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RESEARCH

BENEFICIAL EFFECTS OF A SHORT-TERM EXERCISE PROGRAM ON PARKINSON'S DISEASE

ABSTRACT

Introduction: Parkinson's disease is one of the leading neurogenic causes of falls and gait impairments in the elderly. Maintaining daily living activities becomes harder as the disease progresses. Falls frequently occur because of physical and cognitive disabilities. In the current study, our aims were to assess the effects of exercise and the occurrence of falls in patients with Parkinson's disease.

Materials and Method: Thirty six volunteer patients with Parkinsonism syndrome were evaluated for eligibility for the current study and went through a 4-week rehabilitation program. Exclusion criteria were being at Hoehn-Yahr stages 4 or 5, having a diagnosis of major depression, a change in pharmacological treatment for Parkinsonism symptoms during the rehabilitation program, or having a diagnosis of secondary Parkinsonism syndrome. Eighteen patients were excluded in line with the above criteria. Two patients did not complete the program. Three patients were lost to follow-up 6 weeks after the end of the intervention. In the final evaluation there were13 patients. The Unified Parkinson's Disease Rating Scale, Tinetti Scale, and Timed Up&Go Test were used as assesment tools.

Results: Analyzing the changes in Unified Parkinson's Disease Rating Scale scores, Tinetti scores, and the Timed Up&Go test revealed significant improvement in Unified Parkinson's Disease Rating Scale Part 2 (activities of daily living part) after the exercise program. Furthermore, this improvement was maintained for 6 weeks in the follow up period.

Conclusion: Even short-term exercises can provide improvement in the functional status of Parkinson patients.

Key Words: Parkinson Disease; Exercise; Rehabilitation.

ARAŞTIRMA

PARKİNSON HASTALIĞINDA KISA DÖNEMLİ EGZERSİZ PROGRAMININ YARARLI ETKİLERİ

ÖZ

Giriş: Parkinson hastalığı yaşlılarda düşme ve yürüme bozukluklarının önde gelen nörojenik nedenlerinden biridir. Hastalık ilerledikçe günlük yaşam aktivitelerini sürdürmek giderek zorlaşır. Düşmeler, fiziksel ve bilişsel yetersizliklerden dolayı sıktır. Bu çalışmadaki amaçlarımız egzersizin Parkinson hastalığı üzerindeki etkilerini değerlendirmek ve Parkinson hastalarında düşmeleri araştırmaktı.

Gereç ve Yöntem: Parkinsonizm sendromu olan 36 hasta bu çalışmaya uygunlukları açısından değerlendirildi ve 4 haftalık rehabilitasyon programına alındı. Dışlama kriterleri; Hoehn-Yahr evre 4 veya 5 olmak, majör depresyon veya sekonder parkinsonizm sendromu tanısı almış olmak, rehabilitasyon programı sırasında parkinsonizm semptomlarının farmakolojik tedavisinde değişiklik yapılmış olmasıydı. Bu kriterler doğrultusunda 18 hasta çalışma dışı bırakıldı. İki hasta rehabilitasyon programını tamamlayamadı. Üç hasta programın tamamlanmasından 6 hafta sonraki kontrol değerlendirilmesine gelmedi. Son değerlendirmede 13 hasta bulunmaktaydı. Değerlendirme araçları olarak Birleşik Parkinson Hastalığı Değerlendirme Ölçeği, Tinetti Skalası, Zamanlı kalkma-yürüme testi kullanıldı.

Bulgular: Egzersiz programı bitiminde Birleşik Parkinson Hastalığı Değerlendirme Ölçeği, Tinetti skalası, zamanlı kalkma-yürüme testindeki değişimler değerlendirildiğinde ikinci kısmında (Günlük Yaşam Aktiviteleri bölümü) anlamlı gelişme saptandı. Ayrıca program bitiminden 6 hafta sonra da bu durumun sürdüğü gözlendi.

Sonuç: Egzersiz kısa süreli olduğunda dahi, Parkinson hastalarının işlevsel durumlarında yararlı değişiklikler sağlayabilir.

