ORIGINAL RESEARCH

A Study on the Impact of Low-Vision Therapy and Rehabilitation on Quality of Visual Life of Visually Impaired School-going Children

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ABSTRACT
Aim and objective: To study the impact of Low-Vision Therapy and rehabilitation on the quality of visual life of visually impaired school-going Children. **Materials and Methods**: The LV Prasad–Functional Vision Questionnaire was used to analyze the functional vision performance of the study population in a simulated environment before and after visual rehabilitation intervention. **Results**: For 71 children, male to female ratio was 5:3 with a mean age of years 10.5± 4.3 (range: 6–16 years). At presentation, all children had low vision (<6/18) while 22% were severely visually impaired (VA <6/60–3/60) and 33% of children were blind (VA <3/60). With refractive correction and low vision devices for distance, 55% achieved normal vision (6/18 - 6/6).The statistically significant difficulty scores were highest for Q-5 blackboard copying (70%), Q-8 reading textbook at arm's length (73%), Q-9 writing along a straight line (73%), and in specific performances, namely Q-11 pinpointing dropped objects within the classroom (70%), Q-6 & 7 reading the bus no's (62%). In response to question no. 20, (75%) of children felt that their vision was much less than their peers. Optical devices were provided to 90% of children. For distance vision, a total of 15 spectacles, 59 telescopes, for near vision, 62 magnifiers were provided. Non-optical devices were provided to 62 children and exclusively to 10 children of whom 05 children from school for the blind were found fit for the Braille method. The mean of Quality of life assessment improved from 3.89 (Standard deviation from 1.48) to 5.12 (Standard deviation from 1.10) after 3 months of low vision intervention. **Conclusion:** there was a significant improvement in functional vision quality after low vision rehabilitation, especially in academic performance. It signifies the important role of early intervention, proper counseling of parents, and consistent follow-up to increase compliance in utilizing Low vision services.

Keywords: low vision rehabilitation, functional vision quality, visual impairment in children

INTRODUCTION

According to the WHO description of low vision, there is significantly reduced vision, i.e., visual acuity is worse than 6/18 in the better eye or central visual fields less than 20 degrees after standard treatment or refractive correction [1]. Functional vision is the visual capability to execute essential day-to-day activities. The Quality of visual life (QoVL) can be defined as the sense of personal satisfaction with the conditions in which one lives and functions, like daily living activities previously taken for granted such as dressing, eating, writing, traveling, simple communication or interaction with others and how that might be affected by visual impairment which greatly affects quality of life.

The worldwide prevalence of low vision in children is 12 times that of blindness [2]. Low vision has massive socioeconomic implications as long-term loss of productivity and economy [3]. Furthermore, visual impairment in early life results in social isolation and its psychological consequences [4].To reduce the burden of this handicap and to maximize their residual functional vision, the best-proven technique worldwide is to provide children with low-vision assistive devices (LVDs) and rehabilitation therapy. Based on the Rights of Persons with Disabilities Act

(RPDA) 2016 and the SarvaShikshaAbhiyan (SSA) system in India, children with low vision deserve the right to inclusive education. In developing countries, due to a lack of awareness regarding the presence of such amenities and the associated economic factors and paucity of trained eye healthcare workers, it is a challenging task to educate children having visual impairment [5,6]. Among children having visual impairment, it is well known that subjective perceptions of difficulty do not essentially correlate with their objective measurements and even the parents may not be aware of it[6]. There is difficulty in standardizing immeasurable or subjective parameters [7,8]. For these reasons, literature is scarce on the practice of low vision rehabilitation in school-going children [9]. Components of rehabilitation along with visual enhancement include education, social welfare services, mobility, and activities of daily living [10].

In this study, we used the LV Prasad–functional vision questionnaire (LVP-FVQ) translated into the local language. It contains age-appropriate direct questions on difficulty in daily activity for children to assess their self-reported functional vision capabilities [11]. The LVP-FV Questionnaire has 19 questions intended to cover 4 areas: Distance vision (6 nos.), near vision (6 nos.), color vision (2 nos.), and visual field (5 nos.).All questions are concerned with difficulty in executing specific activities depending on visual capabilities. An extra question (20th) is for comparative self-assessment of the child's vision in association with his or her friends with normal vision. The response is graded on a five-point scale (0 to 4); a Yes or No response is first essential for each question. If the answer is No, it is documented as No difficulty (zero score). If the answer is Yes, then the difficulty level is considered in the 1 to 4 category; score 1 refers to little difficulty, and score 4 to incapable of performing the activity because of visual impairment.

