Neurodegenerative diseases result in the gradual degeneration of neurons and nerve cells. Neurodegeneration leads to serious diseases such as Parkinson's disease and Alzheimer's disease. Early distinction amongst neurodegenerative diseases is an important clinical tool that is greatly needed to improve clinical practices. Event-related potentials (ERPs) have been identified as possible biomarkers for distinguishing between neurodegenerative diseases. This research utilized an electrophysiological comparison to identify differences between Parkinson's disease (PD) and healthy controls, focusing specifically on the P300 and its elemental components the P3a and P3b. This study aimed to investigate whether neurodegenerative disorders elicit disease specific ERPs that can be used as reliable biomarkers in diagnosis. It was predicted that PD patients would elicit a reduced P3a amplitude generated from the frontal cortex (F3 electrode) than compared to healthy controls.

**RESULTS**

**Scalp Topographies of the P3a**

![Figure 1. Time Frame: 250-300 ms after a novel sound was heard](image1)

![Figure 2. Time Frame: 300-400 ms after a novel sound was heard](image2)

**P300 Amplitude Comparison**

![Figure 3. This figure illustrates the averaged ERPs for PD patients and controls and indicates no significant difference between the amplitudes of controls and PD patients off medication. The red represents the averaged ERP for all the PD patients off medication and the blue represents the averaged ERPs for the controls. During the time frame of 250 ms - 400 ms, there is no cyan colored line indicating a significant difference.](image3)

**CONCLUSION**

The averaged amplitude elicited by Parkinson’s disease patients was greater than that of controls, but this difference was not statistically significant. These results contradict previous studies on the P300 of Parkinson’s disease patients. In previous studies, PD patients elicited a reduced P3a amplitude compared to controls. This phenomenon can be attributed to several factors. These results could be attributed to PD patient's inability to habituate to novel stimulus over a series of tasks. In previous work, PD patients have had little to no change in P300 amplitude from beginning trials to end trials indicating lack of habituation[4]. Whereas, controls have larger changes in P300 amplitude from the beginning trials to end trials[4]. When tested for habituation, it was shown that the controls did habituate, whereas the PD patients did not habituate to the novel stimulus. These results could also be attributed to the reorganization of dopaminergic pathways while being off medication or due to the medication itself. Years of diagnosis was found to positively correlate with L-DOPA dosage (R = 0.596) and negatively correlated with the P3a amplitude of Parkinson’s disease patients while off medication (R = -0.308). This suggests that years of diagnosis may contribute to a reorganization of dopaminergic pathways that affects the P3a amplitude of individuals with Parkinson’s disease.

**REFERENCES**


**METHODOLOGY**

**The Oddball Paradigm:**

- beep beep boop beep beep chirp beep

**Purpose:**

- Indicates attentional focus required to identify a novel sound as a distractor or target stimulus[4].
- Focius attention for memory by requiring participant to count the number of target stimuli[4].

**The Electrophysiological Response:**

Event-related potentials (ERPs) are an electrical signal from the brain that is a response to a visual or auditory stimulus that are measured by an electroencephalogram (EEG). The amplitude and scalp topography of the P300 component of an ERP was specifically analyzed.

The P300:

- A positive peak of the ERP that occurs at 300 milliseconds after an auditory or visual stimulus is presented[4].
- Consists of two smaller peaks, the P3a and the P3b.

P3a: signifies an automatic detection of a novel stimulus

P3b: signifies a controlled response to a target stimulus.

**Correlation for Years of Diagnosis, L-DOPA dosage and P3a Amplitude**

<table>
<thead>
<tr>
<th>Years of Diagnosis vs. L-DOPA Dosage</th>
<th>Pearson’s R Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.596 ** (significant at the 0.01 level (2-tailed))</td>
<td>-0.308</td>
</tr>
</tbody>
</table>

N = 25