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VISUAL ATTENTION AND CLINICAL SCALES IN PATIENTS WITH DEMENTIA

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Abstract

Attention is a critical indicator in dementia assessment, and its cognitive fluctuation serves as a key metric for evaluating treatment effectiveness. With technological advancements, eye-tracking has emerged as a reliable and non-invasive tool for measuring attentional performance. This study employed the Gazepoint eye-tracker to assess visual attention in 16 patients diagnosed with mild dementia (Clinical Dementia Rating, CDR = 0.5). Two visual response tasks, digit discrimination, and letter recognition, were designed to evaluate gaze heatmaps and task accuracy. Concurrently, patients were assessed using standardized clinical scales: the Montreal Cognitive Assessment (MoCA), the World Health Organization Quality of Life Scale (WHOQOL), and the Geriatric Depression Scale (GDS). Results showed that seven patients demonstrated improved attention during the digit task, while four improved in the letter task. Twelve patients showed stable or increased response accuracy. Higher MoCA and WHOQOL scores were associated with greater attentional improvements, while higher GDS scores correlated with diminished focus. These findings highlight the effectiveness of low-cost eye-tracking technologies like Gazepoint eye-tracker in quantifying attention and supporting the integration of cognitive, emotional, and quality-of-life indicators in dementia care. The study further validates the Gazepoint system's applicability for clinical research, aligning with prior work on its accuracy and usability in realistic settings.

Keywords: Clinical Dementia, Attention, eye-tracker, clinical research, visual response tasks.

INTRODUCTION

Dementia is a progressive neurodegenerative disorder that impairs memory, attention, and executive function. Fluctuations in attention are often early indicators, making their detection crucial for evaluation and treatment monitoring. Eye-tracking, a non-invasive and quantifiable method, has recently been applied to assess visual attention and cognition. Abnormal eye movements also reflect neurological changes and predict disease progression.

In this study, conducted with Kaohsiung Municipal Kai-Syuan Psychiatric Hospital, the Gazepoint eye-tracker was used to evaluate patients with mild dementia. To provide a comprehensive assessment, eye-tracking data were combined with CDR, MoCA, WHOQOL, and GDS. This approach aimed to examine correlations between visual attention and clinical

indicators, validating eye-tracking as a reliable tool in dementia research and practice.

MATERIALS AND METHODS

Sixteen patients with mild dementia (CDR = 0.5) participated in two tasks: digit discrimination (target “6”) and letter recognition (target “X”). Eye-tracking data were recorded with Gazepoint, and fixation ratios, reaction times, and accuracy were analyzed. Invalid data points were excluded. Clinical assessments included MoCA, WHOQOL, and GDS to evaluate cognition, quality of life, and emotional status.

RESULTS & DISCUSSION

In the digit task, seven of sixteen participants showed improved fixation ratios, and most maintained or enhanced accuracy, indicating stable attention. By contrast, only four improved in the letter task, where longer and less structured design contributed to variability.
Correlation analyses showed that higher MoCA and WHOQOL scores were associated with greater attentional gains, while higher GDS scores corresponded with limited improvement. These findings align with prior research linking abnormal eye movements with cognition across domains. Despite calibration errors and incomplete recordings, results support eye-tracking as a practical tool for early dementia assessment.

As an example, Subject 07 demonstrated:

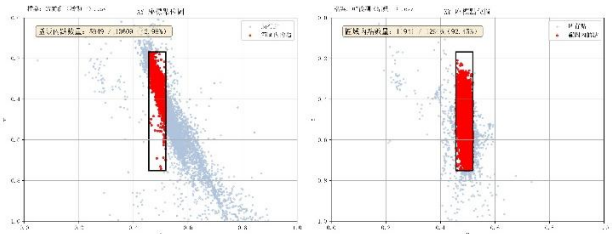

Fig.1 Digit discrimination task: attention improved from 42.98% to 92.45%.

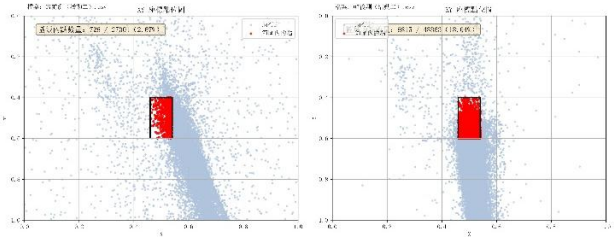

Fig.2 Letter recognition task: attention improved from 2.67% to 18.04%.

CONCLUSIONS

This study shows that eye-tracking can quantify attention in mild dementia. Improvements correlated with MoCA and WHOQOL, whereas higher GDS scores predicted limited benefit. Although constrained by calibration errors and task inconsistencies, findings underscore the potential of eye-tracking as a complementary tool for dementia care. Future work should expand samples, refine calibration, and standardize task designs to enhance reliability and clinical value.

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