MATERIALS AND METHODS

71 visually impaired children in the age group 6 - 16 years attending our Low Vision OPD at RIO, SCB Medical College and Hospital, Cuttack over one year (May 2020 to April 2021) were included. Inclusion criteria- children who were capable of comprehending and undergoing standard clinical vision screening and could properly recognize and react to questions were enrolled. Exclusion criteria - Children with improvement of visual acuity to better than 6/18 after refraction in any eye, those with cognitive or neuromotor impairment, deafness, not on regular follow up and children utilizing Low vision services earlier, were omitted. In the present research, the low vision categorization was followed according to the 'World Health Organization guidelines for prevention of Blindness program form for the recording of children with blindness' and vision impairment [1]. Nature and the probable consequences of this study were described to all parents and children individually and only after getting their informed consent and approval from the institutional ethics committee, the study was done.

METHODS

Detailed Ophthalmic examination: Distant visual acuity was estimated uni-laterally and bi-laterally by the Logarithmic visual acuity chart 2000, charts 1 & 2 at 3 meters or 1 meter followed by the Logarithmic Low contrast chart. Very low VA was assessed as counting fingers(CF), hand motions(HM), light perception(PL), or no light perception. Near vision tested by LVRC − Near Vision acuity test card at 40 cm in ambient room light followed by low contrast chart. The Log Mar unit was converted to Snellen's equivalent for easy interpretation [7]. Evaluation of anterior and posterior segments, color vision, cycloplegicretinoscopy, and visual fields were tested when possible. In low vision rehabilitation therapy, detailed counseling of parents and children was done to evaluate the specific optical requirements of children, explaining the consequences of their visual impairment, the probable advantages, and limitations of low vision devices, other means of education, electronic media, social and economic rehabilitation available to integrate them into the social mainstream, modification of their surroundings to prevent injuries, genetic counseling were explained. Subsequently, as per the visual requirements of the children, a trial of LVD was done. The magnification power of the telescope (X) was calculated from the ratio of measured visual acuity to desired visual acuity. LVDs for near addition were calculated using Kestenbaum's rule. Nonoptical devices included reading lamps, reading stands, writing guides, tinted glasses, bold-lined notebooks, large printed books, electronic magnifiers, audio converter, and Braille. Children demonstrating at least one line improvement in distance or near vision were prescribed appropriate LVD.LVD categories recommended to the children were tabulated in Table 1.The training session was conducted for all children and their parents to train with the use of low-vision devices and compliance was noted. Follow-up was done every 15 days till three months of initial dispensing and changes in visual acuity were noted in the LV Prasad – Functional vision questionnaire re-administered to children by the same surveyor through direct interview.

STATISTICAL ANALYSIS

A Chi-square test was done to evaluate the variance in functional vision after usage of a low-vision device; a P value of <0.05 was considered significant.

RESULTS

The present observation included 71 children aged 6 - 16 years. The mean age was 10.5 ± 4.3 years, male to female ratio was found to be 5:3. 52 children had congenital visual complications while 19 were

detected by parents in the initial years. No child received low vision therapy previously. 56(79%) attended regular schools, whereas 10 (14%) were in school for the blind, 5 (7%) were school dropouts. Demographically, 14(20%) were from urban, 17(24%) suburban and 40(56%) from rural background.

Table 1: Etiology of Low vision in children

Cause	Number	Percentage
Aphakia(surgical/congenital)	27	39
Microphthalmos	16	23
Retinal dystrophy and Retinopathy of Prematurity	10	14
Amblyopia	06	09
Iridofundalcoloboma	05	06
Optic atrophy	03	04
Corneal scar	01	01
Congenital/Developmental cataract	01	01
Congenital/Developmental glaucoma	01	01
Anophthalmos	01	01
Total	71	100

Table 1 shows the clinical etiology of Low vision in children. the main cause of low vision was aphakia in 39%, microphthalmos in 23%, Retinal dystrophy and retinopathy of prematurity in 14%