Anahtar Sözcükler: Parkinson Hastalığı; Egzersiz; Rehabilitasyon.

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Introduction

Parkinson's disease (PD), one of the leading neurogenic causes of falls and gait impairments in the elderly, is a chronic progressive neurodegenerative disease accompanied by loss of dopaminergic neurons in the substantia nigra.

Hypokinesia and bradykinesia, resting tremor, postural instability and rigidity are general characteristics of PD (1). More salient features are mask-like facial expression, slowing of movements, camptocormia and festination. Initiating a movement, changing direction while walking, walking around an object and standing can be difficult. Arm swings can be diminished or absent. The patients walk with short strides and low steppage heights (2). Symptoms are usually asymmetrical.

Initiating and maintaining eye, mimic, chewing, and speaking activities which are realized by small muscles becomes more difficult. Speaking is monotonous and hand motions are significantly impaired. Letters get smaller and hand writing becomes progressively unreadable. As the disease progresses, performing daily living activities becomes harder. Falls are frequent because of postural imbalance, dyskinesia, confusion and dementia.

In spite of substantial advances in pharmacological and surgical treatments, gait and balance problems continue to cause dependence and increase health expenditures. Current medications ameliorate symptoms such as tremor, bradykinesia and rigidity. However they have limited benefit for balance impairment, falls and camptocormia (3,4). Novel rehabilitation approaches and strategies need to be developed to cope with these challenging problems.

In PD, the aims of rehabilitation are maintaining or increasing mobility, preserving range of motion, preventing falls, increasing respiratory capacity, supressing anteflexion posture, and achieving comprehensible speech (5). Generally, physiotherapy focuses on mobility strategies and daily functionality (6).

Exercises are described in 6 special areas: 1-Transfers (rolling in bed, standing up from a chair, etc); 2-Posture (especially for neck and back); 3-Reaching and grasping; 4-Balance education and preventing falls, gait; 5- Physical capacity; and 6-Mobility (6).

The rehabilitative approach has gained significance recently and is a popular topic, with many ongoing studies. Primarily, these studies are providing insights into the beneficial effects of rehabilitation on functional status and independency. Moreover, the neuroprotective potency of exercise has been pointed out in the literature (7).

Some investigations of rehabilitative approaches support the benefits of these methods (8,-12) but others do not (13,14). This study was designed to evaluate the effects of a brief regular exercise program on mental and physical status and daily living activities of patients with Parkinson's disease, with the aims of contributing to the clarification of the above mentioned dispute and also evaluating falls in Parkinson's disease.

Materials and Method

The study used a pretest-posttest design with sixteen selected idiopathic PD patients who were referred to the Physical Medicine & Rehabilitation Department due to gait, balance and posture impairments at Gazi University, Faculty of Medicine Hospital during the period between February 2008 and January 2009. The patients gave informed written consent for the exercise protocols. The study was approved by the local ethics committee.

Medications were kept constant during the rehabilitation period. Hoehn-Yahr Stage 4-5 patients, patients with dementia and major depression, patients who changed their medicine regimen during the rehabilitation period and/or secondary Parkinson patients were excluded. Eighteen of 36 patients were excluded by the above criteria. Two patients did not comply with the rehabilitation program. Sixteen patients were available for analysis at the end of the rehabilitation program. Three patients were lost to follow-up at 6 weeks. In the follow-up evaluation, only 13 patients were available for analysis (Figure 1).

Nine patients were rehabilitated as inpatients and 7 patients attended as outpatients according to their convenience. The inpatient participants received a daily rehabilitation program during their stay. The outpatient participants received an exercise program for 4 weeks (2 sessions of 30 minutes per week). Two physiotherapists were assigned to the current study.

The exercises were performed during on phase. 'On phase' is the period in which Parkinson patients can move most actively. The same physiotherapist carried out the exercise program for each patient throughout the study. The outpatient participants were instructed to perform home exercises daily. The rehabilitation program included range of motion, balance and coordination, stretching, strengthening, gait and mimic exercises.

