Objective horizontal heterophoria measurements using a new vision analyzer

Jaume Pujol¹, Rosa Borras¹, Irene Claramunt¹, Mireia Sanchez¹, Alfonso Sanchez-Magan ¹, Juan Carlos Ondategui-Parra¹

Davalor Research Center (DRC) – Universitat Politècnica de Catalunya, Terrassa, Spain.

Purpose: To compare the results of two subjective methods used to measure horizontal heterophoria with an objective method implemented in a prototype of a new vision analyzer (EVA) that records eye movements while the patient watches a true-3D videogame.

Methods:

- Patients: 54 young healthy patients were selected for this study. The mean age ± standard deviation (SD) was 21.5 ± 1.5 years (range:19 to 24).
- Inclusion criteria: Far and Near Visual Acuity (VA) ≥ 0.0 logMAR; Spherical Ametry ≤ ±6.00D; Astigmatism ≤ 3.00D; No previous history of amblyopia or strabismus, ocular pathology or history of eye surgery.
- Test distance: 40 cm
- Run time, including time for instructions, was also measured

- Von Graefe with a line of letters (VGL)
  - Stimulus dissociation: 15 PD BD (RE); 8PD BU (LE) using phoropter Risley prism.
  - Optotype: Vertical line of letters corresponding to a VA of 0,2 logMAR.
  - Increment speed of prismatic diopters was 2PD/sec
  - E=450 lux
  - 3 measurements with a time interval of 5 sec.
  - The mean heterophoria value for each patient was considered.

- Modified Thorington (MT)
  - Stimulus: Spotlight
  - Stimulus dissociation: Maddox rod with horizontal orientation (RE)
  - E=50 lux
  - 3 measurements with a time interval of 5 sec.
  - The mean heterophoria value for each patient was considered.

- Objective Alternating Cover Test (OACT)
  - While watching binocularly a 3-D video game, one of the patient eyes was occluded for 2 seconds. This procedure was repeated 5 times alternating between each eye.
  - Optotype: Letter corresponding to a VA of 0.2 logMAR
  - Eye movements were recorded by the eye-tracker (30Hz).
  - The mean heterophoria value for each patient was considered.

Results:

<table>
<thead>
<tr>
<th>Method</th>
<th>Mean phoria ±SD (PD)</th>
<th>Run Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VGL</td>
<td>-6.7 ± 6.0</td>
<td>137 ± 20</td>
</tr>
<tr>
<td>MT</td>
<td>-1.0 ± 3.8</td>
<td>83 ± 13</td>
</tr>
<tr>
<td>OACT</td>
<td>-2.0 ± 3.0</td>
<td>26 ± 5</td>
</tr>
</tbody>
</table>

Mean difference, confidence interval and intraclass correlation when methods were compared.

Conclusions:

- The EVA prototype is a useful device to objectively measure horizontal heterophoria.
- Difference in heterophoria values obtained using OACT and MT (considered the gold standard of subjective methods) is lower than 1PD (not clinically significant)
- OACT is over 3 times faster than MT and over 5 times faster than VGL.

References: