

A Specially Designed Bengali Near Vision Chart For Normal Vision And Visually Challenged Subjects

Presenting Author :

Dishari Pathak, Bachelor of Optometry (6th semester)

Guide:

Sirajum Monira Choudhury

INTRODUCTION

Visual acuity testing allows to quantify the degree of vision for both far and near vision which monitors progression or stability of ocular pathology. ^[1] Good near vision is a prerequisite for many occupations in modern approach.

So, it is becoming increasingly necessary to use a method that reproducibly measures the visual functions-good predictors of real world vision. Various vision charts for both distance and near have been constructed in different Indian languages like Hindi, Tamil and Gujarati etc. in consideration of the language specific influence on cognitive tasks involved in reading. ^[2] Bengali is spoken by 8.03% of Indian population and 240 million people around the globe. ^[3] 86.22% Bengali speakers are there in West Bengal. There are 2million PWDs in West Bengal. Among them 21.04% are visually impaired. ^[3] All these factors justify a very urgent development of tools that are able to accurately measure the visual functions among the Bengali population. However there is no standardized near vision chart in Bengali. Thus a gap is created between Bengali literate people and eye care system delivery.

AIM AND OBJECTIVE

This study aims to construct and validate new log MAR near visual acuity chart in Bengali language. The objective is to evaluate the effectiveness and usability of the specially designed Bengali near vision chart among normal vision individuals and various categories of visually challenged subjects.

LITERATURE REVIEW

<u>Year</u>	<u>Authors</u>	<u>Article Name</u>	<u>Conclusion</u>	<u>Research Gap</u>
2013	Asimina et al	Development and validation of the Greek version of the MNREAD acuity chart	Constructed a standardized near visual acuity chart for Greek speakers	250 million native Bengali speakers in the world as of 2024 – a huge population are Bengali speakers
2014	Antonnio et al	Design of short Italian sentences to assess near vision performance	28 short Italian sentences for Italian version of the Radner Reading Chart developed	
2016	Andreia et al	Development of the Portuguese version of a standardized reading	27 short sentence optotypes for the Portuguese version of the	

		test: the Radner-Coimbra Charts	Radner Reading Charts developed	
2016	Inger Christine Munch	The Danish version of the Radner Reading Chart: design and empirical testing of sentence optotypes in subjects of varying educational background	Danish version of Radner reading chart constructed	
2017	Balsam Alaabdulkader	Toward developing a standardized Arabic continuous text reading chart	Arabic near visual acuity chart created similar to Colebrander chart	
2018	Kalpa, Deepmala et al	Construction and validation of logMAR visual acuity charts in seven Indian languages	Constructed a distance visual acuity chart in seven different languages	Vernacular near visual acuity chart is very essential

METHODS

The study followed a cross-sectional, double-blinded design conducted at the Pailan Eye Clinic (Optometry Division) over a duration of 1.5 years. The research was internally funded using institutional resources. Ethical approval was obtained from the Institutional Ethics Committee to ensure compliance with research standards. The study was conducted in three phases: the first phase involved word selection, followed by chart construction in the second phase, and finally, chart validation in the third phase.

Phase 1: Word Selection

- Selection of 500 common Bengali words from the Bengali textbooks and local newspapers - readable by all
- The way of word selection - Bengali language is an abugida or a syllabic alphabet where all consonants have an inherent vowel embedded within it
- 150 words with four, seven and ten syllable were selected from total 500 number of words
- The selected 150 words have been printed in three commonly used Bengali typographic styles : *SOLAIMAN LIPI*, *SIYAM RUPALI* and *KALPURUSH*
- Staffs and students having Bengali as their native language were recruited for the word selection phase

In Phase 1 of the study, word selection was carried out with a total of 50 subjects aged between 18 to 35 years, with a mean age of 24.92 ± 4.81 years. The inclusion criteria for participants were a best corrected visual acuity (BCVA) greater than 6/6, normal contrast sensitivity, refractive errors less than 1 diopter (myopia, hypermetropia, astigmatism), normal phorias (based on Morgan values), and a minimum educational qualification of 10th

standard. Subjects with a history of ocular surgery or pathology, or those using any form of eye drops, were excluded from the study. Participants were instructed to read words aloud from three different typefaces, with their responses recorded in audio format. The room illumination was maintained at a normal level. Reliability was calculated using the formula:

Reliability = [(Total number of times word read – number of times it was mispronounced, omitted, or unreadable) / Total number of times word read] × 100

Phase 2: Chart Construction

- The words were typed in KALPURUSH - the most readable among other typefaces
- The chart has 15 rows from the range of N80 point to N3.2 point print following the logarithmic progression of size. The logMAR progression was employed in such a way, in which the upper row is larger than the next lower row with the constant ratio of 0.1 log unit.
- Chart printed on A4 size; off white matte paper - 100% contrast setting in Coral draw software.
- Two sets of chart were constructed for the repeatability measurement
- 2 words in first 3 lines: one 7 syllable and one 4 syllable
- 3 words in next 3 lines: one 10 syllable, one 7 syllable and one 4 syllable
- 6 words in next 9 lines: each type of word were arranged randomly

