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OBJECTIVES. To investigate the relationship between cognitive performances and gait and postural parameters using wearable sensors in early cognitively unimpaired Parkinson's disease (PD) patients.

MATERIALS. Fifteen early cognitively unimpaired PD patients (disease duration <5 years, Hoehn & Yahr ≤ 2.5) and 15 age and sex-matched healthy controls (HC) were consecutively enrolled.

METHODS. All patients underwent a II-level neuropsychological assessment to exclude the presence of any cognitive impairment. Motor symptoms were evaluated using the Unified Parkinson's disease Rating scale part III (UPDRS-III). UPDRS-III subscores for axial, gait and limb symptoms were also calculated. Gait and balance parameters were acquired using six Opal V2R wearable sensors, when performing the Timed up and go test, in both single and dual task (ST/DT) conditions. Bivariate correlation analysis between clinical and wearable sensors metrics were performed.

RESULTS. Overall, worse gait and postural parameters as detected by wearable sensors in both ST and DT conditions significantly correlated with cognitive tests specifically exploring: (i) visuo-spatial processing; (ii) psychomotor coordination; (iii) executive functions involved in retrieving words from lexical vocabulary and information recalling (Figures 1-3). Interestingly, no correlations have been found between cognitive tests and UPDRS-III scores, including axial and gait subscores.

DISCUSSION. Gait impairment is the most disabling symptom in patients with PD and is associated with high risk of falls, worse disease progression and shorter survival time. Cognitive impairment has been consistently associated with impaired walking ability, increased risk of falls, and reduced quality of life in PD. We found that subclinical gait and postural changes are already associated with cognitive performances in PD patients with normal cognition, highlighting the sensitivity of digital biomarkers.

CONCLUSIONS. Application of wearable sensors could provide useful information for the characterization of early PD patients, even when gait and postural disturbances are not clinically detectable. Integration of clinical, neuropsychological and digital data may help to identify patients more prone to develop clinical overt cognitive impairment over time, that may be targeted for potential novel prevention strategies.

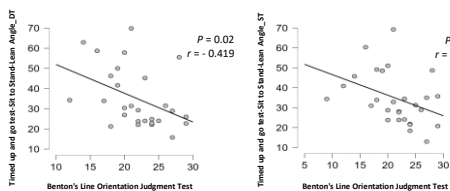


Figure 1. Correlation between Timed up and go test-Sit to Stand-Lean Angle in both ST and DT conditions and Benton's Line Orientation Judgment Test in PD patients and controls.

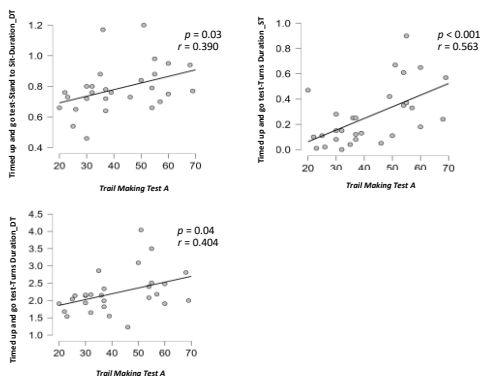


Figure 2. Correlation between Timed up and go test-Stand to Sit-Duration in DT conditions/Turns Duration in both ST and DT conditions and Trail Making Test A in PD patients and controls.

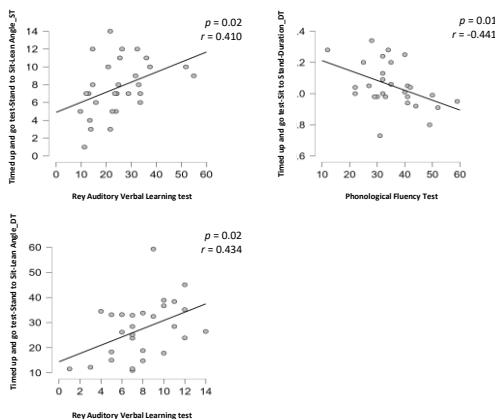


Figure 3. Correlation between Timed up and go test-Stand to Sit-Duration in both ST and DT conditions and Rey Auditory Verbal Learning test; correlation between Test Timed up and go test-Sit to Stand-Duration in DT condition and Phonological Fluency Test in PD patients and controls.