A Comparison of Three Tests of Stereo Acuity

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PURPOSE

Testing of stereo acuity is a standard part of the routine optometric examination. The basis of all stereo tests is by using disparity, the subject identifies the shape that appears to be closer. One of the first clinical tests, which is still widely used, is the Titmus Stereo Test, also know at the Wirt Stereo Test, but called by most, the Stereo Fly. This test is a two-page design with the Stereo Fly on the right-hand page and the Wirt Circles on the upper part of the left-hand page (see Figure 1). The lower part of the left page has the Animal test for children. The Wirt Circles test shows four circles each in one corner of a diamond shape. The graded circles on the Wirt Circles go from 800 down to 40 seconds of arc. Limitations of the test include: a top limit of 40 seconds of arc and monocular cues to depth.

Random dot stereograms were invented in the 1960’s by Bela Julesz and several clinical tests have been made for use by the eye care professionals. The Randot Stereotest (see Figure 2) is also a two-page design with one page containing Randot shapes and the other page containing Wirt circles and animals, similar to the Stereo Fly. Unlike the Stereo Fly test, there are 3 Wirt circles arranged horizontally on a random dot background. The graded circles in this test go from 400 to 20 seconds of arc. Random dot tests have less potential for monocular cues to be present or even discernable at all but the stereo targets with the largest amount of depth.

The Random Dot 3 Stereo Test (see Figure 3), is also designed with multiple tests. The larger targets are Lea symbols. The “Wirt equivalent” design has all the circles done with random dot patterns, both the background and the figures. The disparity on this test goes from 160 to 12.5 seconds of arc.

METHODS

122 second and third year SCO students sat as subjects. There were no exclusion criteria. Testing included best corrected visual acuity with the right, left and both eyes, and distance and near cover test.

The order of the three test presentations were randomized. All three tests required the use of Polaroid glasses. Subjects wore their best correction, either in the form of glasses or contact lenses. The Polaroid glasses were worn over the subject’s own glasses in those cases where their correction was in ophthalmic lens form. All testing was done at 40 cm with the tests on a stand perpendicular to the line of sight. Lighting was held a constant for all subjects for all trials by a single subject.

RESULTS

Because each test had a different endpoint, direct comparison across the entire range of targets was impossible. The maximum disparity for each test is as follows: Wirt Circles with the Stereo Fly Test – 40 seconds of arc, Wirt Circles on Randot Stereopsis – 20 seconds of arc and Randot Dot 3 test – 12.5 seconds of arc.

• Over the ranges where the tests covered the same stereo demands there was no statistical differences between the tests. Spearman Correlation Matrix revealed that each test is significantly correlated (pp < .001). This means that up to 40 seconds of arc, all three tests performed well and they were equivalent to one another. Up to 20 seconds of arc, the Randot Stereopsis tests and the Random Dot 3 test performed the same. Results for each test are illustrated below in Table 1.

<table>
<thead>
<tr>
<th>Test</th>
<th>% Achieving 40’</th>
<th>% Achieving Max Stereo</th>
<th>Max Stereo Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titmus Stereo Fly</td>
<td>92.11</td>
<td>92.11</td>
<td>40</td>
</tr>
<tr>
<td>Randot Stereopsis</td>
<td>88.60</td>
<td>71.05</td>
<td>20</td>
</tr>
<tr>
<td>Random Dot 3</td>
<td>91.23</td>
<td>45.61</td>
<td>12.5</td>
</tr>
</tbody>
</table>

DISCUSSION/CONCLUSION

Although the Random Dot 3 test contains finer gradations of stereo acuity, the results of this study show that each test is significantly correlated. The results of this study demonstrate that the Random Dot 3 test is not the most difficult of the 3 stereo tests. Furthermore, the impression that subjects or patients do not achieve as fine a stereoacuity value is not supported.

Differences in the results may be attributed to the design of the targets (e.g. Wirt circles compared to Randot stereopsis). Additionally, the size and thickness of the Wirt Circles in the Random Dot and Stereo Fly Test, are different (see Figure 6). The circles from the Random Dot stereopsis test have a larger overall diameter but smaller thickness of lines, while the circles from the Stereo Fly have a smaller diameter and larger thickness of lines.

FINANCIAL DISCLOSURE

Dr. Paul Harris was unpaid and consulted in the development of the Randot DOT stereo visual acuity test. He has no direct financial interest in the product nor is he compensated in any way by the manufacturer nor any of the distributors of the test.