Quality of life in children with low vision following use of low vision aids

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Abstract:
CONTEXT: Vision loss early in life has profound functional and psychological implications. Functional vision, defined as vision that can be used to perform a task(s) requiring vision, can be assessed by a number of tools. Questionnaires are a popular tool.
AIMS: This study aimed at assessing the vision-related quality of life (QOL) with the help of LV Prasad-Functional Vision Questionnaire (LVP-FVQ) and also to analyze the outcome of baseline best-corrected visual acuity (BCVA) 3 months after the introduction of low vision aids (LVAs) in children with low vision (LV).
SETTINGS AND DESIGN: This was a prospective, longitudinal study.
SUBJECTS AND METHODS: Thirty children aged between 8 and 18 years with LV were recruited and prescribed LVAs for distance and/or near based on their needs. The QOL and BCVA for distance and near were assessed before and 3 months after the introduction of LVAs.
STATISTICAL ANALYSIS USED: Descriptive and inferential statistical analyses. Student’s t-test was used to calculate the P value.
RESULTS: There was a significant improvement in the vision-related QOL (P < 0.001) as well as the baseline BCVA (P = 0.002), 3 months after use of LVAs.
CONCLUSION: LVAs are effective in improving the vision-related QOL and can also act as vision stimulator.
Keywords: LVAs, best-corrected visual acuity, children, low vision, quality of life

Introduction

In children, low vision (LV) is ten times more prevalent compared to blindness. An Indian study found LV prevalence of 1.05%, with 10.6 million people requiring LV services. Vision loss early in life has profound functional and psychological implications, thus affecting the Quality of life (QOL). Vision loss early in life has profound functional and psychological implications, thus affecting the Quality of life (QOL). LVAs, as a part of LV rehabilitation, are the most effective method to maximally enhance the residual vision. Questionnaires are a popular tool for assessing QOL in children as they are simple, inexpensive, quick, do not necessarily require attendance and can be applied to large population. This study was conducted because of paucity in Indian literature regarding LVAs and QOL in children.

Aim

The aim of this study is to assess the vision-related QOL with the help of LV Prasad-Functional Vision Questionnaire (LVP-FVQ) and also to analyze the outcome of baseline best-corrected visual acuity (BCVA) after the introduction of LVAs in children with LV.

Subjects and Methods

This was a prospective, longitudinal study of children with LV who attended the
outpatient department between July 2014 and March 2016. A sample size of 30 was calculated based on the previous literature and at 1% level of significance (type 1 error) and 90% statistical power, with minimum sample size of eight using the n-Master software. Considering 10% of patients losing to follow-up, 35 eligible children were recruited and first 30 children who completed all follow-ups (3 months) were analyzed. Children of either sex aged between eight and 18 years with BCVA < LogMAR 0.5 (<6/18 Snellen chart) in the better eye (WHO definition of LV) and who could correctly understand and respond to questions were included in the study. Children with previous use of LVAs, hearing impairment, developmental delay, progressive blindness such as retinitis pigmentosa and any other health issues precluding follow-up were excluded from the study. The study was approved by the Institutional Review Board and adhered to all the principles mentioned in the Declaration of Helsinki 2000. However, the board did not give ethical clearance for a control group as we had intended because the board felt that it is not ethical to deprive the children in control group of LVA (who also need it). Informed consent was obtained from parents of all 35 children. A complete ophthalmic history was taken including the visual requirements of the child, followed by a detailed ophthalmic examination. Following parameters were assessed: un-corrected and best-corrected distant and near visual acuity (uncorrected visual acuity (UCVA) and BCVA) were measured unilaterally and bilaterally using Logarithmic visual acuity chart “2000” (LogMAR) at 3 m and Snellen Near Visual acuity test card at 15–25 cm under standard room illumination by a single examiner. Ocular alignment and fixation, slit lamp examination, fundus examination, and cycloplegic refraction were done in all children. Electrophysiological tests, such as electoretinography, electro-oculogram, and visual evoked potential, were carried out wherever indicated and whenever possible. A clinical diagnosis was made. Spectacles were prescribed wherever needed and a refractive adaptation period of 2 months was allowed. Children with BCVA < LogMAR 0.5 (<6/18 Snellen chart) in the better eye (eye that had better BCVA between the two eyes) after this adaptation period, were subjected to LV rehabilitation. Before initiation of the same, a counseling session was carried out with the parents to assess the visual needs of the child, to explain them the nature of visual impairment and the possible influence as well as limitations of usage of LVAs. Thereafter, as per the visual requirements of the child, a trial of LVAs was done. The initial magnification power used for telescopes was predicted from the ratio of the denominator of the measured visual acuity to denominator of the desired visual acuity. LVAs for near was initially determined using the Kestenbaum’s rule (using the reciprocal of the distance visual acuity to calculate the dioptric power of the addition) and the ratio rule (comparing near visual acuity to target acuity). The reading addition power was again tested with the school books for all children. We also advised nonoptical devices such as table lamps to increase illumination, writing and reading guides, black felt tip pens, and highlighters to all children.

