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The role of HOTV visual acuity chart in estimating vision among illiterate adults in comparison with Snellen's E chart

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Abstract
Comparative studies of different visual acuity charts among illiterate adults are lacking.
Aim and objectives -*This study tries to ascertain the role of HOTV chart in assessing vision among illiterate adults as compared with conventional illiterate E Chart.*
Design – *Descriptive cross sectional study*
Methods – *Phakic illiterate adults with an uncorrected visual acuity better than or equal to 6/18 on Snellens chart were included. The visual acuity of each individual was tested with both E chart and HOTV chart by separate observers. These were compared.*
Results - *The study group included 48 adult illiterate patients. 58.33% (n=28) were females. The mean age of this group was 60.23 with SD of ±9.518. Among 40 eyes, HOTV overestimated the vision. An improvement of one line was observed in 82.5% (n=33). Out of the nine eyes which showed underestimation of vision on HOTV test, 88.9% (n=8) showed a worsening of one line. The difference in the visual acuity was more evident among those with vision less than 6/9 (p= 0.000).*
Conclusion – *HOTV may be an easy and better choice for estimating potential vision among illiterate adults without ocular co morbidities.*
Keywords – *Snellen's visual acuity, illiterate E chart, HOTV chart, Recognition acuity.*

Introduction

Illiterate E chart is the commonly used visual acuity testing device for illiterates.Both E charts and Landolts C chart are based on direction recognition. Visual acuity charts based on recognition acuity used for assessing preschool visual acuity uses letters and objects (toys) which are easy to recognize and identify by elders as well. The potential use of such tests among illiterate adults has not been studied extensively. Numerous comparative studies in preschool children are available but are lacking among adult illiterates.[1,2,3,4,5,6,7] In this study Illiterate E chart and HOTV charts are compared for assessing the visual acuity of adult illiterates. We intended to assess the efficiency of HOTV chart as compared with the conventional E chart in checking visual acuity among illiterate adults.

Materials and Methods

All consecutive cases of phakic adults who were illiterates and had an uncorrected visual acuity better than or equal to 6/18 on Snellens chart were included. Best corrected visual acuity of 20/20 was ensured. The study period was six months. The work was approved by the institutional ethics committee. Eyes with visual acuity less than 6/18, psychiatric patients, those with ocular diseases

and uncooperative patients were excluded from the study. Age, gender, socioeconomic status, area of residence and occupation of the participants were recorded. The visual acuity of each individual was tested with both E chart and HOTV chart by separate observers. Statistical analysis was performed with PASW 18. Chi square test was used for univariate analysis.

Visual acuity was tested with Snellens E chart at a distance of 6meters. After closing one eye patient was asked to mention the direction of each Es in the chart. By noting the last line in which the patient correctly identified the direction of E, visual acuity was noted. Then another observer assessed the visual acuity with HOTV at a distance of 3meters. The patient was given a card with HOTV and was asked to match the letters on the chart. Snellens equivalent of 6/6-6/60 can be estimated by this method.

Results

The study group included 48 adult illiterate patients. 58.33% (n=28) were females. The mean age of this group was 60.23 with SD of ±9.518. The cases were distributed normally (fig 1). 79 eyes satisfied the inclusion criteria. Distribution of cases based on their age and gender is given in table 1.

Visual acuity with E chart and HOTV were dissimilar in 62.03% (n=49 eyes). Majority showed better vision with HOTV than with E chart as evidenced in fig 2. Among this 49 eyes, 81.6% (n= 40) eyes, HOTV overestimated the vision. An improvement of one line was observed in 82.5% (n=33 eyes). 12.5% (n=5) showed an improvement of less than one line Snellen's visual acuity. The rest 5% (n=2) showed more than one line improvement. Out of 49 eyes, 18.36 % (n=9) eyes which showed worsening of vision on HOTV test, 88.9% (n=8) showed a worsening of one line, 11.1% (n=1) showed less than one line. This observation was statistically significant (p 0.000). The distribution of cases is given in fig 3. Age and gender had no effect on the results of visual acuity with each charts.

The difference in the visual acuity was more evident among those with vision less than 6/9 (table 2). The observation was statistically significant (p =0.000).

