EXAMINATION OF THE VISUAL ACUITY ON THE LCD OPTOTYPE WITH WHOLE-LINE AND INTERPOLATION METHOD

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Introduction: In human history visual acuity has been defined many times. One conventional definition, which also describes the resolution of the eye as follows: “Visual acuity is the eye’s ability to distinguish two objects as close as possible.” [1, p. 1] Resolution of two of values was points that lie at a distance from each other. In the macula there are the images of these two points separated by one cone. [1] It is necessary to realize that the patient’s visual acuity and even the minimum separable does not reflect only on the state of the macula but also the whole refractive condition of the eye. The work focuses on the visual acuity value differences measured with whole-line and threshold interpolation method. It includes also a comparison of measured values (between two methods). Measurement was performed on LCD optotype in order to maintain the opportunity to repeat this study. The purpose of this work is to highlight the differences between whole – line and threshold interpolation visual acuity scoring methods. It should be pointed the fact that the methods and measurements procedure were inspired by the optometric practice. For this reason there was the optotype which is used in practice used for each method. In this period of time fairly comprehensive set measured that can be processed in various ways. In this work there was chosen such processing methods which allow investigators to choose the appropriate method, according to the character of the measured values, available equipment and possibilities for the investigation. These methods of measuring visual acuity will be evaluated and compared. It is necessary to remark that if there is a comparison of the results from different measuring methods and optotype boards, the finally output could be affected by the conversion of the result to a common unit (logMAR).

Hypotheses:

First hypothesis: The value of visual acuity measured with whole-line method on Snellen chart is not equal to the value measured by interpolation method on ETDRS chart.

Second hypothesis: Interpolation method has better repeatability, so it is more reliable than the whole-line method.

Participants and methods:

Sample FNUSA: Number of respondents was 36, in the range of age from 22 to 88 years. Some patients had artificial mydriasis, or had an ambyopic eye, that is why only 66 eyes were measured. The patients were performed only with letter optotype charts. The charts were presented with a LCD optotype Smartchart LCD CP-400 made by Opto, which has 27-bit display and a diagonal dimension of 19 inches. The testing distance was 4 meters, the background brightness was constant (200 cd/m²).

Sample LF: Number of respondents was 33, including 7 men 26 women (age 19-30). The measurements were performed with letter optotype characters and some with Landolt rings. The measurement was carried out LCD optotype Smartchart CF-200 made by Opto, which has 18-bit display and a diagonal dimension of 15 inches. The testing distance was 5 meters, the background brightness was constant (200cd/m²).

Snellen chart: The vision testing started with the top of the chart and then continued until a line was reached where more than 60% of the letters (2g of 3, 3 of 5) were read correctly or the patient read all letters on the chart. The visual acuity was measured using whole-line scoring method with the lowest value of the line, where at least 60% of the letters (2g of 3, 3 of 5) were identified correctly.

Results: A total of 1034 measures of visual acuity, were divided into different groups and evaluated.

Sample Method of scoring Average visual acuity (logMAR)
FNUSA ETDRS-interpolation 0.0247
Snellen-whole-line 0.0454
LF ETDRS-interpolation -0.0184
Snellen-whole-line 0.0431

Mean values of visual acuity (logMAR)

First hypothesis

Sample FNUSA, box plot of visual acuity values (logMAR)

Sample LF, box plot of visual acuity values (logMAR)

Sample FNUSA-percentage distribution of the number of characters differences according to the methods of measurement

Sample LF - percentage distribution of the number of characters differences according to the methods of measurement

Conclusion: From the measured results imply that there is significant difference between the measurement of visual acuity with whole-line and interpolation method. It is also confirmed that the interpolation method on ETDRS chart is a better repeatability than the whole-line method on the Snellen chart. Similar results describe authors of following studies [3,4,5,6,7,8,9]. There have been not described all the factors by which these two methods could be examined and compared (e.g. measuring length, the height of the examiner)), so it would be premature to draw absolute conclusions about determining the better method. However, on the base of results, it can be formulated some recommendations for practice:

If comparing the patient’s visual acuity measured by these different methods, you must attention to that the actual visual acuity will be different even if the measurements indicate the same value. The worse vision is, the greater the deviation. (see hypothesis 1)

If we want to compare the visual acuity measured by several different examiners in different offices, it is better to perform these measurements on ETDRS chart. It is more reliable and standardized in practice than the Snellen chart. (see hypothesis 2)

In the case of repeated measurements, such as long-term monitoring of the patient’s visual acuity the interpolation method on the ETDRS chart is more efficient than the whole-line method to eliminate errors. (see hypothesis 2)

References:
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