Gender, educational status, medications, extra medical problems and Hoehn-Yahr staging status were recorded.

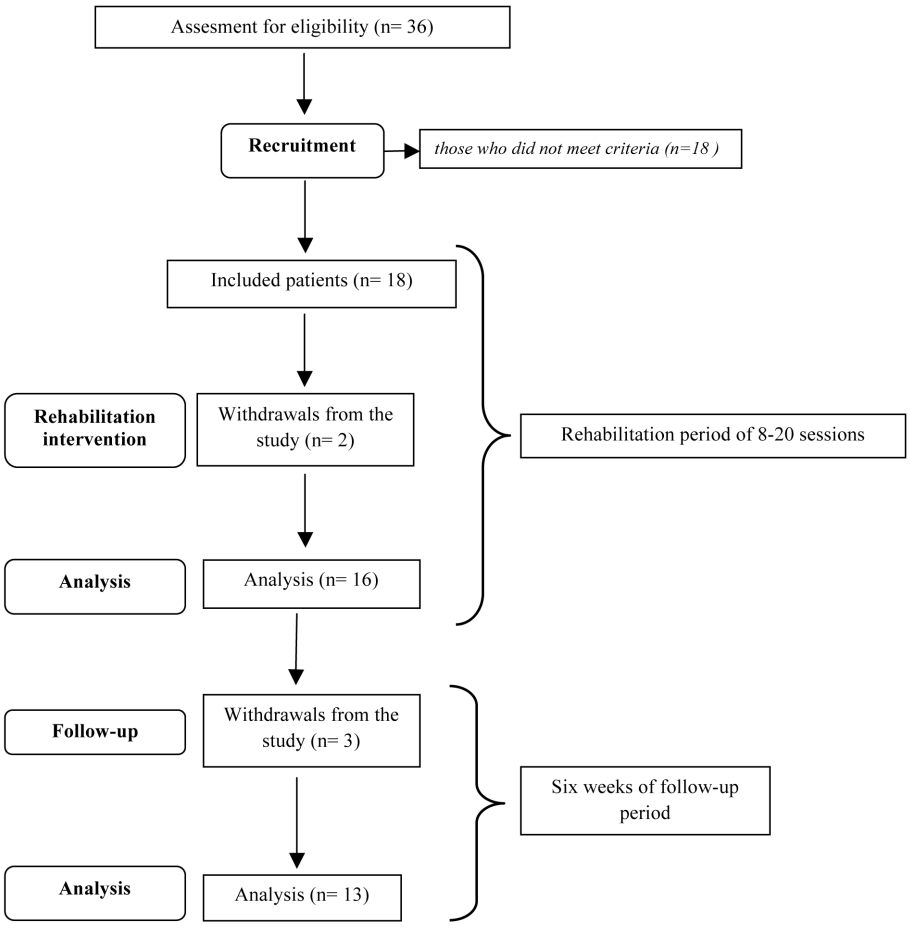

Figure 1— Consort diagram.

Before the exercise program, patients were evaluated by means of neurologic and locomotor examinations, the Unified Parkinson's Disease Rating Scale (UPDRS), Tinetti Gait and Balance Scale and Timed Up&Go Test (TUG).

Evaluations were performed and recorded at the begining, at the end and at 6 weeks following the program.

Statistical Assesment

Statistical evaluations were performed using the SPSS 11.5 program. The descriptive properties of the study group were identified. Progress in UPDRS, Tinetti, and Timed Up&Go test scores of the study population at the end of the program and at the follow-up were evaluated by paired t-tests. The significance threshold was accepted as $p<0.05$. The patients were divided into two groups, as fallers and non-fallers. The patients who fell at least once within the last year were included in the 'fallers' group; the others were grouped as 'non-fallers'. The distrubution of these groups was found to be normal according to the Kolmogorov-Smirnov test. The mean age, the time interval between the disease onset and the diagnosis, the number of medications used, co-morbidities, Hoehn-Yahr staging, UPDRS scores (for all parts), TUG scores, Tinetti scores, rates of smoking, alcohol and coffee consumption, and fear of falling were compared using Student's t and Chi-Square tests. The significance threshold was accepted as $p<0.05$. The patients were allocated to two groups as inpatients and outpatients. The mean age, Hoehn-Yahr staging, UPDRS scores (for all parts), Tinetti scores, TUG scores and the differences in these scores at the end of the study were compared using Student's t-test. The significance threshold was accepted as $p<0.05$.

