



Original Article

Relationship between manual dexterity and the Unified Parkinson's Disease Rating Scale-Motor Exam

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Abstract. [Purpose] The purpose of this study was to examine the relationships between manual dexterity and the Unified Parkinson's Disease Rating Scale-Motor Exam as a clinical tool for quantifying upper extremity function in persons with Parkinson's disease. [Subjects and Methods] Thirty-two persons with idiopathic Parkinson's disease participated in this study. This study measured two clinical outcomes, the box-and-block test and the Unified Parkinson's Disease Rating Scale-Motor Exam, to investigate the relationships between manual dexterity and the Unified Parkinson's Disease Rating Scale-Motor Exam. [Results] The box-and-block test on the more affected side was positive relationship with the box-and-block test on the less affected side. The Unified Parkinson's Disease Rating Scale-motor exam score had a negative correlation with the box-and-block test results for both sides. [Conclusion] A positive association was noted between manual dexterity and motor function in patients with idiopathic Parkinson disease. The results of this study suggest that the box-and-block test and the Unified Parkinson's Disease Rating Scale-Motor Exam are good clinical measures that quantify upper extremity function and are necessary for the accurate evaluation of patients and to plan intervention strategies.

Key words: Dexterity, Motor, Parkinson's disease

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INTRODUCTION

Parkinson's disease (PD) is the most common, progressive neurodegenerative disease, and is the result of a loss of dopaminergic neuronal degeneration in the basal ganglia. Individuals with PD may experience bradykinesia, rigidity, tremor, stiffness, and postural instability¹⁾. These deficits can interfere with daily and functional activities such as writing, manipulation, reaching and grasping, postural stability, transfer to other positions, turning around to change direction, and gait performance. In particular, due to motor and cognitive impairments, many patients with PD have compromised functional abilities in their upper extremities, which are used for reaching, grasping, and manipulating objects²⁾. The clinical characteristics of PD may be explained by outcome measures that provide simple and comfortable methods for identifying and assessing changes in functional activities and the effects of therapeutic intervention. Clinical measures that quantify upper extremity function are needed for the accurate evaluation of patients and to plan intervention strategies in patients with PD.

The Unified Parkinson's Disease Rating Scale (UPDRS) is the most widely and frequently used scale in research and clinical practice and is used to monitor psychological and physical aspects. It may be used to comprehensively assess PD-related symptoms over time³⁾. This tool consists of four sub-items, including mentation, behavior and mood, activities of daily living, motor evaluation, and complications of therapy. All of the test's measurements, except for Hoehn and Yahr staging and Schwab and England activities of daily living, and two other sub-items, which include activities of daily living

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and motor evaluation, involve the functional activities of upper extremities such as handwriting, cutting food and handling utensils, dressing, hygiene, turning in bed and adjusting bed clothes, action or postural tremor of the hands, finger taps, hand movements, and rapid alternating movement of the hands³).

Dexterity is one of the components of hand functions, and is a manual skill that is required for rapid co-ordination of fine and gross movements. It is developed through repetition and experience in motor learning⁴. Previous studies have shown a strong correlation between dexterity and functional independence⁶⁻⁸). The purpose of this study was to evaluate the relationship between manual dexterity and the UPDRS-Motor Exam in patients with PD.

SUBJECTS AND METHODS

Thirty-two patients with idiopathic PD participated in this study. We used convenience sampling by means of a leaflet. Patients were informed about the procedure used for data collection and provided informed consent before participating in the study according to the guidelines of the human research ethics committees from all participating institutions. The study was carried out in accordance with the International Ethical Guidelines and the Declaration of Helsinki and was approved by the local Institutional Review Board. The inclusion criteria were a medically confirmed diagnosis of idiopathic PD and a score of 3 or lower on the Hoehn and Yahr staging scale. The patients were excluded from the study if they had a history of other neurologic or orthopedic diseases that would have affected their functional activities or if they had severe cognitive deficits that precluded their involvement in the procedures of this study. General and clinical characteristics of the patients are shown in [Table 1](#).

This study had a correlational research design. This study assessed the patients using two clinical tools, the box-and-block test (BBT), and the UPDRS. The BBT was developed by A. Jean Ayres and Patricia Buhler in 1957. This tool consists of a wooden partition and 152 wooden cubes with dimensions of 1 inch. Each participant was asked to sit comfortably on a high table and chair and complete the BBT using their upper extremity. The test involves grasping, moving and releasing wooden blocks from one side of a 20.32 cm-per-side square box to the other side while passing them over a wooden partition 12.20 cm high. The score is obtained by observing the number of blocks passed over the wooden partition in 1 minute. Lower scores represent higher hand function impairment⁵). The tool has been reported to have excellent reliability and validity. The UPDRS was developed by Fahn et al. and has become the “gold standard” as it contains measures of outcomes across the enablement/disablement spectrum and demonstrates excellent reliability. The UPDRS consists of four sections: I-Mentation, Behavior, and Mood (4 items); II-Activities of Daily Living (ADL) (13 items); III-Motor Examination (14 items); and IV-Complications of Therapy (11 items). All sections except section IV are scored using a 5-point scale ranging from 0 (no impairment) to 4 (marked impairment). This study measured only those outcomes that related to motor performance³).

The patients were given the standard verbal instructions for each of the clinical measures in a quiet and well-organized therapy session. The verbal instructions were repeated if required by the participants. The patients were allowed to rest between tests.

