Design and Validation of Persian Near Reading Card: A Pilot Study

Ebrahim Jafarzadehpur, PhD[1] • Hassan Hashemi, MD[2] • Tahereh Abdollahinia, MSc[1,2]
Reza Norouzirad, MSc[3] • AbbasAli Yekta, PhD[4]
Hadi Ostadimoghaddam, PhD[4] • Mehdi Khabazkhoob, MSc[5,2]

Abstract

***Purpose*:** Design and establishment of Persian near reading card for clinical use and practice

***Methods*:** At first, card dimension, word and character size and specifications were calculated. Then, English near reading card, Richmond Product INC, was considered as a template. Context and syntax contribute to reading accuracy and efficacy of the Richmond card was considered for designed Persian card. Near reading acuity of 50 Persian native languages, that could read conventional English texts, was compared with three near reading card (two designed Persian cards and Richmond card). These cards randomly presented to the subjects. Visual acuity (VA) was randomly measured with and without a cylindrical lens (+2.00 x 90) for all participants. VA results and reading time were compared in three cards.

***Results*:** Correlation coefficient of first and second Persian reading card were 0.824 and 0.817 ($p<0.001$) respectively. Plus cylindrical lens would change the reading time and VA in all reading cards. Kappa index of agreement in these three cards was acceptable (61.1%). Comparison of Persian cards and English card showed high sensitivity (97.5%). Specificity for 1.25 MAR cut point for these charts was 55.6%. Reading time for Persian card was less than English card.

***Conclusion*:** These finding implies that Persian near reading card may be used for near reading acuity. It may be very useful for evaluation of visual function of Iranian and other Persian language persons at near distance.

***Keywords*:** Visual Acuity, Near Reading Card, Persian Language

Iranian Journal of Ophthalmology 2013;25(3):216-221 © 2013 by the Iranian Society of Ophthalmology

1. Optometry Department, Iran University of Medical Sciences, Tehran, Iran
2. Noor Ophthalmology Research Center, Noor Eye Hospital, Tehran, Iran
3. Dezful University of Medical Sciences, Dezful, Iran
4. Department of Optometry, School of Paramedical Sciences, Mashhad University of Medical Sciences, Mashhad, Iran
5. Department of Epidemiology, Faculty of Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Received: May 20, 2013
Accepted: October 14, 2013

Correspondence to: *Mehdi Khabazkhoob, MSc*
Department of Epidemiology, Faculty of Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran, Tehran, Iran
Email: khabazkhoob@yahoo.com

Introduction

Visual acuity (VA) measurement is one of the most important clinical procedures in optometry and ophthalmology.[1] Different VA charts may be used for different purposes in different centers.[2] Regardless of test type, patient instructions and education should be considered as any other subjective tests.[3] Patient misunderstanding about testing procedure may be seductive.[3] Therefore, scientist tries to simplify the VA charts and increase the accuracy, sensitivity and performance of clinical VA chart.

Letters recognition and spatial resolution are most common method for far and near clinical VA charts.[4] Landolt C and E chart are the most common letter charts.[4] However, reading chart may be more complicated for patients. Spatial resolution and reading capabilities and skills are very important for reading chart results.[5] Reading charts are usually used at near distance. Near vision quality and quantity and better estimation of near vision performance may be achieved by near reading chart.[5] Accommodation status and stability, in usual near work may be evaluated by near reading charts.[5]

Inconsistency of patient language or lack of language proficiency is the most important limitation for reading chart.[6,7] Therefore, English near reading chart could not be used for every literate patient in any country.

Essentially, many letters in Persian language have many dots. These "dots" increase the spatial frequency of letters.[6,7] Arabic language is the nearest language to Persian but, four high spatial frequency letters (گ، پ، ژ، چ) are exclusively in Persian. Additionally, many Iranian are not very fluent in Arabic language. Persian near reading card design may be more sophisticated than English or Arabic card. Moreover, the spatial frequency is not the only problem in card design, high perceptual level of reading card is another issue.[8] Therefore, Persian near reading card should be individually designed for Persian speakers.

Millions of people around the world speak, write and communicate with Persian language. Their abilities and fluency in Persian language is obviously better than any second language. Therefore, English near reading chart for many people with native Persian language may be useless and sometime misleading. Standard Persian near reading chart may be very useful for routine and specific clinical examination. Near reading chart may be essential for low vision patient, vision therapies, visual efficiency and reading performance, near glasses prescription and many other clinical procedures. The first Persian near reading card has been designed for near vision evaluation. Like many of the charts design; geometrical, physiological, optical, language and literatures parameters and factors should be considered for a standard near card.