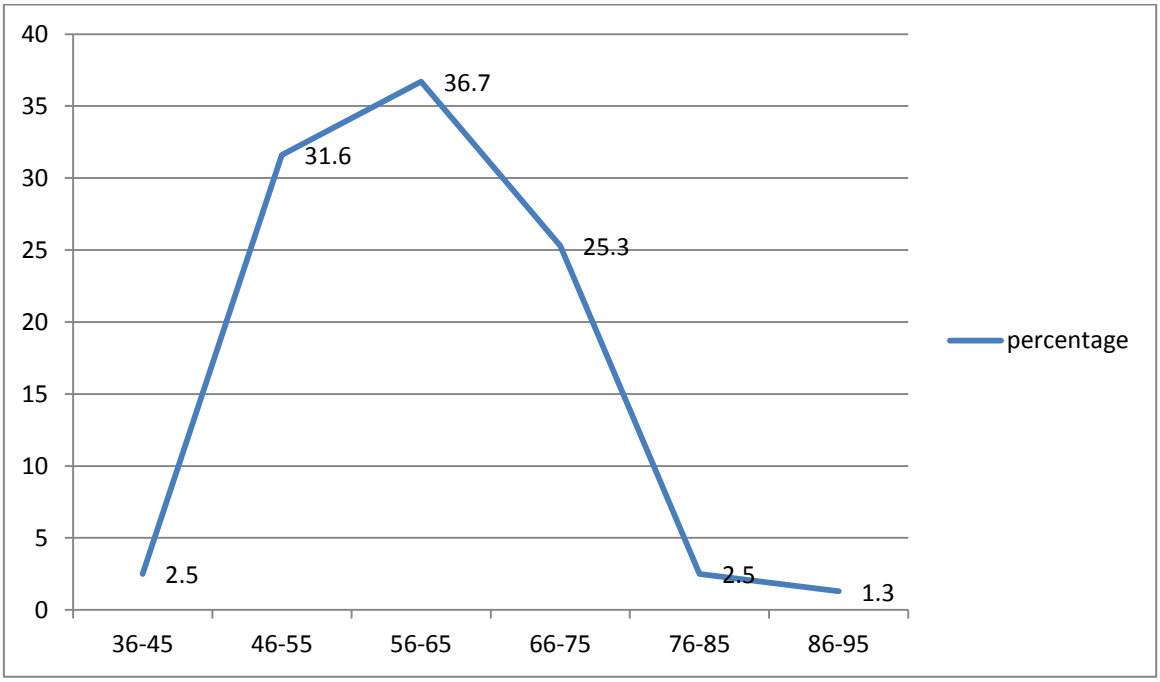

Fig 1 - Normal distribution of cases based on age

Table – 1 – Distribution of cases based on gender, age and vision tested by HOTV and E chart

Factor		N	%
Gender	male	20	41.67
	female	28	58.33
Age group	36-45	2	2.5
	46-55	25	31.6
	56-65	29	36.7
	66-75	20	25.3
	76-85	2	2.5
	86-95	1	1.3
HOTV vs E chart	Similar VA Dissimilar VA	30 49	39.97 60.03
	overestimation	40	81.63
	underestimation	9	18.37

