

# Is the high contrast visual acuity chart a good predictor of improvement in visual acuity with low vision aids?

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**Purpose:** To assess whether the objective improvement seen with HCVA chart using LVAs correlates with subjective improvement in the quality of life as measured on low vision quality of life (LVQOL) questionnaire of such patients. **Methods:** This was a prospective, consecutive, observational study. Objective improvement in visual function was assessed using LVAs with high contrast LogMAR visual acuity chart for near and distance. Subjective improvement for distance was assessed using LVQOL score for “distance mobility and lighting”, whereas for near it was assessed using the LVQOL score for “near and fine work”. A total of 46 patients completed one follow-up after low vision trial and were included in the study. **Results:** Improvement in objective visual acuity was highly significant for both near and distance ( $P < 0.001$ ) with LVAs. LVQOL score improved from 65.85 to 76.83 after one of using low vision aids ( $P < 0.001$ ). The improvement in LVQOL score for distance and mobility was also highly significant (2.55;  $P < 0.001$ ); and so was for near and fine work (5.89;  $P < 0.001$ ). However, Spearman rank correlation coefficient showed no correlation between improvement in visual acuity for distance and LVQOL score improvement for distance ( $r_s = -0.086$ ;  $P = 0.57$ ). For near also, improvement in acuity did not correlate with the LVQOL score improvement for near and fine work ( $r_s = 0.036$ ;  $P = 0.81$ ). **Conclusion:** No statistical correlation was observed between the improvements measured by objective HCVA charts and subjective improved as perceived by the patient after use of low vision devices.

**Key words:** Low vision aids, low vision, quality of life, visual acuity

The high contrast visual acuity chart (HCVA) has been utilized for visual acuity measurement since the time Snellen described his chart in 1862.<sup>[1]</sup> There is considerable debate about the use of other forms of vision testing, as HCVA testing does not reflect the contrasts available in everyday life.<sup>[2-4]</sup> This lacuna becomes even more magnified in visually impaired (VI) patients where contrast sensitivity is substantially decreased.<sup>[5,6]</sup> However, VI patients are still identified in the clinic based on the acuity from high contrast charts. The WHO working definition of low vision is also based on the visual acuity derived from such charts.<sup>[7]</sup> Though contrast sensitivity, low contrast acuity, real-life simulations are done in low vision clinics, the outcome of low vision aids is still measured in terms of HCVA charts.

Another method of evaluating the effectiveness of low vision aids is the validated Low Vision Quality of Life (LVQOL) questionnaire. Wolffsohn *et al.* designed LVQOL questionnaire is an internally consistent, reliable, and fast method for measuring the vision-specific quality of life of the visually impaired in a clinical setting. It is a validated 25 item questionnaire with a minimum score of 0 (low quality of life) and a maximum of 125 (high quality of life).<sup>[8]</sup>

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Though the LVQOL has repeatedly been shown to be a reliable indicator of visual outcome after low vision aids (LVAs), its correlation with the improvement seen in the HCVA chart with LVAs has not been assessed previously.<sup>[8,9]</sup> It is crucial, as the HCVA chart is still the main criteria to identify low vision patients and also to dispense low vision aids to them. In our study, we aim to find out whether the objective improvement seen with the HCVA chart using LVAs correlates with the subjective improvement in the quality of life of such patients.

## Methods

The study was approved by the institutional ethics committee and conducted according to the principles of the declaration of Helsinki. This study was a prospective observational study carried out in Central India from July 2015 to December 2016.

All patients referred to the Low Vision Clinic were included, after ruling out any treatable ocular condition. Patients previously using low vision aids, those having a mental disability or unable to understand the questionnaire, those with no perception of light in either eye were excluded. Written

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and verbally informed consent was taken from all patients recruited for the study.

This study included 48 cases. It was calculated based on the number of patients visiting the Low Vision Clinic of the institute in the past 24 months, with a 95% confidence level and 5% margin of error. The effect size was 1.5 and a power of 80%.

