INTERNATIONAL STANDARD

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Optics and optical instruments — Visual acuity testing — Method of correlating optotypes

Optique et instruments d'optique — Méthode d'essai de l'acuité visuelle — Méthode de corrélation entre les optotypes

Reference number
ISO 8597:1994(E)

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 8597 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 7, *Ophthalmic, endoscopic, metrological instruments and test methods*.

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Optics and optical instruments — Visual acuity testing — Method of correlating optotypes

1 Scope

This International Standard specifies a method of correlation between a given set of optotypes and the standard optotype (Landolt ring) specified by ISO 8596.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 8596:1994, *Ophthalmic optics — Visual acuity testing — Standard optotype and its presentation.*

3 General requirements for optotypes

For all optotypes, the requirements and method of use given in ISO 8596 shall appply, unless otherwise specified in this International Standard.

Each size of a set of optotypes shall be specified in terms of the size of some critical dimension common to that set of optotypes. In the case of the standard Landolt ring, the critical detail is the gap size. In the case of a set of optotypes where there is no dimension common to the different members of the set (e.g. optotypes for illiterates), the members of a given acuity grade shall have the same relative dimensions as corresponding members of other acuity grades. The size shall be identified by a specified dimension of one member of the set.

NOTE 1 If letters or figures are used for visual acuity measurement, then it should be acknowledged that these normally show large differences in respect of recognizability, even if their size and thickness of stroke are identical. The disadvantages of their use can be reduced by choosing letters or figures which are comparable with each other.

4 Correlation of optotypes

4.1 Standard optotypes

The optotype sizes (grades) specified in ISO 8596 shall be used. Sufficient grades or steps shall be used to establish a frequency of seeing curve for the standard optotype and the optotype being investigated.

4.2 Test area

The test area shall be circular with a diameter of 4° ± 0,4°.

The surrounding field shall have a diameter of 15° ± 1,5 % and shall be illuminated homogeneously so that it does not influence the measurement.

The luminance of the surrounding field shall not be greater than that of the test area.

4.3 Presentation of the optotypes

In making a measurement of visual acuity with the eight-position Landolt ring, 120 presentations shall be made one ring at a time with the ring positions for successive presentations arranged in random order. In the case of the optotypes to be correlated, these shall also be presented one at a time in random order until a series of 120 presentations has been completed. In the 120 presentations, the different optotypes in each set shall be represented approximately the same number of times.

NOTE 2 The number 120 is divisible by 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 30, 40 and 60. Hence, with sets of optotypes having any of these numbers of different optotypes, it is possible for each optotype to be represented the same number of times in 120 presentations.

The comparison shall start with a grade of optotypes large enough to yield a frequency of seeing of 100 %. Measurements shall be made with both eight-position Landolt rings and the optotypes of the same size being correlated. When this has been completed, the procedure shall be repeated with smaller and smaller sizes until the failure rate corresponds to the level of guessing of 0,125. Each optotype shall be exposed for 3 s with an interval of 4 s between exposures.

NOTE 3 If possible, the comparison of optotypes should be made by means of binocular measurement.

4.4 Corrective lenses

The observers shall be fully corrected to a visual acuity of 1,0 or better, if necessary.

4.5 Test distance

The test shall be performed at a distance of 5 m ± 0,05 m between the subject and the optotype.

NOTE 4 This test distance is for correlation purposes only. For visual acuity testing, the minimum viewing distance is 4 m (ISO 8596).

4.6 Luminance

The luminance of the test area shall be 200 cd/m^2 ± 50 cd/m^2 and shall be the same for the Landolt ring as for the optotypes to be correlated. The difference between the luminances of both test areas shall not exceed 10 %. The luminance of the optotypes themselves shall not exceed 10 % of the luminance of the test area.

5 Assignment of an acuity score

If, before the end of the test, the observer makes a point of no longer being able to recognize the test types, the subject shall be requested to make a guess. The subject shall not be informed before the end of the test whether or not any mistakes were made. The number of errors per optotype size shall be recorded. From the raw data, an allowance for guessing shall be made and the frequency of seeing shall be assessed for each optotype size.

NOTE 5 The allowance for guessing is performed by the following equation:

$$\frac{E}{N} = \frac{R - Np}{N(1 - p)}$$

where

E is the number of right answers corrected for guessing;

N is the number of presentations;

R is the number of right answers;

p is the probability of guessing (p is equal to the reciprocal of the number of different optotypes or directions in the set).

For the various grades, the frequency of seeing shall be plotted against the logarithm of the size of the critical details. The points on the graph for each type of optotype shall be fitted with an ogive curve represented by the integral of the probability curve.

NOTE 6 Any of the usual methods of fitting the ogive curve may be used.

From the curves, the optotype sizes at which the frequency of seeing is 50 % shall be estimated, representing the thresholds for the Landolt ring optotype and the optotype being correlated. From these thresholds the acuity scores shall be derived.

6 Assessing the equivalence of two kinds of optotypes

The measurements described in clause 5 shall be repeated with ten or more observers with normal vision (visual acuity of 1,0 or better) or the observers shall be fully corrected to a visual acuity of 1,0 or better, if necessary. The threshold values for each kind of optotype shall be averaged.

NOTE 7 If the two averages differ by more than 0,05 log units, the two sets of optotypes cannot be said to be equivalent. They can be made equivalent by enlarging or contracting the size of the non-standard optotypes by a factor equal to the ratio of the visual acuity for the non-standard optotypes to the visual acuity for the standard optotypes.

7 Significance of the difference between the two averages

The meaningfulness of the difference between the two averages can be studied by

a) comparing the overlap of the frequency distributions of the two sets of scores;

b) using standard statistical procedures to evaluate the significance of the difference between the averages;

c) plotting a frequency distribution of the differences between the scores on the separate tests to evaluate the tendency to be high or low on both tests;

d) using the method of linear regression.

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