# Hand Motor Slowness in Parkinson Disease Patients performing Fitts Task

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## Introduction

Most daily movements require a compromise between speed and accuracy. Parkinson's disease (PD), is characterized by an inability to adapt movement control concerning task temporal and spatial constraints [1]. One of the most studied paradigms in movement control sciences is Fitts' task [2]. Fitts' law states that the amount of time required for a person to move a pen, from a target to another is a function of the distance between targets, and the target width. The longer the distance and the smaller the target's width, the longer it takes, due to the existence of a speed-accuracy trade-off. This study aimed to compare the performance between PD subjects and healthy paired controls on a reciprocal tapping task.

## Materials and Methods

Kinematics was assessed using a tri-axial accelerometer placed on the subjects preferred hand (Fig.1). Subjects were asked to perform continuously hand pointing movements between two identical targets of 1, or 2 cm width (W), separated by 2, 4, 8, or 16 cm (D), during 20 seconds (Fig. 2).

Fig.1 Mobility Lab System with Opal Accelerometer

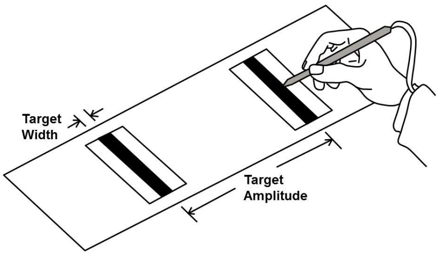


Fig.2 Fitts tapping Task

The task was performed in 5 different conditions with different Difficulty Indexes (DI = log² (2D/W)). Data analysis included movement duration, number of movements, percentage of errors, and mean velocity and acceleration.

The study was approved by ethics committee of Faculty of Human Kinetics. Informed consent was obtained from all subjects.

## Results

Nine people with PD formed the experimental group (EG or A), presenting UPDRS III score 26,4 (+/-11,24); Hoehn and Yahr score 2, ON state). Nine age-matched healthy controls formed the control group (CG or B) (ages between 43 and 76 years). Mean velocity was significantly lower for the EG on DI 3 (*p*=0.038) and 5 (*p*=0.008).

Table 1. Number of movements and % of errors

| | DI | Méan (SD) | |
|---|---|---|---|
| | | Group A | Group B |
| Average number of movements (right arm) | 1 | 38,18 (16,25) | 49,47 (10,22) |
| | 2 | 36,82 (11,79) | 47,06 (9,77) |
| | 3 | 30,80 (10,78) | 42,17 (5,30) |
| | 4 | 27,00 (6,58) | 38,21 (3,19) |
| | 5 | 23,73 (7,63) | 31,40 (2,58) |
| % Errors (right arm) | 1 | 1,23 (1,38) | 0,24 (0,49) |
| | 2 | 0,54 (0,77) | 0,00 (0,00) |
| | 3 | 1,40 (1,77) | 0,22 (0,46) |
| | 4 | 0,99 (1,35) | 0,34 (0,55) |
| | 5 | 1,91 (1,77) | 0,23 (0,36) |

No significant differences in mean acceleration were found, although mean values tended to be lower on EG. The increase of DI caused a decrease on the number of movements and a longer duration, in both groups.

PD subjects consistently performed less movements ($p < 0.05$) with a greater percentage of errors ($p < 0.05$) (Table 1).

## Discussion and Conclusions

This study, confirmed the existence of motor control differences between a group of people with PD and a healthy adult group. The results presented by the PD group, like in other studies, showed a tendency for smaller movement acceleration [3, 4], a decrease in the speed of movement, which becomes more visible as the level of precision increases [1,3,4], a decrease in the number of movements, and a significant increase in the percentage of errors [3]. The fact that PD people were ON state during the assessment may have contributed to smaller differences in outcomes between the PD group and the healthy subjects.

References:

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