



Original Article

Comparative Reliability of Pelli-Robson and Lea Number Chart for Contrast Sensitivity Measurement

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Objective: To find reliability of Lea contrast sensitivity chart and its comparison with Pelli-Robson chart taking the latter as gold standard.

Method: Contrast sensitivity was measured with Pelli-Robson and Lea number contrast sensitivity chart. Study was conducted on 50 subjects having 6/6 visual acuity and no ocular disease which affect contrast sensitivity. To check reliability, tests were performed twice with six week interval on same individuals under same conditions.

Results: Contrast sensitivity tested with Pelli-Robson chart showed that right eyes of 92% subjects and left eyes of 94% individuals had same contrast sensitivity between both visits. Reliability of Lea contrast chart had been found low for both eyes of all fifty individuals using standard testing protocol. With Lea contrast chart, 40% subjects presented different results between both visits. Right eyes of 60 % individuals had same contrast level between both visits. Left eyes of 58% had same values between 1st and 2nd visit with Lea chart.

Conclusion: Pelli-Robson chart is more reliable to use in clinical practice. Lea contrast chart has relatively less test-retest repeatability than PR chart hence less reliable. Normal values are 1.65log and 1.25% with PR and Lea chart respectively.

Key words: Contrast sensitivity, Pelli-Robson (PR) chart, Lea contrast chart, Repeatability.



Introduction:

Contrast sensitivity is the capability of visual system to discriminate between object and its low contrast background. Contrast is produced by difference in amount of light reflected from surfaces. According to Michelson contrast is:

Contrast= $(L_{\text{target}} - L_{\text{background}}) / (L_{\text{target}} + L_{\text{background}})$ L is luminance of target and surrounding.

Activities like mobility, orientation, reading fluency, ability to recognize faces, night driving needs good contrast sensitivity. As items in our environment present having varying level of contrast so contrast sensitivity is more fine component of visual functions while performing tasks like distance judgment, walking and driving etc. Contrast sensitivity may be affected in many ocular conditions such as diseases of ocular media (lens, aqueous), retina and optic nerve (i.e. neuritis), glare.

An inverse relationship exists between contrast sensitivity and age of patient. It starts decreasing by the age of 40 or 50 years. It is interesting to know that contrast sensitivity is also associated with glare, it (glare) reduces the ability to see low contrast pattern especially in older patients.

There are many charts used in clinical practice to measure the contrast sensitivity. Pelli-Robson is a letter-based contrast sensitivity chart; consist of six letters in each row. It has good repeatability. Due to its significance, studies are conducted to compare new charts with it.

Lea contrast sensitivity chart is available in two formats 1) Lea symbol chart 2) Lea number chart. It is also available in flip cards, portable and reasonably priced. This chart does not accurately measure contrast

sensitivity. This letter size subtend different angle at the eye when seen at different distances.

Wolcott notes: "Whatever validity is, I apparently 'have' or 'get' or 'satisfy' or 'demonstrate' or 'establish' it. . ." In psychometric theory, the idea of reliability is a functional method to present quantitative measurement of error. It is essential to monitor different causes of fault that may affect the validity of test used. It can differ among practitioners or viewers and comes out when different types of same test are used at different times called test-retest reliability.

Materials And Methods:

It was comparative cross sectional study, conducted in College of Ophthalmology and Allied Vision Sciences (COAVS), from August 2014 to December 2014. Fifty patients aged between 20 to 40 years were included in study by using non probability convenient sampling method. Dependent variables were Contrast sensitivity by Pelli-Robson chart and Contrast sensitivity by Lea contrast sensitivity chart while independent variables were comprised as age, gender and visual acuity. Verbal and cooperative clients, Between 20 to 40 years of age, and having BCVA equal to 6/6 were included in study. Patients, who were mentally retarded, uncooperative persons had ocular diseases that affect contrast sensitivity were excluded. Distance visual acuity was assessed by using Snellen visual acuity chart, and contrast sensitivity was assessed with Pelli Robson and Lea number contrast sensitivity chart. Reliability of two charts was assessed by filling a self-structured proforma. Data was recorded and entered in Statistical Package for Social Science (SPSS version 20.0). The results were analyzed and tabulated by using same software.