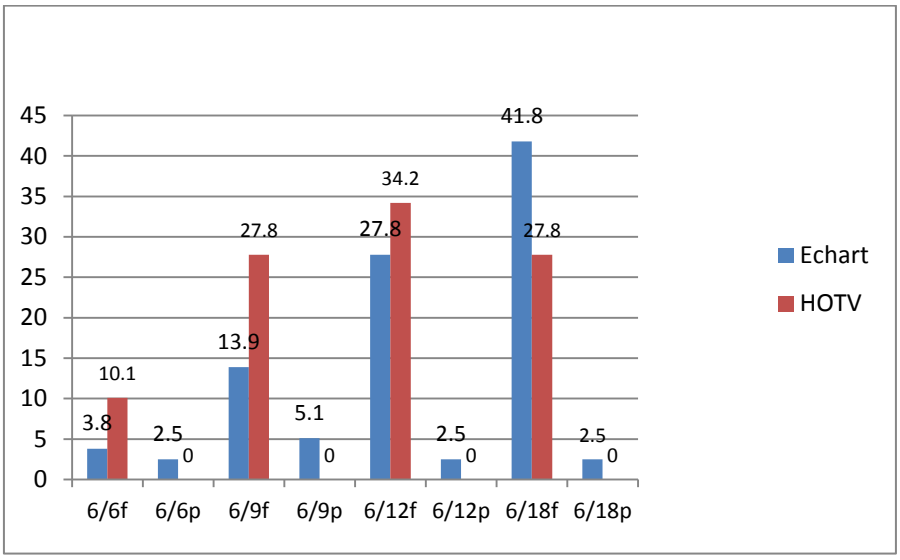

Fig 2 – Comparison of visual acuity based on E chart and HOTV

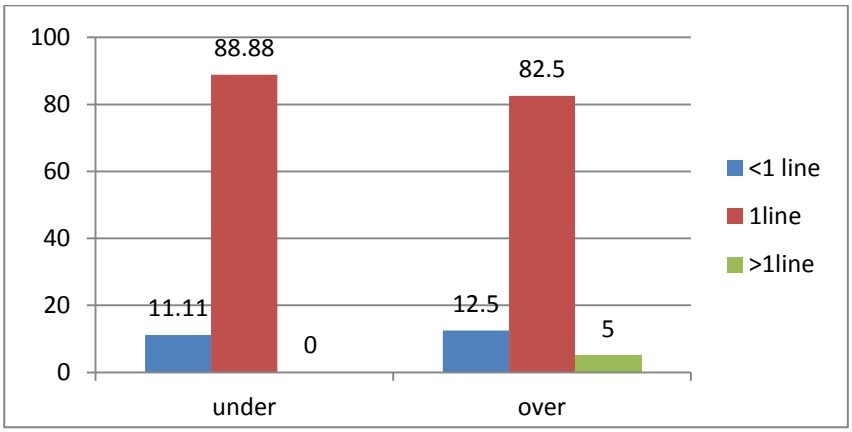

Fig 3 – Distribution of cases based on over and underestimation

Table 2- Comparison of cases based on actual visual acuity

		Visual acuity based on HOTV				
		6/6	6/9	6/12	6/18	Total
Visual acuity based on E chart	6/6	2	1	0	0	3
	6/6p	1	1	0	0	2
	6/9	4	6	1	0	11
	6/9p	1	2	1	0	4
	6/12	0	9	8	5	22
	6/12p	0	1	0	1	2
	6/18	0	2	17	16	35
Total		8	22	27	22	

Discussion

Visual acuity assessment is the most ubiquitous measurement of visual function[8,9]. It is the function of diopteric apparatus of the eye, retina, visual pathway, and central nervous system. The four components of visual acuity are minimum visible, resolution, recognition, and minimum discreminible (hyper acuity). In clinical practice, the measurement of visual acuity is the measurement of minimum resolvable, 30- 60 seconds of an arc. Therefore all clinical tests (eye charts) for measuring visual acuity are based on the threshold of the one minimum resolvable. But both the Snellen's E chart and HOTV chart are designed to assess the ability to recognize the stimulus (Recognition acuity). Visual acuity assessment depends on the optotype used [10]. Even if the critical details of different optotypes appear under the same visual angle, the ability to recognize them differs[10]. Differences in the lower visual acuity range cannot be excluded with these optotypes since they are evaluated in normal individuals with good visual acuity [10]. Since both charts are not in Log MAR units, Visual acuity score cannot be obtained [11]. Many commonly used visual acuity charts have some easily recognizable optotypes than others optotypes but visual acuity measurements are interpreted under the assumption that all optotypes are equally recognizable[12].The inclusion of contour interaction (crowding phenomenon) in visual acuity tests is important to avoid the over-estimation of visual acuity[12].

Snellen E chart is commonly used to assess visual acuity in preschool children, illiterate adults and in countries where people do not use the alphabet in their native language. This chart consists of series of black Es on a white background arranged in lines each progressively decreasing in size. These letters are arranged in such a way that they subtend 5 minutes of an arc at the nodal point of the eye at a particular distance. For a normal individual the direction or orientation of the topmost letter can be identified from a distance of 60 meters. Subsequent lines can be identified from a distance of 36m (meters), 24m, 18m, 12m, 9m, 6m and 5m respectively. Illiterate E cutout and Tumbling E tests are variations of this test, used specifically in preschool children. In illiterate E cutout test, the child is given cutout of E to match with isolated Es of varying sizes. In Tumbling E test different sizes of Es with different orientations are marked on four sides of a dice. The test distance of each of these tests vary.

