ABSTRACT

Background: Attention Deficit/Hyperactivity Disorder (ADHD) is one of the most common disorders diagnosed in children today. Researchers have found links between tracking deficits, convergence insufficiency, and ADHD diagnosis, but little research exists on the relationship between accommodation and ADHD. This study investigates whether there is a correlation between ADHD and accommodation dysfunction.

Methods: Patients ages 7-18 in the Pediatrics service at the Ferris State University Eye Center were invited to participate in the study by completing an anonymous survey, produced and accredited by the American Pediatric Association, investigating symptoms of inattention, hyperactivity, and impulsivity. Parents or patients attesting that the patient had already been diagnosed were not required to complete the survey. The student clinician then recorded the patient’s amplitude of accommodation and accommodative lag at the conclusion of the eye exam in order to correlate the diagnosis with accommodative findings.

Results: Using t-test and chi-square analyses, a statistically-significant link between lower than average lag of accommodation and ADHD was shown. A link between amplitude of accommodation and attention disorders was not significant. Conclusions: While accommodative lag was shown to correlate with ADHD symptoms, further investigation is necessary in determining if accommodative amplitude correlates with attention and hyperactivity disorders.

METHODS

Each patient aged seven to eighteen who presented to the University Eye Center for a primary care exam was offered the opportunity to participate in an anonymous survey produced by the American Academy of Pediatrics.11 The patient and his/her guardian were first prompted to check-off a box as to whether the patient had been diagnosed with ADHD by a healthcare provider. Group 2b represented participants who had been previously diagnosed with ADHD by a healthcare provider. Group 2b represented participants who were symptom-positive on the survey (see Figure 2). For this study, 61 of the 90 participants (67.7%) were in Group 1 and 29 (32.3%) were in Group 2, with 12 (13.3%) in Group 2a, and 17 (18.8%) in Group 2b.

RESULTS

89 pediatric patients (42 males and 47 females) were surveyed in this study. The participants were divided into two groups. Group 1 was defined as participants with no ADHD diagnosis and lack of six or more symptoms to indicate an ADHD diagnosis. Group 2 was defined as participants with an ADHD diagnosis or six or more positive symptoms. Group 2 was further divided into groups 2a and 2b, where Group 2a represented participants who had been previously diagnosed with ADHD by a healthcare provider. Group 2b represented participants who were symptom-positive on the survey (see Figure 2). For this study, 61 of the 90 participants (67.7%) were in Group 1 and 29 (32.3%) were in Group 2, with 12 (13.3%) in Group 2a, and 17 (18.8%) in Group 2b.

Table 1: Amplitude of Accommodation

<table>
<thead>
<tr>
<th>Amplitude of Accommodation</th>
<th>Group 1</th>
<th>Group 2a</th>
<th>Group 2b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Above Min. Expect. Value (D)</td>
<td>1.5</td>
<td>2.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Standard Deviation (D)</td>
<td>3.2</td>
<td>2.5</td>
<td>3.1</td>
</tr>
<tr>
<td>Number Below</td>
<td>11</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Number at or above</td>
<td>34</td>
<td>6</td>
<td>15</td>
</tr>
</tbody>
</table>

The manifest amplitude of accommodation measured during the exam was compared to the expected amplitude of accommodation, which was determined by 18.5-[(1/3)*(age)].12 (see Table 1). A one-tailed T test determined that Group 2 patients did not demonstrate a statistically-significant difference in the mean of the amplitude of accommodation when compared to the mean of Group 1 patients. The p-value was calculated to be .466 with a confidence interval of 95% which is not statistically significant for difference. A chi-square analysis also failed to demonstrate an association between being in Group 2 and having a reduction in amplitude of accommodation.

CONCLUSION

The study indicates a connection between being in Group 2 (ADHD) and having a deviation in lag of accommodation in one or both eyes, particularly with lower than average lag of accommodation.

For patients in Group 1, the average accommodative lag was +0.50D in each eye. For patients in Group 2, the average accommodative lag was +0.38D in the right eye and +0.33D in the left eye.

A two-tailed T test demonstrated a p value of 0.08 that Group 2 displayed a non-statistically-significant deviation (either higher or lower) in mean lag of accommodation when compared to the mean of patients in Group 1. A one-tailed T test using the alternate hypothesis that patients in Group 2 displayed a statistically-significant reduction in mean lag of accommodation when compared to patients in Group 2 found a statistically-significant p-value of .04 with a 95% confidence interval. Therefore, our data indicates that the means do not differ by chance, and a statistically-significant difference in mean lag of accommodation exists between Groups 1 and 2 when considering only a reduction in lag of accommodation. A chi-square analysis with one degree of freedom was 13.505, which gives a probability (p) of less than 0.1% that having a deviation in lag of accommodation is independent from being a patient in Group 2.

The study indicates a connection between being in Group 2 (ADHD) and having a deviation in lag of accommodation in one or both eyes, particularly with lower than average lag of accommodation.