All patients were reassessed in Low vision clinic. Objective distance visual acuity assessment was done with high contrast LogMAR chart for patients who could read the English alphabets. High contrast Log MAR E-chart was used for patients who could not read the English alphabets. Vision was not described as 'count fingers' or 'hand movements.' The test distance was reduced to obtain a measure of distance visual acuity. Near visual acuity was assessed by high contrast reduced Snellen's Chart with overhead illumination, asking the patient to read from a distance from which he/she is habitual or accustomed to reading.

The patient was instructed to answer a questionnaire before the trial of low vision aids (LVAs). The questionnaire used was the LVQOL survey questionnaire, initially designed by Wolffsohn and Cochrane in the year 2000 which consists of 25 questions to assess four areas of quality of life: (1) Mobility, distance vision, and lighting; (2) adjustment; (3) reading and fine work; and (4) activities of daily living. Based on the patients' requirement trial of LVAs, both for distance and near, was done. Best-corrected visual acuity (BCVA) for both distance and near were recorded along with the best visual acuity with the low vision aid accepted by the patient. Distance acuity was recorded with log MAR chart, and near visual acuity was recorded in N notation, which was converted to M notation for statistical calculations. All patients were asked to review after one and were again instructed to answer the LVQOL questionnaire.

Objective improvement in visual function was assessed by improvement in visual acuity using LVAs with high contrast LogMAR visual acuity chart for near and distance. Subjective perception of improvement in visual function was assessed by LVQOL scores during the follow-up visit. Subjective improvement for distance was assessed using the LVQOL score for "distance mobility and lighting," whereas for near, it was assessed using the LVQOL score for "near and fine work."

#### Statistical analysis

A perusal of medical records of subjects, including outpatient work up sheets, follow-up sheets, and questionnaire forms were done. Data pertaining to demographic details and clinical investigations were recorded in a predesigned format, and data was transferred to a Microsoft Excel spreadsheet.

Continuous variables like LogMAR visual acuity and LVQOL score were expressed as "mean  $\pm$  standard deviation." Wilcoxon signed-rank test was used to compare baseline (before low vision trial) and follow-up LVQOL scores; and also to compare LogMAR visual acuity for distance and M notation near visual acuity before and after low vision trial. Two-tailed Spearman rank correlation coefficient was used to correlate improvement in distance visual acuity noted with HCVA chart with improvement in 'distance and mobility' score of LVQOL questionnaire, and similarly near visual acuity improvement was correlated with improvement in 'reading and fine work'

component of LVQOL questionnaire. A "P" value of 0.05 was considered statistically significant. Statistical analysis was done using the software SPSS version 16.0.

## Results

A total of 48 patients were included in the study. Two were lost to follow-up, so they were excluded from statistical calculations. Of the 46 patients, 27 were male, and 19 were female. The average age at presentation was 29.2 years.

#### Visual acuity by HCVA chart

The mean presenting logMAR visual acuity for distance was  $0.94 \pm 0.24$  (20/160), which improved to  $0.46 \pm 0.24$  (20/50) after the prescription of low vision aids ( $P < 0.001$ ). The mean presenting visual acuity for near in M notation was  $2.02 \pm 1.09$  (corresponds to N16 in N notation). It improved to  $0.98 \pm 0.57$  (N8) ( $P < 0.001$ ). Near vision calculations were done for 45 patients as low vision aid for near was not prescribed for one patient [Table 1].

#### LVQOL score

The mean LVQOL score before performing the low vision trial was  $65.85 \pm 15.9$ . The mean score for "distance, mobility, and lighting" was  $32.80 \pm 9.03$ , whereas the mean score for "near and fine work" was  $10.48 \pm 4.4$ . After the prescription of low vision aids, the mean LVQOL score improved to  $76.83 \pm 16.3$  ( $P < 0.001$ ); whereas the mean score for "distance, mobility, and lighting" improved to  $35.35 \pm 8.79$  ( $P < 0.01$ ) and for "near and fine work" improved to  $16.37 \pm 5.41$  ( $P < 0.01$ ) [Table 2].