Methods

This study was registered with postgraduate review board of rehabilitation school of Tehran University of Medical Sciences (TUMS) and it was approved by ethical committee of rehabilitation school of TUMS (Reg. cod 2127/260/91).

Two English reading near card; from Richmond Products INC (CAT No 11968R) and Bernell Vocational near test card (BC1196670) were chosen. Font style, number of letters in each sentences and number of row in each acuity line, the size and number of print extending from the bottom of the descenders (under the line) to the top of the ascenders (above the line) were evaluated in two cards. Each letter was magnified (10X) and projected on a screen with a modified lantern projector system. This allows accurate measurements of each letter.

According to the letters that have been used in the English near reading cards, specific letters selected in Persian language. An exact correspondence course in this case did not exist in Persian and English languages. English words are often vertical, but Persian letters are mostly horizontal. "B lotus" font was used for Persian reading cards.

Students from three English institutes were randomly chosen. Number of subject in each institute was proportion to the total number of upper intermediate student in each center.

Fifty upper intermediate English students were participated in the study. The 64% of participant were female and the average of their age was 27.8±4.1 years.

Literary difficulties and context themes are another issue in reading cards. Different

studies show that non-visual information, such as literary information, familiarity with text and previous knowledge about the subject may be very important in reading.[5] Therefore, a simple and new text was considered for Persian card. Each row was about a different subject. The participant could not guess next line easily.

Content and meaning of subject in reading card is another issue. Some social, political, economical, religious and other subject that is controversial may affect reading achievements.

Two Persian reading cards with two different fonts with the same size were designed. As the font designed may influence on the font legibility, we choose two common Persian fonts.

Persian near reading card design was according to these two English cards, but comparison of two English near reading cards did not show any significant differences. Context, font and other geometrical, physiological, optical, language and literature parameters and reading performances were not significantly different. Richmond card (Richmond Products INC CAT No 11968R) was randomly selected for clinically comparison of English and Persian cards (Appendix 3, page: 256). Two Persian cards with the same parameter presented to participants. We assigned two different cods for two Persian cards. The practitioner was not aware of the same cards. Near VA for every participant was measured with three cards; two Persian cards and one English card. All of the cards had the same VA rows; 0.4 M, 0.5 M, 0.63 M, 0.8 M, 1 M, 1.25 M, 1.6 M, 2 M (Appendix 4 , page: 257).

Three cards randomly presented to them. VA was measured without and with a plus cylindrical lens (+2.00 X 90) over correction.

As the VA is non linear visual response and it changes as a logarithmic function. However its small optotypes may not show very many differences but larger optotype may be differently reported in subject with lower VA. Therefore we must evaluate and compare different parts of these charts.

VA results converted to minimal angle of resolution (MAR). Statistical evaluations for three cards could be easily accomplished with M.A.R that is a quantitative parameter.

SPSS software were used for descriptive (mean, standard deviation, minimum and maximum) and analytical (pair *T* test, Pearson correlation test) statistics. Sensitivity and specificity was determined according to 1.25 MAR ($^{20}/_{25}$) cut point. Agreement of these charts was shown by kappa sensitivity and specificity.

Results

Comparisons of MAR (minimum angle of resolution) acuity in three charts with and without plus cylindrical lens are shown in table 1.

Comparison of MAR without lens in first Persian card with English card shows good correlation coefficient (0.824, $p<0.001$) but, when the subject sees the chats with plus cylindrical lens, correlation coefficient with these charts would be 0.756 ($p<0.001$). Correlation coefficient for second Persian card and English card without and with cylindrical lens was 0.817 ($p<0.001$) and 0.777 ($p<0.001$), respectively. VA with and without lens was significantly ($p<0.001$) different in pair *T* test in English and two Persian reading cards ($p<0.001$).

According to the $^{20}/_{25}$ cut point, two Persian card showed the same kappa coefficient (61.1%). These two Persian charts in comparison of English chart showed high sensitivity (97.5%) and moderate specificity (55.6%). Agreement of the first Persian card according to the MAR with English card was 0.752 and for second Persian card and English card was 0.742.

Reading time for two Persian and English card are shown in table 2. First and second Persian reading card showed low correlation coefficient with English card (0.503 and 0.322 respectively). Reading time for the first Persian card and English card was significantly different ($p=0.019$) but, it is not significantly different ($p=0.987$) for the second chart.

