the basal ganglia – supplementary motor area circuit by "recruitment" of other areas in the

Table II

Differences in gait speed within groups before and after treatment.

Groups (n=60)	Group therapy (n=30)			Individual therapy (n=30)		
Test	10-meter walk test normal speed (m/s)	10-meter walk test maximum speed (m/s)	6-minute walk test (m/s)	10-meter walk test normal speed (m/s)	10-meter walk test maximum speed (m/s)	6-minute walk test (m/s)
Gait speed (m/s) mean ± SD (95% CI)	-0.17 ± 0.08 (95% CI [-0.2 – -0.14])	-0.16 ± 0.1 (95% CI [-0.19 – -0.12])	-0.16 ± 0.11 (95% CI [-0.2 – -0.12])	-0.11 ± 0.11 (95% CI [-0.15 – -0.07])	-0.13 ± 0.15 (95% CI [-0.19 – -0.07])	-0.06 ± 0.19 (95% CI [-0.13 – 0.01])
p-value	<0.05	<0.05	<0.05	<0.05	<0.05	0.07

brain, such as the premotor cortex. One of the interventions is the application of external cues and cognitive strategies for initiation of motor acts (Tamir et al., 2007). Literature data show that external stimuli (acoustic, visual and /or somatosensory) are able to modulate the motor pattern in PD, helping the patients to start and maintain a rhythmic motor task. Cued gait training represents a precious aid for managing motor symptoms in PD patients (Stolze et al., 2005). Cueing is defined as using external temporal or spatial stimuli to facilitate gait initiation and continuation and to improve walking speed, step length and step frequency (Rubinstein et al., 2002; Lim et al., 2005a).

The influence of cueing has mainly been studied in single-session experiments in laboratory settings, and results show a short-term correction of gait parameters and gait initiation (Morris et al., 1996; Thaut et al., 1996; Lewis et al., 2000).

The purpose of the current study was to assess whether a group physical therapy program applied to patients with PD has more positive effects on gait speed when compared to an individual physical therapy program. The results show that both treatment interventions were effective in improving gait speed, as measured by the 6-minute walk test and the 10-meter walk test (all $p>0.05$), except for the gait speed in the 6-minute walk-test in the IPT group, which did not improve significantly ($p=0.07$). When comparing the two treatment groups, the GPT group showed higher gait speeds as measured by the 6-minute walk test ($p=0.002$) than the IPT group. This could be of importance for PD patients, as the 6-minute walk test scores are of importance in everyday life, due to its similarity to normal daily activities.

A study conducted by Gauthier (Gauthier et al., 1987) showed that patients with PD treated by occupational therapy within a group achieved more behavioral changes than an individual, more dependent client-therapist relationship would have achieved. This has shown that group therapy is well suited for patients with chronic degenerative diseases who are easily drawn into depression and social isolation.

Also, a more recent study showed that training as a group has long-term benefits for people with PD. The positive and supportive environment provided by the group exercise program helped to improve attitudes, fostered optimism and was a positive force for the patients (Park et al., 2014).

In comparison to other studies with participants with PD at similar Hoehn & Yahr stages, tested while taking PD medications, the mean comfortable walking speed found in this study was close to that reported by Morris et al. (1996) and Brusse et al. (2005). However, it was considerably faster than previously reported by Steffen et al. (2008). The mean fast walking speed recorded by the group of participants in this study was also faster than the previously reported speeds (Lim et al., 2005b).

Certainly, any study involving patients with a degenerative, neurological disease and sometimes fluctuating symptoms has its limitations. However, our study was conducted with maximum scientific rigor. The main limitations of the present study are the modest number of participants, the fact that the patients were selected from the same hospital setting and that only one gait parameter was assessed, as it did not require special equipment. But as said before and validated by different authors, measurement of gait speed is a valid tool to emphasize the functional limitations of a patient with a neurological, degenerative disorder and to assess the outcomes of a rehabilitation program implemented. Also, it is important to see whether this type of GPT intervention has long-term positive effects on gait speed, and it should be further assessed in larger cohorts and multiple treatment centers in order to validate its potential.

Conclusions

1. A physical therapy program aided by the cueing techniques has a positive effect on gait speed. Patients with PD could benefit more from a GPT program, as gait speed increased more than in the IPT program.

2. The group provides in addition a supportive environment and facilitates interactions among peers. Also, the group approach is cost-effective, as it requires one therapist for 6 patients.

3. This therapy format is a necessity, since the number of patients with PD is increasing.

Conflicts of interests

No conflicts of interests.

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