We used LVP-FVQ, in this study, which was translated into Kannada by two people separately and cross-checked by a third person (identity not revealed), and the final version was back translated into English to reconfirm the original version. This questionnaire was administered to each child during every visit to assess QOL. Children who were unable to read the questionnaire were dictated orally and asked for a response. The questionnaire has 19 questions designed to cover four domains: distance vision, near vision, color vision, and visual field. These 19 questions are related to difficulties in performing certain tasks which mainly rely on visual capabilities. An additional question 20 is related to global self-assessment of the child’s vision as compared with his or her friends with normal vision. The response was graded on a 5-point scale (0–4); a “Yes” or “No” response was first required for each question. If the answer was “Yes,” the difficulty level was further categorized into 1–4 category; Score 1 refers to “a little difficulty,” Score 2 “moderate difficulty,” Score 3 “great difficulty,” and Score 4 to “unable to do the activity.” The FVQ score, thus obtained, was designated as the baseline score. Those who showed improvement with LVA for distance and/or near, same was prescribed based on the child’s requirement. The uniocular telescope was prescribed for use in the eye, which got better improvement with LVA or in the dominant eye, usually right eye if the improvement was the same in both the eyes. Binocular telescope for distance, stand, and bar magnifiers for near were used by both the eyes. All children were followed up after 1 month and 3 months. At each of these visits, LVP-FVQ was administered to assess the QOL. The FVQ score at each of these visits was compared with the baseline. The data collected was analyzed using SAS 9.2 (SAS Institute, North Carolina State University, USA), SPSS 15.0 (SPSS Inc., Chicago, IL, USA), Stata 10.1 (Systech Technocraft Services Pvt Ltd, Mumbai, India), MedCalc 9.0.1, Systat 12.0 (Chicago, IL, USA) and R environment ver. 2.11.1 (University of Auckland, New Zealand). Descriptive and inferential statistical analyses were carried out. Student t-test (two-tailed, dependent) was used to find the significance (P) of the study parameters. A significance level of 5% was used, and the power was set to 90%.

**Results**

Out of 30 children, 20 (66.7%) were in the age group of 8 to 12 years, and 10 (33.3%) were in the age group of 13–18 years.
with the mean age being 12.27 ± 2.97 years. There were 20 (66.7%) males and 10 (33.3%) females. The causes for LV were pathological myopia in 9 children (30%), amblyopia in 6 (20%), macular dystrophy in 6 (20%), retinochoroidal coloboma in 3 (10%), albinism in 3 (10%), nystagmus in 2 (6.7%), and rubella retinopathy in one (3.3%). BCVA for distance at the first visit (baseline) was LogMar 0.6–1 in all 60 eyes of 30 patients. BCVA for near at first visit: N6–N10: 32 eyes (16 children), N12–N18: 23 eyes (8 children), N24–N36: 5 eyes (6 children). Nearly 15 children (50%) were prescribed spectacles. BCVA with LVA for distance was between LogMar 0.6–1 in 43 eyes of 21 children (72%) and LogMar <0.5 in 17 eyes of 9 children (28.3%). BCVA with LVA for near was between N6 and N8 in 13 patients (43.3%); between N10 and N12 in three patients (10%) and none between N18 and N36. 25 children (83.3%) were prescribed an LVA for distance. The monocular telescope was prescribed in 23 children (76.7%), of which the predominant type was ×4 monocular in 14 children and binocular telescope (×2.8) in two children (6.7%) [Figure 1].