Correlation coefficient time with plus cylindrical lens was respectively 0.444 and 0.478 for first and second Persian card. No significant differences was seen in reading time in these chart after applying lens ($p>0.20$).

Table 1. The visual acuity (MAR) in three chart with and without lens

		Mean	Standard Deviation	Minimum	Maximum
Without cylindrical lens					
	Persian chart 1	1.24	0.22	1.00	2.00
	Persian chart 2	1.23	0.23	1.00	2.00
	English chart	1.33	0.30	1.00	2.50
With cylindrical lens					
	Persian chart 1	3.05	1.10	1.25	5.00
	Persian chart 2	3.05	1.05	1.00	5.00
	English chart	3.43	1.04	1.25	5.00

Table 2. The time (seconds) in three chart with and without lens

		Mean	Standard Deviation	Minimum	Maximum
Without cylindrical lens					
	Persian chart 1	19.44	5.61	8.00	35.00
	Persian chart 2	21.72	7.31	9.00	46.00
	English chart	21.80	7.74	10.00	45.00
With cylindrical lens					
	Persian chart 1	10.66	6.09	3.00	30.00
	Persian chart 2	10.08	6.68	2.00	35.00
	English chart	11.38	8.17	4.00	43.00

Discussion

Design of near reading card was the main aim of this study. It was accomplished according to the psychophysical principles of spatial resolution of the eye[9] and Persian alphabets. But, we must determine the sensitivity of these Persian reading cards. As we consider the Richmond Products INC (CAT No 11968R) as a reference reading card, our result shows Persian reading card is very sensitive (97.5%) reading card. Therefore, it may be used in general clinical practice. It means this reading card is good predictor for many visual problems and patients who are suffering from visual and reading problems. But, as its specificity is 55.6%, it implies VA may be underestimated for normal subjects. This finding is very common in non-English reading cards.[10] It may be due to specific pattern of alphabets in non English alphabets. Horizontal, vertical and oblique direction of alphabets and different forms of them in different words need different visual processing.[11]

Our result showed Persian near reading card is an acceptable and reliable reading card for person who speaks Persian. Many Persian speakers may live outside Iran. Therefore, Persian near reading card may be useful for them.

All the participants were Iranian and their native language was Persian. They studied English as a second language. Therefore, as it is shown in table 2 reading time with English card in all situations are more than Persian cards. Visual performance with different retinal blurred image may be different[12,13] because, VA is a logarithmic scale.[12,13] As it is shown in table 2, reading time for English card without cylindrical over correction is more than reading time for the same card with cylindrical over correction. The same results are shown for Persian cards. English reading card without cylindrical overcorrection showed significant ($p<0.05$) longer reading time than Persian card in the same situation, but with cylindrical overcorrection no significant differences could be found between English and Persian cards. Previous perceptual experiences, meridional magnification of cylindrical overcorrection, increasing the letter size may be the other reasons for these findings.[12,13] Reading speed and response time for different charts with the same language may be completely different.[6,7] For a person, VA results with Snellen chart may be different from reading chart at the same distance.[14]

Comparison of reading cards in different situation may be more informative about their relations or differences. Plus cylindrical lens provides a good comparison point. Plus cylindrical lens causes simple myopic astigmatism.[15] It changes the VA without any significant stimulation of accommodation. Other lenses (minus spherical or cylindrical lenses) may change accommodation demand; consequently stable accommodative response may not be predictable.[16] Plus spherical lens does not change VA significantly. Comparison of three cards with plus cylindrical lens reveals good relation of these three cards.

Applying plus cylindrical lens over the subject's eye may induce unpredictable VA. Many research reports show that there is not a linear relation between VA and refractive error.[17,18] In other word, as the refractive error increases the VA globally worsens, but many confounders many change the patient's responses. As we find correlation coefficient with English reading card and two Persian cards was decreased after putting plus cylindrical lens over correction. It is the same concept for using different near cards that may show different VA despite of the same chart language.[19]

MAR acceptable agreement of first and second Persian cards with English card (0.752 and 0.742, respectively) implies these Persian reading near card are suitable for effective and correct measurement of near reading acuity in Persian language. The main reason that we used two Persian reading cards was their different Persian fonts that were used in these cards. Two different B lotus fonts seem the same in this card.

