P68

Technological assessment of handwriting and finger tapping in subjects with Parkinson's disease

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Introduction: People with Parkinson's disease (PD) often complain difficulties in repetitive hand movements and handwriting. Micrographia, defined as a reduction of handwriting speed and amplitude, is a common sign of PD.

Objective: To assess handwriting and finger tapping abilities in PD relative to healthy controls using new technological devices and software.

Methods: Ten PD and 15 age/sex-matched healthy controls underwent handwriting and finger tapping assessments. Three electromagnetic sensors placed on first and second fingertips and on the back of the right hand were used to evaluate finger tapping amplitude and speed. We developed handwriting tests consisting of pre-writing tasks such as drawing repetitive cursive loops as ample and fast as possible and colouring a figure as much as possible in a given time. Handwriting tests were performed on the touchscreen of a tablet using a touch stylus pen.

Results: Relative to healthy controls, PD patients showed reduced handwriting amplitude and speed ($p<0.05$). During finger tapping, patients with PD showed decreased movement amplitude and speed and a higher tendency to reduce them during the repetition of movements compared to healthy controls ($p<0.05$). The ability to colour the figure and to perform ample and rapid finger movements correlated with a better performance at the UPDRS-III both on and off medication ($r>0.65$; $p<0.05$).

Conclusions: As expected, patients showed reduced handwriting and tapping abilities relative to healthy controls. Interestingly, handwriting and finger tapping outcomes obtained through technological devices correlated with the motor performance assessed with clinical scales. This study showed that technological devices with customized software can provide quantitative measures of handwriting and bradykinesia that can be used in future studies to assess the effect of hand abilities rehabilitation in PD.

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