Table.1 Reliability of Pelli-Robson chart for right eye Count

		contrast sensitivity at Pelli-Robson chart at 2nd visit of right eye			Total
		1.65	1.80	1.95	
contrast	1.50	2	0	0	2
sensitivity at	1.65	24	2	0	26
Pelli-Robson	1.80	0	14	0	14
chart at 1st					
visit of right eye	1.95	0	0	8	8
Total		26	16	8	50

Table.2 Reliability of Pelli-Robson chart for left eye Count

	contrast sensitivity at Pelli-Robson chart at 2nd visit of left eye			Total	
	1.65	1.80	1.95		
contrast sensitivity at Pelli- Robson chart at 1st visit of left eye	1.65 1.80 1.95	20 0 0	2 18 0	0 0 10	22 18 10
Total		20	20	10	50

Table.3

Contrast sensitivity at Lea contrast sensitivity chart at 1st visit of right eye *
Contrast sensitivity at Lea contrast sensitivity chart at 2nd visit of right eye
Count

	contrast sensitivity at Lea contrast sensitivity chart at 2nd visit of right eye			Total	
	5%	2.5%	1.25%		
contrast sensitivity at Lea contrast sensitivity chart at 1st visit of right eye	5% 2.5% 1.25%	4 0 0	4 10 8	0 8 16	8 18 24
Total		4	22	24	50

	contrast sensitivity at Lea contrast sensitivity chart at 2nd visit of left eye				Total	
	10%	5%	2.5%	1.25%		
contrast sensitivity at Lea contrast sensitivity chart at 1st visit of left eye	5% 2.5% 1.25%	2 0 0	4 2 1	2 9 9	0 5 16	8 16 26
Total		2	7	20	21	50

Table 1 is showing that 46 (96%) subjects had same contrast sensitivity values for right eye between 1st and 2nd visit with Pelli-robson chart. Only 8% came with different results at 2nd visit. Table 2 represents the results for left eye as 96% individuals were found to have same results between both visits with Pelli-robson chart. However 4% subjects had different results from 1st visit. Table 3 illustrates that 60% persons showed same and 40% exhibited different contrast sensitivity values for right eye between 1st and 2nd visit with Lea

contrast sensitivity chart. Table 4 indicates that 58% subjects gave same results at 1st and 2nd visit for left eye with Lea contrast chart whereas 42% individuals had different results between both visits demonstrating poor repeatability. P value for all is .000

Discussion:

The clinicians all over the globe are in consensus about the type of contrast sensitivity chart to be used for



research. Importance of having same standards of CS measurement, in clinical trial as well as research, is much significant when apply to outcome from clinical practice. Accurate evaluation of CS is essential as it help in early diagnosing conditions and also to monitor the succession of diseases like glaucoma, cataract etc.

Reeves et al conducted a study which showed that Pelli-robson gives two triplet differences between two visits while evaluating reliability. But our study demonstrates only one triplet difference in two visits of six weeks. This may be due to the fact that in that study patient having minor diseases also included but in this study emmetropes having no pathology were considered.

Results of this study proved that Pelli-robson chart is more consistent to use for the measurement of contrast sensitivity in persons having normal visual acuity. As conducted in this study that Lea contrast chart is less reliable as compared to Pelli-robson chart, which is relevant to a study conducted by Leat SJ et al. in 2004 according to that Lea contrast symbols do not demonstrate good compatibility with PR chart. And it was found that Lea chart is a tool which cannot measure actual sensitivity value for contrast. Reason behind this was floor effect. Above data give almost same results corresponding to this research. This illustrates Pelli-Robson chart to be more consistent than Lea chart. Lea chart is not sensitive enough to provide useful information for clinician.

Age and gender are other potential sources of variability. Limited range of individual in research demonstrates that age is not related to variation in results of either eye. CS is related to age as it decreases with increasing age but Repeatability is not associated with any definite age limit. For any test there is no change in variability with age.

Most of the persons appear to have 1.65log unit on PR chart and 1.25% on Lea chart when visual acuity is 6/6. These values can be considered as normal for emmetropes. According to a previous study carried out in 2004 to find out the normal values for Pelli-Robson chart, it was proved that adults have 1.65log contrast sensitivity and young show 1.85log unit as normative value.

Conclusion:

Pelli-Robson chart is more reliable to use in clinical practice. Lea contrast chart has relatively less test-retest repeatability than PR chart hence less reliable. Normal values are 1.65log and 1.25% with PR and Lea chart respectively.

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