Therefore, B lotus font Persian reading card would be suitable for patients that English reading near card is not usable or available for them. It is expected that these Persian near reading card may be widely used in Iran and other Persian language countries.

Some limitation should be considered for the study. First of all, there is not a standard validate or similar study for reading near card in Iran. As our study is preliminary study in this regard, we suggest evaluating these reading cards in a bigger population with different visual and ocular conditions. But, presenting the first Persian reading near card was the most important power of this study. Considering the psychophysical principle of chart design and Persian language, writing concepts and semantics rules of texts are the most important advantages of this study.

Many English reading card may show very different letter size. Therefore, usually in clinical practice it is recommended to declare the chart's name with patient VA. It may also recommend for these Persian reading card. However, long-term clinical practice and comparing the Persian reading card with other cards may improve its reliability.

Conclusion

These finding implies that Persian near reading card may be used for near reading acuity. It may be very useful for evaluation of visual function of Iranian and other Persian language persons at near distance.

References

1. Powers DW, Meador SA. Testing visual acuity in the emergency department: a simple method of correcting refractive error by using the hand-held ophthalmoscope. Ann Emerg Med 1986;15(7):818-9.
2. MacMonnies CW. Chart construction and letter legibility/readability. Ophthalmic Physiol Opt 1999;19(6):498-506.
3. Lovie-Kitchin J, Feigl B. Assessment of age-related maculopathy using subjective vision tests. Clin Exp Optom 2005;88(5):292-303.
4. Grimm W, Rassow B, Wesemann W, Saur K, Hilz R. Correlation of optotypes with the Landolt ring--a fresh look at the comparability of optotypes. Optom Vis Sci 1994;71(1):6-13.
5. Stifter E, König F, Lang T, Bauer P, Richter-Müksch S, Velikay-Parel M, et al. Reliability of a standardized reading chart system: variance component analysis, test-retest and inter-chart reliability. Graefes Arch Clin Exp Ophthalmol 2004;242(1):31-9.
6. Al-Salem M. A new Snellen's visual acuity chart with 'Indian' numerals. Br J Ophthalmol 1987;71(12):923-5.

7. Varadharajan S, Srinivasan K, Kumaresan B. Construction and validation of a Tamil logMAR chart. Ophthalmic Physiol Opt 2009;29(5):526-34.
8. Al-Salem M. Arabic reading types. Br J Ophthalmol 1986;70(4):314-6.
9. Charalampidou S, Nolan J, Loughman J, Stack J, Higgins G, Cassidy L, et al. Psychophysical impact and optical and morphological characteristics of symptomatic non-advanced cataract. Eye (Lond) 2011;25(9):1147-54.
10. Oduntan AO, al-Abdulmunem MA. Design of Arabic near visual acuity chart. Ophthalmic Physiol Opt 1997;17(2):158-60.
11. MacMonnies CW, Ho A. Letter legibility and chart equivalence. Ophthalmic Physiol Opt 2000;20(2):142-52.
12. Ricci F, Cedrone C, Cerulli L. Standardized measurement of visual acuity. Ophthalmic Epidemiol 1998;5(1):41-53.
13. Kniestedt C, Stamper RL. Visual acuity and its measurement. Ophthalmol Clin North Am 2003;16(2):155-70.
14. Zhang JY, Zhang T, Xue F, Liu L, Yu C. Legibility variations of Chinese characters and implications for visual acuity measurement in Chinese reading population. Invest Ophthalmol Vis Sci 2007;48(5):2383-90.
15. Remón L, Tornel M, Furlan WD. Visual acuity in simple myopic astigmatism: influence of cylinder axis. Optom Vis Sci 2006;83(5):311-5.
16. Wold JE, Hu A, Chen S, Glasser A. Subjective and objective measurement of human accommodative amplitude. J Cataract Refract Surg 2003;29(10):1878-88.
17. Rosser DA, Murdoch IE, Cousens SN. The effect of optical defocus on the test-retest variability of visual acuity measurements. Invest Ophthalmol Vis Sci 2004;45(4):1076-9.
18. Carkeet A, Lee L, Kerr JR, Keung MM. The slope of the psychometric function for Bailey-Lovie letter charts: defocus effects and implications for modeling letter-by-letter scores. Optom Vis Sci 2001;78(2):113-21.
19. Lueder GT, Garibaldi D. Comparison of visual acuity measured with Allen figures and Snellen letters using the B-VAT II monitor. Ophthalmology 1997;104(11):1758-61.