RESULTS

The mean age of the study population was 65.44±9.55 years. The mean disease onset age was 58.59±9.84 years. The number of male and female participants was equal.

The mean Hoehn-Yahr staging was 2.63±0.72 (1-3). The mean number of medications used was 5.75±2.93 (2-11) and the mean number of co-morbidities was 1.73±0.96 (0-3).

The mean initial, terminal and follow-up UPDRS scores are presented in Table 1.

There were no statistically significant differences among the initial, terminal, and follow-up UPDRS scores for part 1 (mentation, behaviour, mood), part 3 (motor) and part 4 (complications of therapy) (p>0.05). However, UPDRS part 2 (activity of daily living) scores significantly improved at the terminal evaluation (p=0.016). This beneficial effect was also evident at follow-up, even when compared with the initial assessment values (p=0.012). Total UPDRS scores did not change.

Initial, terminal and follow-up Tinetti scores [balance, gait, total (balance+gait)] and TUG durations are shown in Table 2. Terminal and follow-up Tinetti and TUG scores did not change (p>0.05).

Eight patients (50%) had a fall history in the previous year and eight (50%) patients admitted fear of falling. The mean number of falls among the fallers was calculated as 2.38±1.41 during the previous year. 85.70% of falls occured during the day and 14.30% occurred during the night. 62.50% of the falls happened indoors and 37.50% outdoors. The mean age, height, weight, disease span, number of medications used and comorbidities, Hoehn-Yahr staging, UPDRS scores, TUG scores, Tinetti scores and the differences observed at the end of the rehabilitation period were not significantly different between fallers and non-fallers (p>0.05). Moreover the groups were similar regarding gender, education status, fear of falling, rate of smoking, and consumption of alcohol and coffee (p>0.05).

Inpatients and outpatients were evaluated regarding age, disease duration, Hoehn-Yahr staging, number of concomitant diseases, UPDRS-Tinetti-TUG scores, and differences between initial and terminal UPDRS-Tinetti-TUG scores. Outpatients' initial TUG scores were significantly lower than inpatients' (p=0.045). The mean age, disease duration, Hoehn-Yahr stages, the number of comorbidities, UPDRS and Tinetti scores, and the outcomes of UPDRS-Tinetti-TUG scores were not different between these two groups (p>0.05).

Table 1— Changes in UPDRS Scores During the Study.

Evaluation Times	Initial	4th Week		10th Week	
	Mean±sd	Mean±sd	p*	Mean±sd	p*
UPDRS Part 1	2.25±1.44	1.81±1.22	0.395	1.54±1.56	0.515
UPDRS Part 2	8.75±4.27	7.56±4.56	0.016	7.08±4.19	0.012
UPDRS Part 3	11.81±5.22	11.50±5.74	0.650	12.38±6.80	0.729
UPDRS Part 4	3.87±3.20	3.25±3.00	0.136	2.08±1.71	0.095
UPDRS Total	26.69±9.21	24.19±11.36	0.061	23.08±10.90	0.260

UPDRS: Unified Parkinson's Disease Rating Scale.
*compared to initial scores.

Table 2— Changes in Tinetti Scores and TUG Durations During the Study.

Evaluation Times	Initial	4th Week		10th Week	
	Mean±sd	Mean±sd	p*	Mean±sd	p*
Tinetti-balance	14.19±1.56	14.80±1.26	0.094	13.69±1.70	0.242
Tinetti- gait	10.31±2.09	10.27±1.16	1.000	10.46±0.92	0.110
Tinetti- total	24.50±2.42	25.13±1.92	0.054	24.15±2.27	0.915
TUG duration(sec)	11.65±3.37	10.74±2.14	0.080	11.58±3.41	0.493

TUG: Timed up and go test.
*compared to initial scores.