Eight children (26.7%) were prescribed an LVA for near [Table 1], and three children (10%) were prescribed LVAs for distance as well as near.

Table 2 shows the evaluation of the mean FVQ score, as well as the range of FVQ score, from baseline till the end of 3 months.

Evaluations of BCVA for distance and near from baseline to the end of the study (3 months) are shown in Tables 3 and 4, respectively.

## Discussion

The rationale for the treatment of LV in children is to utilize the residual vision to make them independent, improve their educational experiences and employment opportunities, thereby enhancing their self-confidence.

Another important aspect of tackling the burden of LV is differentiating visually impaired children from blind children because erroneously classifying visually impaired children as blind deprives them a chance of rehabilitation. Many such students are enrolled in blind schools and educated using Braille, even though they may do well in regular schools.[7,8]

Early diagnosis and intervention for a vision problem are crucial to maintain and to maximize functional vision,[4] defined as vision that can be used to perform a task(s) requiring vision.[9]

There are a number of tools for assessing functional vision but most are inappropriate for use with children,[10] especially those from developing countries. Questionnaires are a popular tool for assessing QOL as they are simple, inexpensive, quick, do not necessarily

### Table 1: Number of patients using low-vision aid (near)

| LVAs (near)     | Number of patients (n=30), n (%) |
|-----------------|----------------------------------|
| Nil             | 22 (73.3)                        |
| Yes             | 8 (26.7)                         |
| ×1.5 bar magnifier | 4 (13.3)                       |
| ×3 stand magnifier | 4 (13.3)                      |

LVAs=Low-vision aids

### Table 2: Functional vision questionnaire score

| Minimum-Maximum | Means±SD | Difference from day 0 | P       |
|-----------------|----------|-----------------------|---------|
| Day 0           | 6.00-38.00 | 17.47±9.70             | -       |
| 1 month         | 4.00-36.00 | 16.90±9.64             | 0.567 <0.001 |
| 3 months        | 3.00-35.00 | 15.30±9.42             | 2.167 <0.001 |

FVQ score is inversely proportional to QOL. FVQ=Functional vision questionnaire, SD=Standard deviation, QOL=Quality of life

### Table 3: Best-corrected visual acuity (distance): An assessment

| BCVA            | Day 0 (%) | 1 month (%) | 3 months (%) |
|-----------------|-----------|-------------|--------------|
| <0.5            | 0         | 2 (3.3)     | 9 (15)       |
| 0.5-1           | 60 (100)  | 58 (96.7)   | 51 (85)      |
| Total           | 60 (100)  | 60 (100)    | 60 (100)     |

Mean±SD | 0.91±0.13 | 0.85±0.22 | 0.75±0.31 |

P<0.002 (paired proportion test), BCVA=Best-corrected visual acuity, SD=Standard deviation

### Table 4: Best-corrected visual acuity (near): An assessment

| BCVA (near) | Day 0 (%) | 1 month (%) | 3 months (%) |
|-------------|-----------|-------------|--------------|
| N6          | 8 (13.3)  | 8 (13.3)    | 8 (13.3)     |
| N8          | 12 (20)   | 12 (20)     | 16 (26.7)    |
| N10         | 12 (20)   | 12 (20)     | 16 (26.7)    |
| N12         | 13 (21.7) | 14 (23.3)   | 12 (20)      |
| N18         | 10 (16.7) | 10 (16.7)   | 6 (10)       |
| N24         | 1 (1.7)   | 0           | 2 (3.3)      |
| N36         | 4 (6.7)   | 4 (6.7)     | 2 (3.3)      |
| Total       | 60 (100)  | 60 (100)    | 60 (100)     |