Descriptive statistics were used to analyze data regarding general and clinical characteristics. These included gender, age, height, weight, mini-mental state examination (MMSE), post-disease duration, and Hoehn and Yahr staging scale. To examine the relationship between manual dexterity and the UPDRS-Motor Exam, this study used Pearson’s correlations. Analysis was performed with the aid of PASW version 18.0 for Windows (SPSS Inc., Chicago, IL, USA). This study used a statistical significance level of 0.05.

RESULTS

This study examined 31 patients with idiopathic PD. The study included 8 males and 23 females with, a mean age of 79.19 years, a mean height of 156.39 cm, and a mean body weight of 54.87 kg. The mean MMSE score was 25.90 and post-disease duration was 27.06 months ([Table 1](#)). The BBT scores was 38.16 on the more affected side and 44.00 on the less affected side. The UPDRS-Motor Exam score was 24.19 ([Table 2](#)). The BBT results for the more affected side had a positive relationship with the BBT results for the less affected side (0.584) and a negative relationship with UPDRS-Motor Exam score (-0.574). The BBT results for the less affected side had a negative relationship with the UPDRS-Motor Exam score (-0.715) ([Table 3](#)).

DISCUSSION

This study examined the correlation between manual dexterity and the UPDRS-Motor Exam in patients with PD to determine whether upper extremity function can be used to accurately evaluate patients and plan an intervention approach in patients with PD. The main findings were as follows: first, the BBT results for the more affected side had a positive relationship with the BBT results for the less affected side. Second, the UPDRS-Motor Exam score demonstrated a negative correlation with the BBT results for both sides.

It is important to measure disease-related impairments to be able to diagnose systematic dysfunction and to plan intervention strategies in clinical and research settings. Therefore, it is necessary to develop and apply appropriate clinical measures based on the impairments observed in each patient. Patients with PD frequently experience manual dexterity impairments

Table 1. General and clinical characteristics of the participants (N=31)

Variables	Participants
Gender (male/female)	14/17
Age (yrs)	79.19 ± 4.51
Height (cm)	156.39 ± 7.58
Weight (kg)	54.87 ± 9.32
Mini-Mental State Examination (scores)	25.9 ± 1.08
Post-disease duration (months)	27.06 ± 6.95
Hoehn and Yahr staging score (II/III)	8/23

Table 2. Mean and standard deviations for the BBT and UPDRS values in the participants (N=31)

Variables	Mean	Standard deviation
BBT result for the more affected side	38.16	4.49
BBT result for the less affected side	44.00	3.07
UPDRS-Motor Exam	24.19	5.15

BBT: box-and-block test; UPDRS: Unified Parkinson's Disease Rating Scale

Table 3. Relationship between the BBT and the UPDRS values in the participants (N=31)

Variables	BBT-more affected side	BBT-less affected side	UPDRS-motor exam
BBT-more affected side		0.584**	-0.574**
BBT-less affected side	0.584**		-0.715**
UPDRS-Motor Exam	-0.574**	-0.715**	

BBT: box-and-block test; UPDRS: Unified Parkinson's Disease Rating Scale

**p<0.01

related to muscle weakness and reduced muscle power, which affect the performance of daily living activities and lead to a reduction of independence. Previous studies have shown a strong correlation between dexterity and functional independence. Lee and colleagues examined the influence of discriminative cutaneous sensory dysfunction on impaired finger dexterity in PD. They evaluated 48 right-handed patients with PD during a practically defined off-medication period, and reported that discriminative sensory dysfunction and the consequent abnormal sensorimotor integration seem to be involved in the impaired finger dexterity observed in PD⁶). Proud and Morris compared the performance of patients with PD to that of unimpaired participants on a timed dexterity task and studied the effects of adding a secondary task. They examined twenty-two people with idiopathic PD and measured the Purdue Pegboard score with or without verbal responses as the secondary task in 30 seconds. They reported that manual dexterity was compromised in participants with mild to moderate PD when compared to unimpaired participants. Furthermore dual-task interference occurred more frequently in people with PD than in age- and gender-matched controls⁷).

In the results of this study, there was a negative relationship of manual dexterity with motor impairment in patients with PD. Recently, it has been suggested that ideomotor apraxia may account for impaired finger dexterity in PD. Vanbellingen and colleagues studied the relationship of finger dexterity with ideomotor praxis function and parkinsonian symptoms. They assessed twenty-five patients with PD, and measured Movement Disorder Society-UPDRS, the coin rotation task and a measurement of ideomotor praxis using a novel test of upper limb apraxia as its outcomes. The authors reported that the strong association between finger dexterity and praxis function, but not parkinsonian symptoms indicates that impaired finger dexterity in PD may indeed be apraxic in nature⁸). Quencer and colleagues speculated that "learned non-use" of the hands due to long standing bradykinesia may underlie the development of dexterity deficits in patients with PD⁹). The results of their study confirmed this hypothesis by showing that manual dexterity of upper extremity was significant negative relationship with motor function in patients with idiopathic PD.

In conclusion, there is a significant relationship between manual dexterity and motor function as assessed using the UPDRS in patients with idiopathic PD. This study suggests that the BBT can be used to quantify upper extremity function and to accurately evaluate of patients with PD. Future studies will evaluate the relationships between manual dexterity and other motor functions such as trunk stability and gait performance, as well as cognitive function.

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