#### Correlation between improvement in visual acuity and LVQOL score

Using two-tailed Spearman rank correlation coefficient, no correlation was observed between improvement in visual acuity for distance and LVQOL score improvement for distance ( $r_s = -.086$ ;  $P = 0.57$ ). For near, improvement in acuity did not correlate with the LVQOL score improvement for near and fine work ( $r_s = 0.036$ ;  $P = 0.81$ ). [Figs. 1 and 2] Since no association could be shown between the variables, no further statistical tests were performed.

## Discussion

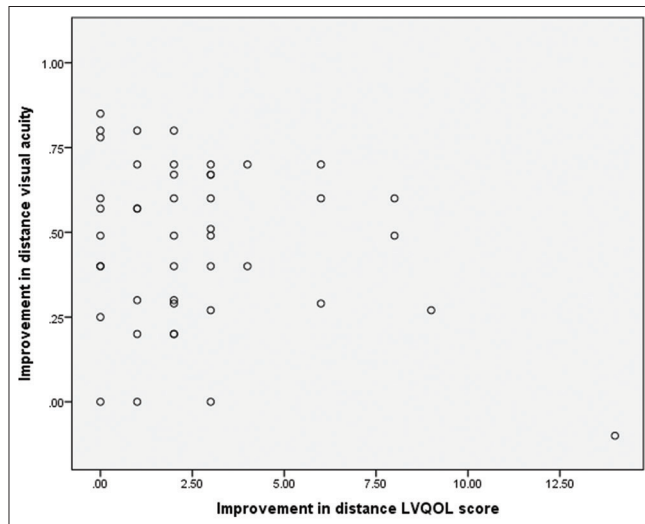
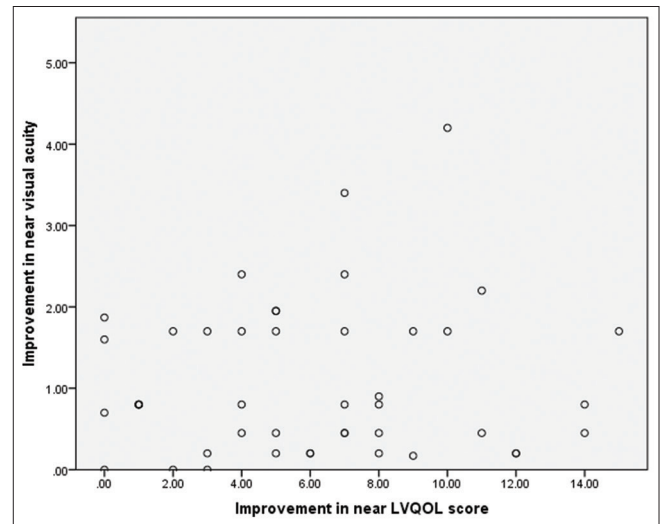
Traditionally, low vision is defined as per the working definition proposed by WHO in 1992, i.e., 'A person with low vision is one who has impairment of visual functioning even after treatment and/or standard refractive correction, and has a visual acuity of less than 6/18 to light perception, or a visual field less than 10 degrees from the point of fixation, but who uses, or is potentially able to use, vision for the planning and/or execution of a task for which vision is essential'.<sup>[7]</sup> Clinically, low vision patients are diagnosed applying the above definition to high contrast visual acuity, and then the patients are referred to low vision clinics. Even low vision aids are prescribed based

**Table 1: Improvement in HCVA chart visual acuity with low vision aids**

	Without LVA	With LVA	Improvement	P
Distance visual acuity	0.94 $\pm$ 0.24	0.46 $\pm$ 0.23	0.48	<0.001
Near visual acuity	2.02 $\pm$ 1.08	0.98 $\pm$ 0.57	1.04	<0.001

**Table 2: Improvement in LVQOL questionnaire score with low vision aids**

	Total LVQOL Score	LVQOL Score For Distance, Mobility and Lighting	LVQOL Score For Near And Fine Work
Before LV trial	65.85±15.89	32.80±9.03	10.48±4.40
After LV trial	76.83±16.29	35.35±8.79	16.37±5.41
Improvement	10.98	2.55	5.89
P	<0.001	<0.001	<0.001

