Background

The prevalence of non-strabismic binocular disorders was found to be second only to refractive error in a clinical pediatric population, yet many states, including ‘Tennessee’, do not require that a test of binocular facility (accommodative and/or vergence) be included in the school vision screening protocol. In fact, ‘Tennessee’ permits a minimum vision screening that measures only distance and near visual acuity and does not mandate vision screening after the eighth grade.2

If the purpose of vision screenings by the school districts is to maximize learning potential (as suggested by the Tennessee document’s non-stated reference, “most persons are visual learners, acquiring approximately 85% of all knowledge through vision”), then an adequate vision screening should include a test that can identify disorders that cause visual discomfort. In a study of 114 visually symptomatic primary school children who were without amblyopia, strabismus, ocular or systemic pathology, contact lens wear, vertebra, phoria, or strabismus reduced below 20/25 in either eye, 71.9% were diagnosed with non-strabismic accommodative and/or vergence dysfunctions.3

In addition, a significant relationship was found between these dysfunctions and academic scores in every academic area (reading, mathematics, social science and science) in the total sample.4

Some school districts provide more comprehensive vision screenings by incorporating the triblecular or the Modified Clinical Technique.5 However, neither protocol evaluates sustained binocular function over time. Because many visually symptomatic patients with a normal heterophoria at distance and near demonstrate reduced ‘vergence3’, these screening methods are insufficient in detecting a conclusion of normal, asymptomatic binocularity.

Thus, young adults near older academic and the workforce with undiagnosed non-strabismic binocular dysfunctions, with visual symptoms contributing to reduced job performance and/or leading to task avoidance. Indeed, Borrelli, et al. reported that 27% of students from select liberal arts colleges in the United States had moderate to severe symptoms of visual discomfort.6 Tosha, et al. found that 17% of students from selective liberal arts colleges in the United States reported that 17% of students from selective liberal arts colleges in the United States had moderate to severe symptoms of visual discomfort.6

Subjects

1. Pre-prophylactic students, faculty, and staff at Southern College of Optometry

2. Pre-prophylactic adults recruited from family and friends of the above individuals

Methods

The data recorded from 164 subjects recruited to participate in other visual perception and visual function studies by one of the authors since 2009 were retrospectively reviewed. Vision tests were conducted in these prior studies other to determine inclusion and exclusion criteria for those studies or as part of their protocols.

Referral rates were calculated for each of the following SINGLE tests:

1. Distance visual acuity with habitual correction

2. Near visual acuity with habitual correction

3. Accommodative facility (adjusted amplitude)

Referral rates were also calculated for the following COMBINATION of tests:

1. Distance visual acuity and near visual acuity (both with habitual correction)

2. Distance and near visual acuities (habitual correction) and accommodative amplitude

3. Distance and near visual acuities (habitual correction) and accommodative facility

Results

Figure 1 shows the referral rates calculated for each of six individual vision tests and for each of the combinations of distance and near visual acuity plus one additional test. Each test combination included both distance and near visual acuities because screening visual acuity is the “gold standard” for vision screenings and because near acuity is needed for some of the other tests.

Visual inspection of the graphed data shows that the referral rate increased for all categories in which one additional test was added to the combination of distance and near visual acuity compared to the referral rate with the combination of distance and near acuities alone.

Conclusion

The referral rate for a population of non-prophylactic adults, most of whom have a large chronic near work demand, is significantly different when a test of accommodative amplitude, near vergence facility, or the convergence insufficiency symptom survey is administered in addition to tests of distance and near visual acuity, with a greater referral rate manifesting with the additional near function test or symptom survey. Further studies are needed to determine whether formal visual screenings with one or more of these additional tests for groups of young adults with large near work demands will result in significantly different referral rates compared to screening distance and near acuity alone, as predicted by this pilot data.

Table 1: McNemar’s Test for Correlated Proportions

<table>
<thead>
<tr>
<th>Test</th>
<th>Referral Rate for Multiple Tests of Visual Function</th>
<th>Referral Rate for Single Tests of Visual Function</th>
<th>McNemar’s Test for Correlated Proportions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance and near visual acuities (both with habitual correction)</td>
<td>0.73 0.36 1.67 6.97 0.40</td>
<td>0.80 0.40 1.29 3.45 0.48</td>
<td>Two-tailed p One-tailed p Odds Ratio Upper Limit Lower Limit 0.95 Confidence Interval</td>
</tr>
<tr>
<td>Distance and near visual acuities (both with habitual correction) + accommodative amplitude</td>
<td>0.73 0.36 1.67 6.97 0.40</td>
<td>0.80 0.40 1.29 3.45 0.48</td>
<td>Two-tailed p One-tailed p Odds Ratio Upper Limit Lower Limit 0.95 Confidence Interval</td>
</tr>
<tr>
<td>Distance and near visual acuities (both with habitual correction) + convergence insufficiency symptom survey (CIS)</td>
<td>0.73 0.36 1.67 6.97 0.40</td>
<td>0.80 0.40 1.29 3.45 0.48</td>
<td>Two-tailed p One-tailed p Odds Ratio Upper Limit Lower Limit 0.95 Confidence Interval</td>
</tr>
</tbody>
</table>

References

1. Jordan Rothlisberger, BS, Patricia M. Cisarik, OD, PhD | Southern College of Optometry


3. Sh, PM, Wik, W, et al. (2008). Referral rates were calculated for each of the following SINGLE tests:

4. Jordan Rothlisberger, BS; Patricia M. Cisarik, OD, PhD | Southern College of Optometry

5. A Comparison of Referral Rates from Vision Screening With and Without Accommodative and Vergence Facility Testing: a pilot study

6. Tosha, et al. found that 17% of students from selective liberal arts colleges in the United States reported that 17% of students from selective liberal arts colleges in the United States had moderate to severe symptoms of visual discomfort.6