BCVA=Best-corrected visual acuity
require attendance, and can be applied to large groups of population. Moreover, questionnaires are useful in children because of their inability to express their problems. There are a few questionnaires available for the assessment of vision-related QOL in children: the Children’s Visual Function Questionnaire (LVP-FVQ), and The Impact of Visual Impairment on Children. The LVP-FVQ was designed in India as a screening tool for developing countries. We found it more relevant to be used in our study because most of our children’s activities matched with those mentioned in the questionnaire. However, two questions were inappropriate for many children such as: “threading a needle and comparing one’s own vision with that of friend’s.” Yet, other problem faced by us was that some of our children could not grade the difficulty as they had visual impairment since birth or early childhood and thus could not judge the level of severity similar to the conclusion made by Boshra et al. who used the same questionnaire.

The mean age in our study was higher (12.27 ± 2.97 years) compared to a similar study by Ganesh et al. (10.5 ± 3.2 years) with male children being predominant (66.7%) in both the studies. The common causes of LV were pathological myopia, macular dystrophy, retinochoroidal coloboma, and amblyopia. This is similar to other studies.

Twenty-five (83.3%) children were prescribed an LVA for distance, and the remaining five (16.7%) children did not need it. Eight (26.6%) children were prescribed LVA for near, 22 children did not require as their visual acuity was optimal and was not impaired to the extent of hampering near tasks and many children could not manage both distance and near tasks and many children could not manage both distance and near LVAs together and preferred to use LVA for distance. Only 3 (10%) children were prescribed LVA for both distance and near.

The mean FVQ scores which were 17.47 ± 9.70 at baseline (day 0), changed to 15.30±9.42 over 3 months. QOL is inversely proportional to the FVQ score which implies that if the score is lower, the QOL is better and vice versa. Thus, the QOL consistently improved over the period of the study, and this improvement was found to be statistically highly significant (P < 0.001).

In our study, the most common reported difficulty was copying letters from the blackboard. Other difficulties were related to outdoor activities such as identifying a person waving from across the road, reading numbers on the bus, locating the ball while playing, etc. Almost none of the patients reported any difficulties relating to routine indoor life such as lacing shoes, applying paste on toothbrush, and locating the food on the plate. With the use of LVAs, children benefited most in activities such as identifying a person across the road during the daytime, copying the letters on the blackboard while sitting on the first bench in the classroom, and reading the vehicle/school bus numbers as evidenced by change in FVQ score from 3.73–2.1, 3.06–1.63, and 3.46–1.8, respectively.

Various studies have reported favorable outcome in the improvement of QOL in visually impaired children following use of LV aids (LVAs). Children with useful residual vision can benefit from spectacles and LVAs, thus emphasizing the need for visual rehabilitation in these “incurably blind children.”

We made an additional observation in our study regarding the outcome of baseline BCVA in the eyes using LVA: Baseline BCVA of LogMar <0.5 which was zero eyes in the first visit, improved to nine eyes of eight children at 3 months [Table 3]. BCVA for near which was N6-N10 in 32 eyes at baseline had 38 eyes at the end of 3 months (six eyes of five children) [Table 4]. This improvement in BCVA for both distance and near from the baseline to the last visit was statistically significant (P = 0.002). Nine (69%) out of the thirteen children who improved were in the age range between eight and 12 years.

This additional improvement in baseline BCVA for both distance and near with the continuous use of LVAs over 3 months indicates that LVAs may even act as a vision stimulator.

This highlights the importance of appropriate diagnosis and rehabilitation of children with LV. In addition, there is a need to educate healthcare providers regarding the magnitude of the problem and LV services.

**Limitations**

Follow-up period in this study was short and sustainability of the improvement in visual acuity and QOL following discontinuation of LVAs, if any could not be assessed. Reduced LogMAR visual acuity chart for near was not used. This study assessed only QOL and outcome of baseline BCVA. Other parameters such as contrast sensitivity and visual fields could not be assessed. Rasch analysis could not be carried out.

**Conclusion**

LVAs are effective in improving vision-related QOL in children with low vision. They are also helpful in improving the baseline BCVA following continuous use of LVAs over a period of time, thus acting as a tool for vision stimulation.

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Conflicts of interest
The authors declare that there are no conflicts of interests of this paper.

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