Table 2: Low-vision devices prescribed for schoolchildren

DEVICES	No. of children	Percentage (%)
OPTICAL DEVICES (90%)		
LVD for distance		
Spectacles	15	22
Hand-heldTelescope (2x/2.5x)	44	63
Hand-heldTelescope (3x/4x)	08	11
Specs-MountTelescope (3x)	06	09
LVDfornear		
Dome /Bar Magnifier(2x/4x)	40	57
IlluminatedStandMagnifier 6x/8x)	10	14
SpectacleMagnifier+8,+14,+20	08	14
Hand Magnifier +6,+14,+20	04	11
NON-OPTICAL DEVICES (72%)		
ReadingStand	58	80
Bold-lineNote-books	20	28
CCTV	02	03
Tinted Glasses	02	03
Braille(School for blind)	05	07

Table 2 shows Low-vision devices prescribed for children. Optical devices were provided to 90% of children. For distance vision, a total of 15 spectacles, 59 telescopes, and for near vision 62 magnifiers were provided. Nonoptical devices were provided to 62 children with near magnifiers and exclusively to 10 children out of whom 05 instead of the 10 children from school for the blind were found fit for the Braille method.

Table 3: Range of visual acuity (converted to Snellen's equivalent) before and after 3 months of Low Vision intervention

BCVA in Better Eye	Percentage Before LVD	Percentage After LVD
6/18 - 6/6	00	55
6/24 - 6/60	46	28
6/60 - 3/60	22	26
3/60 - 1/60	24	Non optical LVD
1/60 - HM+	09	Non optical LVD
No PL	00	00
Total	100	100

Table 3 shows the range of visual acuity (converted to Snellen's equivalent) before and after 3 months of Low Vision intervention. At presentation, all children had low vision (<6/18) while 22% were severely visually

impaired (VA <6/60–3/60) and 33% of children were blind (VA <3/60). With refractive correction and low vision devices for distance, 55% achieved normal vision (6/18 - 6/6).

Table 4: Response to LVP -Functional Vision Questionnaire before and after 3 months of Low Vision intervention

Question No.	Pre-LVD n(%) Score0*	Post-LVDn(%) Score0*	NA+	Pre-LVDn(%) Score4+	Post-LVDn(%) Score4+	NA	% decrease
1	20(28)	38(53)		50(70)	32(45)		25
2	26(36)	52(73)		42(59)	18 (25)		37
3	54(76)	64(90)		12(17)	6(08)		14
4	43(60)	58(81)		24(34)	12(17)		21
5	16(22)	66(93)		50(70)	6(08)		71
6	22(30)	36(51)		44(62)	32(45)		21
7	24(33)	42 (59)		44(62)	30(42)		26
8	12 (17)	66(93)		52(73)	07(10)		76
9	12 (17)	71(100)		52(73)	00(00)		83
10	52(76)	60(84)		22(31)	06(08)		08
11	24(33)	24(33)		50(70)	45(63)		00
12	36(50)	42(59)	24(34)	13(18)	11(15)	24(34)	09
13	52(73)	56(79)		21(30)	14 (20)		06
14	66(93)	66(93)		6(08)	08(11)		00
15	33(46)	40(56)	15(21)	23(32)	16(22)	15(21)	10
16	42(59)	43(61)		30(42)	28(39)		02
17	54(76)	68(96)		16 (22)	00(00)		20
18	60(85)	65(91)		8(11)	04(05)		06
19	53(75)	56(79)		14(20)	211 (15)		04

Score-0: no difficulty in performing activity due to visual reasons, Score-4:unable to perform activity due to visual reasons, NA: not applicable. Table 4 shows the response to the LVP -Functional Vision Questionnaire before and 3 months after the Low Vision intervention. LogMAR visual acuity improved significantly after the introduction of LVDs for distance and near . The total raw score of disability (score-4) also improved after LVDs.. The questionnaire had a 0-4 score rating scale but most children chose either 0 (No difficulty) or 4 category (Extreme difficulty). The total raw score of disability (score-4) ratio before and after LV intervention was improved to 2:1(i.e. the number of children unable to perform the activity due to visual reasons was reduced to half after 3 months. The statistically significant difficulty scores were highest for Q-5 blackboard copying (70%), Q-8 reading textbook at arm's length (73%), Q-9 writing along a straight line (73%), and in specific performances, namely Q-11 pinpointing dropped objects within the classroom (70%), Q-6 & 7 reading the bus no's (62%). In response to question no. 20, (75%) of children felt that their vision was much less than their peers.

Table 5: Quality of Life Assessment

	Mean(SD) out of 9	Min-Max	Median &Mode	P value
Before LV training	3.89(1.48)	0-6	4	<0.01
3 month After LV training	5.12(1.10)	2-8	5	

The mean improved from 3.89 (Standard deviation from 1.48) to 5.12 (Standard deviation from 1.10) after 3 months of Low vision intervention.

