Using Post-Illumination Pupil Response as a Novel Biomarker for Parkinson's Disease

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Parkinson’s disease (PD) is one of the most common neurodegenerative disorders, affecting over 10 million people worldwide. Medications for Parkinson’s are usually ineffective because patients are commonly diagnosed in the later stages when around 70-80% of dopaminergic neurons are already lost. This is because current diagnostic methods such as PET scans and fMRI are very expensive and not readily available to the public. Previous studies have shown that PD patients exhibit abnormal post-illumination pupil responses (PIPR) consistent with their impaired retinal ganglion cells. Thus, we hypothesized that PIPR can be utilized as a novel biomarker for early diagnosis of PD. In order to measure PIPR values, we examined recorded videos of several patients’ eyes reacting to various light stimuli. Rather than tracking pupil size manually, we developed an automated system that can detect abnormality in PIPR faster and more accurately. By extracting video frames and fitting an ellipse to the pupil, the system allowed us to compare pupil parameters to distinguish PD from control patients. Data was analyzed using a student t-test. After the subsequent analyses, our results showed that the PIPR amplitude difference in response to red and blue light stimuli for Parkinson's subjects was significantly smaller (0.12 mm) compared to control subjects (0.60 mm). This remarkable difference could be used to diagnose patients with early-onset PD. Overall, this study demonstrates the utility of this experimental paradigm in improving the clinical efficiency and accessibility of PIPR as a diagnostic tool in evaluating patients with suspected Parkinson's Disease.

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