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Effects of home exercises on motor performance in patients with Parkinson's disease

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Objective: To investigate the effect of home exercises on the motor performance of patients with Parkinson's disease.
Design: A prospective blinded study with allocation of patients into their groups by alternate weeks.
Setting: A University Hospital neurology and physiotherapy department.
Subjects: Recruited from a movement disorders outpatient clinic of Cerrahpasa School of Medicine diagnosed with Parkinson's disease, classified as Hoehn and Yahr Grades I, II and III.
Interventions: Patients who fulfilled the inclusion criteria were recruited to the study. Each patient was evaluated at the end of first and second month after the baseline evaluation. Patients were divided into two groups. Those in the first and third week were put in the exercise group and second and fourth week in the control group. Patients in the exercise group ($n = 15$) were given a schedule of exercises to undertake at home; the others ($n = 15$) did not receive this instruction.
Measures: Ten- and 20-m walking test, first pace length, pace number in 10 m, walking around a chair, Nine Hole Peg Board (NHPB) test.
Results: Following the home exercise programme, patients in the exercise group showed improvement in walking 10 and 20 m, time elapsed to complete walking around a chair and length of the first pace length, and in the motor performance of both hands ($p < 0.001$).
Conclusions: A home-based rehabilitation programme for patients with Parkinson's disease helped to improve motor performance compared to patients who did not take advantage of a regular, professionally designed exercise programme.

Introduction

Parkinson's disease (PD) is a neurological disorder causing loss of functional abilities and progressive loss of independence despite medical treatment.[1–3] Depending on the severity of the disease, functional activity disorders may arise due to loss of trunk mobility and postural reflex, which may also result in dependency in activities requiring manipulation and skill, especially in the early stages.[4–7] Progressive bradykinesia and hypokinesia result in difficulty in performing daily activities. Akinesia may hinder initiation of activity by seconds or even minutes. Although levodopa decreases the bradykinesia, it alone would not be effective in increasing movement, and therefore

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aggressive intervention in the early stages is necessary.[8]

In general, the combination of pharmacotherapy with rehabilitation is the optimal treatment strategy for symptom control.[2] Patients with milder disase severity have a better potential of improvement, hence commencing physiotherapy and rehabilitation programmes at an early stage can be beneficial.[9] In addition, patients at the chronic stage who are independent at home and in the community are known to benefit from a home programme.[9–12] Despite the data obtained from these trials, there is still insufficient evidence to support the efficacy of physiotherapy on motor performance in Parkinson's disease as there are few controlled studies to date.[13]

The aim of this study was to evaluate the effects of a suitable home exercise programme on motor tests evaluating walking and hand skills in patients diagnosed with Parkinson's disease seen as outpatients and who had not previously been involved in a physiotherapy and rehabilitation programme.

Patients and methods

Patients with Parkinson's disease referred to the Movement Disorders Outpatient Clinic at Istanbul University Cerrahpasa School of Medicine from the Neurology Department of the same university were included in the study. We used a prospective, blinded and controlled design and the selection of patients for the groups were done by an alternate week method. Disease stage of the patients was determined by one of the neurologists of the Movement Disorders Outpatient Clinic (GK), and the eligible patients who fulfilled the inclusion criteria for the study and who agreed to participate when they were informed about the study were sent to the physiotherapist (FKM) for other assessments (Figure 1). Each week six referred patients were evaluated by our neurologist. The range of eligible patients for the study per week was 0–2 patients according to our patient inclusion criteria. All eligible patients who fulfilled the selection criteria were actually included. Selection of patients for the study lasted for eight months.

Patients were evaluated by the same physiotherapist (FKM) at baseline, first month and second month a total of three times, at the same time post dose. Patients and relatives were questioned whether medication was taken or not. Following the assessments, patient allocation to the exercise or control group was done by a research physiotherapist, who was also the coordinator of the study (HNG). Patients recruited in the first and third week were included in the exercise group and patients recruited in the second and fourth week were included in the control group. The appointments for assessments and exercise instructions were made for a day best suited for the patients. The home exercise programme was given to the exercise group by another physiotherapist (ATC).

Both the neurologist and physiotherapist who did the assessments and the patients were blinded to the study grouping and they did not know which treatment was to be given in a certain week.

