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Assessment of manual dexterity using a smartphone in subjects with Parkinson's disease

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Introduction: People with Parkinson's disease (PD) often complain difficulties in activities involving precise, ample, and rapid hand movements such as the use of a smartphone.

Objective: To assess hand dexterity abilities using a smartphone in PD relative to healthy controls using customized tests and software.

Methods: Ten PD and 15 age/sex-matched healthy controls underwent hand dexterity assessments. We assessed hand function using Manual Ability Measure (MAM-36) and the Purdue Pegboard Test (PPT). To obtain objective data on movement speed and amplitude, we developed tests involving the most commonly used gesture when using a smartphone (i.e. tap, swipe, slide). These tests were performed on the touchscreen of a smartphone and consisted in: a) alternatively tap with the thumb on two rectangles (TAP); b) perform swipe gestures to browse pages (SWIPE); c) perform thumb movements to link dots of a grid according to a defined path (Swipe-Slide Pattern - SSP).

Results: Relative to healthy controls, PD showed worse performance in the PPT, lower score in the MAM-36, reduced movement amplitude and speed in TAP, SWIPE and SSP tests and a reduced number of correct sequences in SWIPE and SSP tests ($p < 0.05$). Moreover, a higher number of correct gestures during the SWIPE test correlated with a better motor performance assessed with the UPDRS-III both on and off medication ($r > 0.66$; $p < 0.05$).

Conclusions: As expected, PD showed reduced hand dexterity abilities. Interestingly hand dexterity objective outcome measures obtained with the smartphone correlated with the motor performance assessed with clinical scales. This study showed that technological devices can be used to assess dexterity in PD providing objective and task-specific outcome measures of hand dexterity rehabilitation in PD.