Discussion

In the current study, the mean age and disease onset age of the study population were in accordance with the literature, where a meta-analysis (15) has reported age of onset to be 56-72 years.

In the study by Kamsma et al., the exercises given to Parkinson patients included cognitive movement strategies for gait and tranfers, and resulted in improvements in activities of daily living, physical functionality and UPDRS (16).

Gauthier et al. ordered range of motion, gait (with visual and auditory cueings), balance, dexterity, posture, and activities of daily living exercises for 5 weeks. At the end of the study, progress in daily life activities was detected according to the Barthel Index (17). In a study by Comella et al., developments in UPDRS scores (activities of daily living, motor part and total score) were achieved after range of motion, gait, balance, dexterity, and physical capacity exercises. After a 6- month follow-up period during which the patients did not adhere to the suggested exercises regularly, the beneficial effects were lost (18).

Marchese et al. assigned the patients enrolled in their study into two 6-week balance exercise groups. One of the groups performed the exercises with cues and the other without cues. The patients were evaluated by UPDRS at the onset, at the end of the study and after a 6-week follow-up period. In both groups, UPDRS motor and daily living activity scores improved. After the follow-up period, the patients who performed exercises with cues maintained their improved condition. The other group returned to their onset status (19).

In our study, the improvement in UPDRS-Part 2 (Daily Life Activity) continued after the 6-weeks follow-up period. This finding is in agreement with a study by Marchese et al (19). However, the follow-up period in our study was not long enough to reach a definite conclusion. Our study emphasizes the importance of regular exercises. Lack of improvement in parameters related to motor, balance and gait can be due to the small sample size and the brief rehabilitation period (4-10 hours).

It has been reported that 46-70% of patients with Parkinson's disease fall every year (20-22). Fifty percent of the patients in the current study had experienced falls in the previous year. Most of the falls occurred during the daytime in this study population. Usually, patients with Parkinson's disease fall during transfer activities or freezing of gait instances (6). In our study, 62.50% of the patients fell indoors. A study by Bloem et al. also reported that Parkinson patients usually fall indoors (21). Parkinson patients are less active than their peers and spend most of their time at home.

There were no significant differences in UPDRS, Tinetti, TUG scores and fear of falling between fallers and non-fallers. Mak et al. found higher TUG scores among the fallers compared to non-fallers (20).

Fear of falling is more frequent among people with previous falls. Persons who have a fear of falling tend to remain at home all the time. Inactive patients who spend most of their time at home lose their physical fitness and become socially isolated. These factors increase the tendency to fall. However, we did not observe a difference regarding fear of falling between fallers and non-fallers in our study. The small sample size and enrollment of subjects at relatively early stages of the disease may be the reason for this discrepency.

Outpatient subjects who were enrolled in our study were able to visit the hospital two times per week. Generally they were more active than the inpatients. Lower TUG scores of outpatients are in accordance with their being more active. According to our results, there was no difference in the gains after the rehabilitation program between these two groups.

A serious limitation of this study is that it lacks a control group. Although 36 patients were assessed for eligibility at the begining, we could analyze the data for only 16 patients at the end due to exclusion criteria, emerging concomitant health problems and unwillingness to comply with the study. After the follow-up period, only 13 patients were available for the final evaluation. This small number presents difficulties in defining the effects of exercise in Parkinson patients. Some patients received therapy on an outpatient basis and others on an inpatient basis, with non-matching number of hours of therapy. The variability in hours of treatment was very large, ranging from daily to twice per week.

In conclusion, a short-term rehabilitation program provided improvement in daily life activities of mild and intermediate stage Parkinson patients. This improvement was sustained after the 6 week follow-up period. Future studies involving larger sample sizes and longer follow-up periods may provide more robust results about the efficiency of rehabilitation programs in PD.

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