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Early diagnosis of Parkinson's disease using portable eye-tracking technology

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INTRODUCTION Ocular motor abnormalities, including delayed saccades, reduced smooth pursuit gain, and unstable fixation, reflect cortico-striatal dopaminergic dysfunction in Parkinson's disease (PD). Portable eye-tracking systems enable quantitative, noninvasive assessment of these deficits, supporting the development of digital biomarkers. **METHODS** Patients with clinically confirmed PD underwent a battery of tests using the OVRT-C portable eye-tracking system, including horizontal and vertical saccades, smooth pursuit, pupillary light reflex, and gaze stability. Results were compared with age-matched normative limits. Statistical analyses included stepwise multivariate logistic regression to identify the combination of metrics that best discriminated PD-related oculomotor patterns. Independent predictors included saccade latency, light reflex amplitude, and gaze tremor frequency. **RESULTS** Sixty participants were included (43 PD patients, 17 controls). PD patients showed consistent deviations from normative values, including prolonged saccadic latency, reduced light reflex amplitude, and increased microtremor activity during fixation. Multivariable modeling confirmed that these metrics jointly contributed to discriminating PD from reference data, with ocular tremors present in nearly all tests. The protocol was completed in approximately 30 minutes without adverse effects, demonstrating feasibility and tolerability in an outpatient setting. **DISCUSSION** Findings indicate consistent impairment of oculomotor control in PD with relevant discriminative value. The widespread presence of tremor suggests a potential biomarker. Feasibility supports clinical applicability, including early detection. **CONCLUSION:** The portable eye-tracking device provides quantitative, reproducible measures sensitive to oculomotor and neurofunctional dysfunction in PD. These results support its use as an accessible digital biomarker for objective and longitudinal PD assessment, consistent with current literature highlighting eye tracking as a promising tool for early diagnosis and cognitive-motor profiling.

KEYWORDS: Parkinson disease; Eye-tracking technology; Early diagnosis.