Title

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Characterizing Alzheimer's Disease Progression through Event Related Potential (ERP) Analysis

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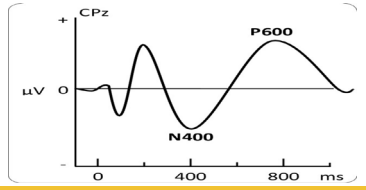
Introduction

- Alzheimer's Disease (AD) is currently the 6th leading cause of death in the United States.[1]
- Cognitive ERP (Event Related Potential) presents a potential cost-effective and non-invasive alternative to current modalities of AD monitoring.[2]
- In particular, P600 and N400, which are important markers for semantic and memory processing, have been shown in previous studies to be both sensitive to pathological aging as well as predictive for patient conversion to AD.[3]



Objectives

- To begin analyzing P600 and N400 amplitude and latency changes in the wordrep paradigm for enrolled AD patients at baseline.

Methods

- Enrolled subjects were classified into 4 groups based on clinical assessment; normal aging, preclinical AD, mild cognitive impairment, and mild AD dementia.
- Took baseline word repetition paradigm data from patients with processed ERP files and a completed clinical classification.
- Converted individual values to standardized z-scores in relation to the normal aging group's average.
- Averaged z-scores within each group for an overall z-score total for 3 different measures of P600 and N400.

Results

Group	Mean Amplitude	Mean Latency
Preclinical AD (7)	0.028	-0.075
Amnestic MCI (11)	0.483	0.210
Mild AD Dementia (4)	0.200	1.507

Table 1. N400 Congruous Effect Z-Score Averages.

This effect is calculated from the amplitude difference of the N400 waveform when initially presented with a congruous target word vs. incongruous target word. Increased latency is represented by a negative z-score.

Group	Mean Amplitude	Mean Latency
Preclinical AD (7)	0.378	-0.172
Amnestic MCI (11)	0.171	0.355
Mild AD Dementia (4)	0.070	0.784

Table 2. N400 Incongruous Repetition Effect Z-Score Averages.

This effect is calculated by measuring the amplitude difference between N400 waveforms on initial presentation of an incongruous target word vs. repeated presentations. Increased latency is represented by a negative z-score.

Group	Mean Amplitude	Mean Latency
Preclinical AD (7)	-0.502	0.517
Amnestic MCI (11)	-0.412	0.547
Mild AD Dementia (4)	-0.691	-1.095

Table 3. P600 Congruous Repetition Effect Z-Score Averages.

This effect is calculated by measuring the amplitude difference between P600 waveforms on the initial presentation of congruous target word vs. repeated presentations. Increased latency is represented by a negative z-score

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Discussion

- **P600 Effects:** P600 is thought to be an indicator of memory processing, and therefore changes tend to occur early in AD pathogenesis.[4] In our initial analysis, we see major decreases in effect amplitude for all 3 groups including Pre-AD. This suggest P600 may be a sensitive marker that can assess pathological aging before clinical symptoms appear. Due to low sample size, further analysis is necessary.

- **N400 Effects**: As an indicator of semantic processing and language, N400 changes should appear later in AD progression than P600.[4,5] Thus, we would expect more decreased congruous effect and incongruous repetition effects in the MCI/AD groups compared Pre-AD. On initial analysis, there is little to no change in the preclinical AD group for congruous effect, but a substantial effect on amplitude and latency for the incongruous repetition effect. This is possibly due to a limited sample size, but it would be necessary to analyze individual waveforms for further analysis.

Future Directions

- Enrollment was halted due to COVID in March 2020. As new patients join, we will have more data and higher power to conduct analyses of ERP differences between patient groups.

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