DISCUSSION

There are several universally recognized questionnaires for measuring functional vision, but most of them are not suitable for pediatric study participants as responses have to be measured in terms of the patient's self-reported ability to perform daily activities. [9, 10].

In our study, LVP-FQL was used to compare the functional vision before and after training on low vision rehabilitation. Research reported in different studies shows that the possibility of children assessing categories I, II, and III was approximately 0[11]. Our study also showed that children who had congenital or early onset visual impairment chose all or none response and were not able to grade the difficulty level. We administered the 1st questionnaire before rehabilitation and the final questionnaire after 3 months of rehabilitation to evaluate the changes in functional vision by LVD, which is considered an optimum period [13].

We also found that 56(79%) of visually impaired children attending regular schools had earlier reported poor academic performance due to demands on visual parameters, like copying from a blackboard, reading

textbooks at arm's length, or writing along a straight line which, is not only restricted the day to day and academic activities of the children but also showed a marked psychological impact in the children who were socially withdrawn, nervous and highly dependent on sighted peers for their regular activities which did not permit most of the children to even try for their full potential resulting in drop out in 05(7%) and no scope for future economic development, similar reports in earlier studies[4,6].

In our study, we noticed that after appropriate implementation of vision rehabilitation therapy and regular follow-up, there was a significant measurable improvement in certain generalized activities like grooming in front of a mirror (P = 0.001) and recognizing faces at a distance (P = 0.001), as reported by parents. Also, a statistically significant and reproducible improvement in functional vision before and after LV intervention in academic activities like reading, copying from blackboard, reading textbook or computer at arm's length, writing along a straight line as reported by teachers. Numerous research studies have reported improvement in visual acuity after using low-vision devices [10-12]. Research documented from blind schools, established the requirement of spectacles and low vision devices for children with some residual vision as there is great potential to enhance their vision by training and usage of low vision devices, digital devices, and visual rehabilitation therapy to study in integrated schools with sighted children and periodic assessment of changes in refraction or device need to be addressed for these students [13].

We reported reasons for noncompliance during follow-up in 18(26%) to spectacles or LVDs as inadequate training, loss or damage, discomfort in using a device or sitting posture, and lack of inclined desk or lighting arrangements, and these problems were subsequently addressed. A study, reported from Ghana, perceived barriers to utilization of low vision services as lack of awareness, inadequate training and manpower, non-availability, and high cost of low vision devices as the foremost hindrance in low vision rehabilitation [14].In our study, the Quality of Life questionnaire showed an increase in mean from 3.89 to 5.12 which is statistically significant.

It is now well-established in many studies that Low vision not only hampers routine and academic activities but has psychological consequences as well, making the children feel depressed, anxious, fearful, withdrawn, and denial does not allow these children to be an integral part of society [15]. Another important finding in our study was that none of the 71(100%) children had received any low vision intervention previously. A study on children attending blind schools concluded that there is a large potential for these "incurably blind children" to benefit from their residual vision through the use of spectacles and LVDs[16].

CONCLUSION

Vision impairment acquired in formative years exhibits multi-factorial hindrance to progress in cognitive skills as well as psychological development of a child, but early detection assists him to receive inclusive education and equal opportunities as his sighted peers for a self-reliant future. Functional vision questionnaire customized precisely for children in that geographical area and Log Mar charts for pediatric vision assessment as in the current study, are more accurate in detecting low vision parameters rather than the standard questionnaires or Snellen's chart and ensures the most substantial, measurable, and reproducible improvement after low vision rehabilitation. A comprehensive pre-admission vision examination of all children, including those admitted into schools for the blind, and administrating early and appropriate treatment and training can reduce the number of blind years. Many children from the school for the blind, who were limited to learning in Braille media were found to have adequate residual vision to benefit from training in optical or non-optical LVDs or electronic media to study in integrated schools with print media. Older children who never had access to school also benefit from electronic devices, which may be helpful in vocational training. The need of the hour is to increase compliance by motivating parents and teachers on appropriate and timely usage of low vision devices (LVDs), awareness and training of eye care personnel at all levels, easy availability of LVDs at an affordable cost to improve the quality of life in children with low vision and integrate them into mainstream society.

LIMITATIONS

This is a hospital OPD-based study and does not represent the population. The study duration and sample size were limited and no long-term follow-up was conducted to compare long-term outcomes with the children who did not receive low vision rehabilitation therapy.

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