**Figure 1:** Scatter plot showing no statistical correlation between improvement in distance visual acuity and improvement in distance LVQOL score**Figure 2:** Scatter plot showing no statistical correlation between improvement in near visual acuity and improvement in near LVQOL score

on the improvement in high contrast visual acuity. Other visual functions like contrast sensitivity, visual fields, colour vision, and light sensitivity are evaluated, but as yet do not play a significant role in management.<sup>[5,6]</sup> Little *et al.*, in their study on Down's syndrome and cerebral palsy children noted that 2.5% low contrast visual acuity test along with HCVA assessment is valuable to fully describe an individual's visual function.<sup>[2]</sup> Balcer *et al.*, noted that deficits in low contrast letter acuity and vision-specific quality of life have been found many years after an episode of optic neuritis, even when HCVA has recovered.<sup>[3]</sup> Use of such low contrast acuity tests should be further explored in the field of low vision.

Our study showed a statistically significant improvement in both distance and near visual acuity with low vision aids as measured objectively with the HCVA chart. Tunay *et al.* in their study on school-age children, showed similar improvement for logMAR visual acuity for distance, which improved from 1.02 (20/200) at presentation to 0.26 (20/32<sup>-3</sup>) after low vision aids.<sup>[10]</sup> Similarly, for near, they noted improvement in M notation from 4.20 (N30) to 1.38 (N10). In another study on the elderly, Tunay *et al.* showed mean logMAR visual acuity for distance improved from 0.92 (20/160) to 0.24 (20/32<sup>-2</sup>) and for near it improved from 4.75 (N36) to 1.44 (N12) with low vision aids.<sup>[11]</sup>

De Boer *et al.*, in their systematic review of vision-related quality of life questionnaires, report that the LVQOL questionnaire is one of the best for use in low vision patients.<sup>[12]</sup> Though its use in the clinic is limited, it has been content validated through several studies, including in India.<sup>[8,9,13,14]</sup>

Wolffson *et al.* showed that rehabilitation improved the LVQOL score of those with low vision by an average of  $6.8 \pm 15.6$ .<sup>[8]</sup> Anna *et al.* from South India, demonstrated a 4.55 point improvement in quality of life, from 77.77 at baseline to 82.33 points at follow-up.<sup>[9]</sup> In our study, we noted a 10.97 point improvement in Total LVQOL score.

However, our study also shows that while LVAs lead to a significant improvement in both objective measures of improvement in visual acuity and subjective measures of improvement in the quality of life, these improvements do not correlate with each other. That is, a patient showing improvement of visual acuity on HCVA charts may not show a similar improvement in his quality of life. Ours is the first study in our knowledge to compare different subsets of the LVQOL questionnaire with different clinical examinations usually done for low vision patients. In their study, Trillo *et al.* found a statistically significant correlation between total LVQOL scores and clinical visual measures like visual acuity at distance ( $r = -0.347$ ;  $P < 0.01$ ) and visual acuity at near ( $r = -0.265$ ;  $P < 0.01$ ). However, they did not consider different subsets of the LVQOL questionnaire for comparison with distance and near visual acuity. They instead used the final total LVQOL scores and visual acuities rather than improvements. In such a scenario, a low vision patient with better visual acuity will be expected to have a better quality of life.<sup>[15]</sup>

#### Limitations

Studies have shown that non-visual variables, such as physical and mental health, may affect the outcomes of vision-related questionnaires in low vision patients. However, such studies

have usually taken the total LVQOL score rather than the subsets, which may skew the outcomes.<sup>[15]</sup> Assessment of physical and mental health of the patient were out of the scope of present study.

## Conclusion

Our study has shown that low vision devices lead to significant improvement in both the high contrast visual acuity as assessed by logMAR chart and the quality of life as assessed by LVQOL questionnaire amongst low vision patients.

However, no association was observed between the improvement measured by objective measures on HCVA chart and subjective improvement as perceived by the patient after the use of low vision devices in our study. This lack of correlation suggests a lacuna in our clinical examination of low vision patients. While questionnaires may not be practical in all low vision clinics, a different set of objective visual acuity assessments, which correlate with the outcome expected by the patient, may be needed. A low vision person able to read off our charts, should not be our aim; low vision patient actually benefitting out of the devices, should.

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## Conflicts of interest

There are no conflicts of interest.

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