A new Snellen's visual acuity chart with 'Indian' numerals

MAHMOUD AL-SALEM

From the Department of Ophthalmology Ibn-Sina Hospital, Kuwait

SUMMARY 'Indian' numerals, which are popular among the Arab population, were used to devise a new Snellen's visual acuity chart. The new chart has the advantages of a reading chart. It keeps the patient's interest, does not miss alexic patients, and is quicker to perform. It is also devoid of the many disadvantages of a kinetic response chart (the capital E letter or Landolt's broken rings), especially that of the limited option of test objects.

Snellen's concept for testing visual acuity is widely used today. Each of the constituent parts of the letters used subtends a visual angle of one minute of arc at the eye, at the standard viewing distance. The minimum resolvable visual angle is taken as the visual acuity which is designated according to Snellen's classical formula $V=d/D$, where d is the distance at which the letters are read and D that at which they should be read.^{1,2}

What matters in a visual acuity test object is its ability as a geometrical pattern to test refractive or retinal functions.³ However, the recognition of letters is a perceptive process with strong personal factors. For this reason many alternatives have been proposed, especially in countries which do not have Roman script, and these are quite necessary when the subject is illiterate. Arabic numerals and the capital E letter provide possible substitutes. But the most popular suggestion which does not depend upon letters is that of Landolt's broken rings.¹

In Middle East countries the capital E letter and Landolt's rings test charts are widely used. But they have several disadvantages. First, these charts contain test objects with only four possible options, and they are likely to be guessed or memorised. For official examinations such charts are not recommended.³ Secondly, they require some considerable time to explain to the patient how to perform the test. Thirdly, in Landolt's rings it is probable that the gap is recognised by increased illumination in its position before its form is clearly discerned, so that a higher value is obtained than in fact exists.¹ Fourthly, Landolt's rings also overestimate the visual acuity of

patients with uncorrected astigmatism because of the absence of vertical and horizontal lines.⁴ Fifthly, the unfamiliarity of the test objects lacks the interest of reading letters or numerals.

We therefore describe a Snellen's chart utilising 'Indian' numerals. It has the advantage of a reading chart but is devoid of the disadvantages of the capital E letter or Landolt's broken rings.

Material and methods

For the calculation of the size of any test object on Snellen's chart at a specified distance in such a way that its details subtend one minute of arc at that distance the tangent of one minute, which is equal to 0.000291, is multiplied by that distance in millimeters. The result is the single unit of the object in millimeters. When this value is multiplied by 5 the result is the whole length of the square of that object. For example, at a distance of 24 meters, the single unit of the object is equal to $0.000291 \times 24\,000$ ($=6.984$ mm) and the whole object is equal to 6.984×5 ($=34.92$ mm). In reality it is approximated to 7.0 mm and 35 mm respectively and so on.

DESCRIPTION OF THE CHART (Fig. 1)

(1) Two digit numerals were chosen.

(2) Each was drawn in a five-unit square to subtend five minutes of arc at the eye, at the specified distance.

(3) The thickness of the lines is equal to the gaps in between and each is one-fifth of the whole square.

(4) The test numerals were arranged on the same gradation in size of letters as that of Snellen's chart, that is, at 60 m, 36 m . . . down to 4 m.

Correspondence to Dr Mahmoud Al-Salem, FRCS, PO Box 43395, Hawalli, 32048 Hawalli, Kuwait.

Fig. Photograph of a Snellen chart with Indian numerals reduced to one-seventh.

(5) A high-contrast black colour is used for printing the numerals on white sheets of durable material. These can also be delivered on white opal plastic (Perspex), for even illumination from behind and to fit in Snellen's chart stand.

(6) The specified distance at which a numeral is to be read is written in small figures, in Arabic numbers to the left hand side and Indian numbers to the right hand side of the chart.

Several charts were made with different arrangements of numerals; also charts for reverse use with mirrors in case of space limitation were made.

One hundred and forty patients were examined by

both the new Indian numerals chart and the capital E letter test chart for comparison.

Results

We compared the visual acuity tested with the new Indian numerals and with the capital E letter Snellen's acuity chart in 140 patients. Their ages varied from 6 to 62 years and their visual acuities from 3/60 to 6/5. Four patients (2.8%) failed to read the new chart. The results from 270 eyes in the remaining 136 patients are shown in Table 1.

Discussion

Testing visual acuity with a reading chart excites a verbal response, while testing with Landolt's rings or the capital E letter excites a kinetic response (pointing by the hand towards the direction of the gap). The verbal response to seeing an object involves a complex neurological pathway,⁵ but the kinetic response is a much simpler one. Thus young children usually score a better visual acuity with tests such as the E letter, which tests the resolving power, than with letters or numerals, which demand interpretation as well.⁶ Moreover, alexic (word blind) patients are likely to be missed when examined by the E letter or Landolt's rings charts alone. For these reasons, and for convenience and to save time, visual acuity charts with either letters or numerals to read are preferred.

Emarah has suggested a reading Snellen's chart with vertical and horizontal predominant lines based on Arabic alphabets to disclose all possible amounts of astigmatism,⁷ but the configuration of letters made the test difficult even for average literate individuals. In addition the presence of many of ophthalmologists and opticians practising in the Middle East whose mother tongue is not Arabic made the test unpopular.

Arabic numerals have not been used as a substitute for letters in Arab countries because they were abandoned long ago, and the so-called Indian numerals are in use nowadays instead of them.⁸ These can be recognised by most of the population, even illiterate people.

Table 1 Comparison of visual acuity with the E letter and with Indian numerals test charts in 270 eyes

	No.		%	
Equal visual acuity	183		67.8	
Deviation from the E letter test				
One line difference	42	17	59	21.8
More than one line difference	18	10	28	10.4
Total	60	27	270	100

Visual acuity tested with the Indian numerals chart correlates well with the E letter chart. 89.6% of tested eyes had equal vision or one line difference. But the numerals were slightly more difficult than the E letter test. A greater number of eyes scored worse visual acuities with them. However, we think that a reading Snellen's chart with Indian numerals would be useful for testing visual acuity in Arab patients because it is devoid of the disadvantages of a kinetic response chart, easier to recognise than Arabic alphabets, and still has the advantages of a reading chart.

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