Phase 2: Chart Validation

In Phase 3, chart validation was conducted through reliability and repeatability testing. A total of 100 subjects were recruited from the Optometry clinic and categorized into four groups: children, adults, presbyopia patients, and individuals with mild low vision impairment. All participants were bilingual, comfortable in both Bengali and English. Repeatability testing involved the use of two different sets of the new Bengali word reading chart, with testing conducted on the better eye only. A minimum 30-minute break was maintained between two repeated measurements to ensure accuracy. The validation was carried out by a single optometrist to minimize bias. The reliability assessment was performed using BWRC and BLWRC, with charts selected randomly. The endpoint was determined when 50% or more of the words were read incorrectly. A correction factor was applied based on working distance, which was standardized at 40 cm.

For deviations, adjustments were made as follows: 32 cm = 1 point closer, 25 cm = 2 points closer, 20 cm = 3 points closer, 16 cm = 4 points closer, and 12.5 cm = 5 points closer. Each point corresponded to a 0.10 log unit correction. If the working distance (WD) exceeded 25 cm, the correction factor was deducted; if it was shorter than 25 cm, it was added.

RESULTS

1. Legibility of Bengali Words

To ensure legibility and reliability, Bengali words of varying syllable counts were evaluated. A total of 24 four-syllable words and 24 seven-syllable words that demonstrated a reliability score of 98% or higher were selected. Additionally, 21 ten-syllable words were chosen based on a minimum reliability threshold of 90%. In total, 69 words out of an initial pool of 150 were finalized for constructing the Bengali Word Reading Chart, ensuring high readability and performance accuracy.

2. Repeatability of Bengali Word Reading Chart

Repeatability testing of the Bengali Word Reading Chart was conducted across four participant groups—adults, presbyopia, low vision, and children. For the adult group, the mean difference between the two Bengali charts was 0.02 logMAR, which was not statistically significant ($P=0.1102$). Similarly, for the presbyopia group, the mean difference was 0.01 logMAR ($P=0.830$), and for the low vision group, it was 0.008 logMAR ($P=0.0161$), both statistically insignificant. For the children group, the mean difference was 0.015 logMAR, again not statistically significant ($P=0.103$), confirming good repeatability across groups.

3. Validation of the Bengali Word Reading Chart

Validation of the Bengali Word Reading Chart was conducted by comparing its reading function results with the established Bailey-Lovie Word Reading Chart. The analysis revealed statistically significant differences in three of the four participant groups. For adults, the mean difference was -0.12 logMAR ($P<0.0001$), for presbyopia -0.072 logMAR ($P=0.0005$), and for children -0.134 logMAR ($P<0.0001$), indicating a significant improvement with the new chart. However, for the low vision group, the mean difference was only 0.01 logMAR, which was not statistically significant ($P=0.609$), showing comparable performance in this specific category.

DISCUSSION

This study showed good correlation between newly designed Bengali word reading chart and Bailey –Lovie word reading chart. According to Lovie-Kitchin a 0.20 logMAR change visual acuity can be considered practically, means up to two lines change in visual acuity can be taken as a real change. The results are consistent and comparable to Bailey-Lovie word reading chart. Bland – Altman plot for all 4 groups showed lower limit of agreement which indicate the new Bengali word reading chart yields a valid measures of visual acuity.

CONCLUSION

Newly designed Bengali word reading chart provides an accurate and acceptable tool for Bengali language speakers compared to Bailey-Lovie word reading chart. Our chart shows high test-retest repeatability. The chart are an added advantage in vision screening programme and can also be used in camps and clinics.

LIMITATION

We found few lack also in the process of chart construction. The same examiner took all measurements throughout the procedure, we could not evaluate inter - observer variation. As mentioned earlier, there is no specific way followed in test-retest procedure in all studies done previously.

Reference:

- [1] Ricci, F., Cedrone, C., & Cerulli, L. (1998b). Standardized measurement of visual acuity. *Ophthalmic Epidemiology*, 5(1), 41–53. <https://doi.org/10.1076/oep.5.1.41.1499>
- [2] Zhang, J., Zhang, T., Xue, F., Liu, L., & Yu, C. (2007). Legibility variations of Chinese characters and implications for visual acuity measurement in Chinese reading population. *Investigative Ophthalmology & Visual Science*, 48(5), 2383. <https://doi.org/10.1167/iovs.06-1195>
- [3] Census of India 2011 - language atlas - India
- [4] Bengali at *Ethnologue* (27th ed., 2024)