HOTV chart introduced by Sheridan to assess visual acuity in preschool children consists of a card with HOTV to match with letters on the chart. The HOTV test is modification of the STYCAR test (Screening test Young Children and Retardates)[12]. As in standard Snellen's chart the letters in the HOTV chart have vertical symmetry [12]. According to Amblyopia Treatment Study group single optotype HOTV test surrounded by crowding barshave reported good testability and excellent test-retest reliability with children[12]. In this chart also each letter subtends an angle of 5 minutes of an arc at the nodal point and the letters are separated by the width of one optotype. The usual test distance is three meters. Snellen's equivalent of 6/6-6/60 can be estimated with this test.

Visual acuity assessment among elderly illiterates, especially matching of patterns is a tedious process due to the uncooperative behavior with relevance to the age group. Though the visual requirements in day to day activities amongst these subjects are similar to a literate individual, they are often sidelined by their inability to read and write. The demand for quality distant and near vision has to be satisfied by optimal spectacle prescription and residual refractive correction after intraocular procedures like cataract surgery. This requires standardization of visual acuity testing among such subjects. Elderly especially illiterate have cognitive impairment in recognition and orientation which interfere with vision assessment[13]. The subject easily gets tired and confused of many repetitions and also starts guessing in an effort to complete the test. Guessing is easy as the expected answer pertains to four directions only. Since the E-chart and HOTV has four optotypes the guessing rate is 25% with each of them (four different response options) [2].

According to Moganeswari D etal among preschool children E chart had 99% sensitivity and 15% specificity whereas HOTV visual acuity chart had good repeatability and slight variability[2]. The HOTV chart has better specificity and positive predictive value than E-chart to detect visual acuity worse than or equal to 0.2 log MAR[2].HOTV and E-chart showed visual acuity difference in various studies[2].

We observed that among a majority, visual acuity tested with HOTV at a working distance of three meters was better than that tested with Snellen's E chart at a distance of six meters. It was independent of their age or gender. The difference was marked among those with visual acuity less than 6/9. In various studies large difference in visual acuity were obtained in lower visual acuity[11]. HOTV charts are considered better than E charts in assessing vision in preschool children[3]. This could be extrapolated to adults as well. Our study could be considered as a pilot work in this regard. The closer working distance, ease of recognition of shapes, less demand on direction sense, need for less dexterity and cognitive demand may be the factors in favor of HOTV like tests among adults. However a small proportion of participants had poorer vision with HOTV. Generalized decline in retinal sensitivity due to coexistent cataracts (though visually not significant) with associated optical aberrations and glare may be contributory. Further studies are warranted to rule out the effects of such confounders.

The difference in visual acuity with different charts may be due to difference in chart construction and examination protocols[14]. Since both the degree of crowding (contour interaction) and the legibility of the optotype can influence the measurement of visual acuity, interpretation of very small changes in visual acuity should be done with caution[12]. According to Nicola S Ansticeetal testing distance is an important factor influencing visual acuity measurements in children, shorter working distances such as 3.0 or 1.5 metres allow for excellent repeatability and reliability andwhich significantly improves co-operation and concentration[12]. The change in chart design and changing from one optotype chart to another as in picture and letter charts may influence the visual acuity[12]. To ensure accurate, reliable and repeatable measurements in pediatric populations uniform principles need to be employed[12].

Small size of the data limiting statistical power, absence of uniform number of cases within each subgroups and lack of use of log MAR charts for comparison were the main limitations of the study.

Conclusion

The response of adult illiterate to visual acuity testing with HOTV differs from the results with E chart. The HOTV overestimate the visual acuity, which is independent of age and gender of the patient. The difference was marked among the patients with visual acuity less than 6/9. One line difference was observed in majority. So HOTV

chart can be considered as a better option for visual acuity assessment in adult illiterate.

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