Novel visual acuity charts with modified 3-bar optotypes: approbation in cataract patients

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Background and aim

Two novel charts for visual acuity (VA) assessment with modified 3-bar optotypes were created. The aim of the work was to compare the novel charts and two standard charts (ETDRS and E-chart) in cataract patient examination.

Participants

Demographic information

All patients were prescribed to the cataract surgery on the eye assessed. Only one eye was assessed in each patient.

Materials and methods

The charts used in comparison

Test-retest results

The Bland-Altman plots for test-retest repeatability assessment. The solid line marks the median (zero for all four charts tested). The dashed lines marks 2.5 percentile and 97.5 percentile, so the range between dashed line is 95% limits of agreement (LoA).

Since the difference was obtained as retest measurements minus test measurements, and also these are logMAR values, so if the dots are lower than zero line, retest values were better, than test (in logMARs lower VA is better, in opposite to usual clinicalVA where higher values are better). That means that if dots are lower the zero line, the chart that is first in the title (row name chart) had better values of visual acuities (overestimates in comparison with those charts).

The differences were measured by subtracting values obtained by the chart in column name from the values obtained by the chart in title (i.e., row minus column). That means that if dots are lower than zero line, the chart that is first in the title (row name chart) had better values of visual acuities (overestimates in comparison with the second chart in title).

Conclusions

The IITP and IITP-V charts are comparable in repeatability with ETDRS and E-chart though novel charts slightly overestimate VA in comparison with those charts. Nevertheless, IITP charts have the following benefits: they are easier to understand and to respond, do not require knowing of the alphabet or discriminating right-left directions.

Table 1. LoAs of the test-retest differences. LoA borders were assessed non-parametrically by percentiles.

<table>
<thead>
<tr>
<th>Chart name</th>
<th>95% LoA borders</th>
<th>95% LoA width (assessment of variability)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IITP-V</td>
<td>Lower border (2.5 percentile)</td>
<td>Upper border (97.5 percentile)</td>
</tr>
<tr>
<td>IITP</td>
<td>0.19</td>
<td>0.12</td>
</tr>
<tr>
<td>ETDRS</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>Tumbling-E</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>IITP-PD</td>
<td>0.30</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Inter-charts comparison. Bland-Altman plot for all chart combinations. Solid line shows median, tightly dashed black lines show 2.5 and 97.5 percentiles, sparsely dashed blue lines show zero level (if not overlayed by median).

Figure 1. Comparison of VA distributions for IITP and ETDRS charts. The IITP chart slightly overestimates VA in comparison with ETDRS chart.