Patients' inclusion criteria:

- Patients had been diagnosed Parkinson's disease by a neurologist.
- Patients had to be at grade I, II and III according to Hoehn and Yahr Scale.[14]
- Patients had to be on a stable drug regime.
- Patients could walk independently with no assistance or walking aid.
- Patients had no orthopaedic problems that would affect mobility and had no systemic and metabolic disease.
- Patients could come to the hospital three times for the physiotherapy assessments.
- Patients had not been previously involved in a physiotherapy and rehabilitation programme.

The following assessments were performed on patients; 10-m walking time (s), 20-m walking time (s), first pace length (cm), pace number at a 10-m distance, time to walk around a chair (s) and Nine Hole Peg Board test.[14] The 10-m timed walk involves asking the patient to walk over a set distance of 10 m (with no turn component) and a 20 m walk (10 m, return, 10 m) at their own preferred speed. The second one is the time test often used with patients with Parkinson's disease but, since two tests were used in different studies,

1) Relaxation and stretching exercises such as bending and turning of trunk.
2) Exercises to ease breathing and facial muscle exercises to stress the mimic expressions and to enhance oral motor function.
3) Exercises to increase movement of head, neck, shoulder, elbow and hand, besides leg, knee and feet and alternative exercise of the four limbs in supine position for recovery of muscular co-ordination.
4) Exercises to assist improving body movements; exercises to get in and out of bed and also exercises to ease standing up and sitting down on a chair and turning around in the chair.
5) Exercises done while standing up to improve balance and finally walking exercises were given.

These programmes were not recommended to the control group and they continued with their routine activities. In order to track the compliance of the exercise group, a daily follow-up diary was given to be completed by the patient or his or her relative. At the second and third visit after the assessments, the exercise group was referred to physiotherapist (ATC) again in order to check the diary and exercise compliance. At the end of the second month final evaluations were carried out, exercises were instructed and an individualized exercise booklet was given to the control group.

The exercise group consisted of 15 patients (mean age 67 ± 5 years) and the control group consisted of 15 patients (mean age 64 ± 3 years). There was no loss in either group in all assessments.

A patient's treatment regimen remained constant throughout this study. Except for two in the control and one in the exercise group taking selegiline, all patients were on L-dopa and a dopamine agonist.

Statistical analysis of the data was carried out using the Kruskal–Wallis test for evaluating each group and the Mann–Whitney *U*-test and Student's *t*-test in comparing the two groups. Non-parametric statistics chi-squared test was used to analyse the proportion of disease stage and Fisher's exact test for the distribution of male and female subjects in the two groups.

Results

During the eight months, of the patients who were referred to the Movement Disorders Outpatient Clinic from the Neurology Department, only 30 fulfilled the inclusion criteria and registered to the study. Difficulties with transport, severity of the illness (at grade IV or over) and having systemic and metabolic disease were the main reasons for withdrawal from the study. Some patients had already had physiotherapy, so they were not allocated to the study. There was no loss in either the exercise group or the control group in all assessments, since the patients who already agreed to come to hospital for three times were recruited to the study. The baseline characteristics of the patients in exercise and control groups are shown in Table 1.

The control and exercise groups were comparable with respect to age, sex, stage and duration of the disease with no statistically significant differences.

The assessment results of the parameters in the first and second months in both groups and the comparison of these parameters in the exercise and control groups at baseline, first month and second month evaluation are shown in Table 2.

All variables were significantly improved in the exercise group, from baseline to second month, whereas there was a significant impairment in the control group in 10-m and 20-m walking times.

The two groups were similar on all variables at baseline with no statistically significant differences. Comparison of groups showed significant changes

Table 1 Comparison of patient characteristics ($n = 30$)

	Control group	Exercise group	*p*-value
Age (years)	64.3 ($\pm$12.3)	67.4 ($\pm$5.04)	0.325[a]
Sex (male/female)	10 M/5 F	11 M/4 F	0.5[b]
Hoehn and Yahr			
Stage I	1	2	
Stage II	11	10	
Stage III	3	3	
			0.827[c]
Duration of disease (years)	5.2 ($\pm$2.7)	5.5 ($\pm$2.7)	0.79[d]

[a]Mann–Whitney *U*-test; [b]Fisher exact; [c]Chi-squared; [d]Student's *t*.

Table 3 Comparison of differences between assessments in two groups

	Difference between assessments	Control group Mean (SD)	Exercise group Mean (SD)	*p*-value[a]
10-m walking time (s)	I–II	−1.93 (2.49)	3.27 (3.31)	<0.0053
	II–III	0.93 (1.94)	0.87 (1.46)	>0.9162
	I–III	−1 (2.77)	4.13 (3.70)	<0.0020
20-m walking time (s)	I–II	−3.53 (4.12)	6.00 (7.80)	<0.0159
	II–III	1.33 (4.27)	2.93 (3.20)	>0.2563
	I–III	−2.2 (5.59)	8.93 (8.68)	<0.0028
First pace length (cm)	I–II	−0.12 (3.82)	−8.62 (8.31)	<0.0017
	II–III	−1.12 (4.94)	−8.92 (6.19)	<0.0002
	I–III	−1.24 (7.01)	−17.5 (8.68)	<0.0001
Pace number in 10 m	I–II	−0.67 (2.06)	4.00 (7.16)	>0.0552
	II–III	0.07 (1.87)	1.40 (1.64)	<0.0474
	I–III	−0.60 (2.38)	5.40 (7.44)	<0.0331
Time taken to turn around a chair (s)	I–II	−1.53 (3.07)	1.53 (2.03)	>0.1201
	II–III	−0.40 (2.10)	1.47 (1.41)	<0.0344
	I–III	−1.93 (3.45)	3 (2.42)	<0.0110
Nine Hole Peg Board test left (s)	I–II	−0.73 (4.37)	6.27 (7.54)	<0.0111
	II–III	0.27 (2.79)	2.73 (2.58)	<0.0181
	I–III	−0.47 (5.05)	9 (7.86)	<0.0011
Nine Hole Peg Board test right (s)	I–II	−0.27 (4.61)	6.07 (7.27)	<0.0119
	II–III	0.27 (4.95)	3.07 (3.33)	>0.0815
	I–III	0 (4.22)	9.133 (6.59)	<0.0002

[a]Student's *t*-test.

Comparison of the groups showed that the changes in I–II, II–III and I–III were significant in the Nine Hole Peg Board test left (s) ($p < 0.0111$, $p < 0.0181$ and $p < 0.0011$, respectively) and in I–II and I–III in the Nine Hole Peg Board test right (s) ($p < 0.0119$ and $p < 0.0002$, respectively).

Compliance was very high and patients displayed great care and attention in keeping the diary. They put ticks for every day for every session.

Discussion

The effects of physiotherapy and rehabilitation on patients with Parkinson's disease have been researched by many investigators in the past.[1,15–17] The findings of these studies have showed the benefits of physiotherapy and rehabilitation programmes carried out in conjunction with drug therapy.[1,15]

Recently, a randomized and controlled study showed that multidisciplinary rehabilitation for patients with Parkinson's disease may improve mobility, and follow-up treatments may be needed to maintain beneficial effects.[18]

Some articles stated the benefits of short-term applied physiotherapy. In one, patients were instructed by a physiotherapist at home, but it was not a controlled study and the physiotherapy only lasted a short time.[10] In a second study, patients were instructed by nursing students and the investigators were mainly interested in nursing parameters.[12]

More recent articles in the literature have also described the use of home treatment for patients with advanced Parkinson's disease.[9,11] Investigators stated that physiotherapy aimed at improving function in Parkinson's disease is best provided in the home situation.[11]

Clinical messages

- Individualized home exercises have positive effect on the motor performance in patients with Parkinson's disease.
- The home exercise programme is easy for the patients.
- Further investigation is required to examine the optimal training period that causes a significant improvement and how long the outcomes are sustained after the programme is finished.

To conclude, the benefits of the home programme are measurable and three sessions of physical therapy training per patient is efficient. Our results are consistent with previous studies and suggest the usefulness of physical therapy as a home exercise programme done at home for patients with Parkinson's disease. The benefits of physiotherapy can be demonstrated at an earlier stage of disability and should therefore be part of management of the disease. Regular visits and a daily dairy would be useful in enhancing compliance to do exercises. It will be interesting to know, in the long-term follow-up, how many patients continue their home exercise and to what extent the improvements are maintained by the patients.

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