

# Preference of low vision devices in patients with central field loss and peripheral field loss

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## Abstract:

**PURPOSE:** The objective of this study was to estimate the profile of patients visiting low vision care clinic at a tertiary eye care center in India and to analyze the preference of low vision devices (LVD).

**METHODS:** A retrospective review was done for 450 patients with low vision who were referred to the LVC clinic from January 2019 to December 2019. The participants were categorized into two groups as central field loss (CFL) and peripheral field loss (PFL). Demographic profile details and low vision device preference were documented.

**RESULTS:** Out of 450 patients, 242 (53.8%) were diagnosed to have CFL and 208 (46.2%) had PFL. The median age of the overall patients was 34.5 years. Overall, 323 (71.8%) were men and 127 (28.2%) were women. Cone dystrophy (21.1%) was the major cause of low vision among atrophic changes (54.1%) in CFL, and retinitis pigmentosa (81.2%) was the majority in retina related changes (81.7%) in PFL. Overall, 71.3% of the low vision patients preferred LVD. CFL group (76%) preferred LVD more than PFL group (65.9%). Almost 34% of the patients in both CFL and PFL group have preferred half eyes and Ashperics, followed by 32.5% in CFL and 28.1% in PFL preferred dome magnifiers. Statistically significant improvement in distance and near vision with the help of LVD was noted.

**CONCLUSION:** The use of LVD can help patients with low vision in restoring useful vision, where medical and surgical treatment have no or a limited role.

## Keywords:

Central field loss, low vision, peripheral field loss, visual rehabilitation

## INTRODUCTION

Low vision services or care is used to describe a person who has impairment of visual functioning even after treatment and/or standard refractive correction and has a visual acuity of <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>[1]</sup>

Globally, the total number of people who are visually impaired is 285 million, out of which 39 million are blind and 246 million present with low vision. In India, 66 million people are suffering from low vision. Moreover, 65% of

people are visually impaired and 82% of all individuals who are blind are 50 years and older.<sup>[2]</sup> Low vision will have a significant impact on patients' functional ability and quality of life (QoL).<sup>[3]</sup> The central retina has a high sensitivity to image contrast and displacement compared to the peripheral retina, whereas the peripheral visual field covers a larger spatial extent than does the central visual field. These differences in visual function play a major role in visual performance.<sup>[4]</sup> For instance, peripheral field loss (PFL) is associated with unwanted contacts and disorientation and central field loss (CFL) is associated with failure to detect elevation changes.<sup>[4-9]</sup> In such cases, the loss of one of the system's components prevents the interplay of central and peripheral vision essential for visual performance. The loss of

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visual function results in visual impairment and thereby visual performance of the patients would get affected.

This visual impairment will have a significant impact on their functional ability and QoL. Most conditions that cause low vision impact either the peripheral low-resolution wide-field or the central high-resolution fovea. The loss of central vision is the hallmark representation of Age-Related Maculopathy and characterizes diabetic retinopathy, optic neuropathy, central retinal vein occlusions, and other conditions. PFL (tunnel vision) is a severe constriction of the peripheral field leaving the central 5°–10° of the functional field.<sup>[10]</sup> This condition is the result of retinitis pigmentosa (RP) and glaucoma.

There are numerous challenges that are not covered in the routine clinical assessment of people with low vision.<sup>[11]</sup> Depending upon the type of field loss and disability, the patients' exhibit difficulties in various visual tasks related to their day-to-day activities. Low vision rehabilitation has traditionally addressed these issues by attempting to replace or supplement the missing function. Low vision devices (LVD) provide magnification effectively in CFL to increase the effective resolution of the residual peripheral field. Magnification has been tried with limited success to expand the peripheral view in case of PFL.<sup>[12]</sup> Vision enhancing devices assist in improving visual performance by maximizing the patient's existing sight using appropriate methods and helping them use this level of vision optimally to provide equal opportunities for people with low vision. The decision of low vision rehabilitation is made based on individual vision requirements and life goals.<sup>[13]</sup>

Although there are various studies that have investigated the use of LVD in different ethnic populations or different ocular conditions, there is a lack of information regarding the preference of LVD based on visual demands and type of visual field loss. Literature have analyzed many visual functions among people with low vision secondary to single ocular condition causing CFL and PFL and their visual demands,<sup>[14-17]</sup> yet studies on multiple ocular conditions and their device preference based on visual demands and field loss are very limited. Therefore, the purpose of this study was to document the clinical characteristics of people with various ocular conditions presenting for low vision care services. Hence, the main purpose of this study is to analyze the ocular condition comparing CFL and PFL to determine the patient's preference of LVD.

## METHODS

A retrospective chart review of patients with low vision attending the low vision care clinic at a tertiary eye care center between January and December 2019 was done. Comprehensive list of ocular conditions was categorized by senior ophthalmologists, into conditions causing CFL and PFL, respectively. Participants who presented with both central and peripheral involvement were excluded from this study. The

low vision assessment and trial of devices were conducted by two experienced optometrists. Data including pre- and postlogarithm of the minimum angle of resolution (logMAR) distant and near visual acuity in the better eye, demographic details, occupation, patient's requirement, primary need, a trial of distance and near LVDs, magnification calculation, Amsler grid, confrontation, computer and environmental modification, contrast enhancements, mobility training, and other suggestions given were collected and documented for the analysis. Institutional review board approval was obtained to analyze the hospital-based data, and the tenets of Helsinki were followed.

## Low vision devices

Distance optical devices were used to magnify the objects up to three times, whereas near optical devices were used to magnify printed materials and near objects. Single or multiple optical devices of the following kinds were used to improve the visual acuity of patients with low vision: SEE TV binocular telescopes (Eschenbach, Germany) are spectacle model telescopes mostly suitable for recognizing faces and watching television in the adult population.<sup>[18]</sup> A telescope, which are handheld monocular or binocular telescope available in prescribed format with magnification ranging from  $\times 2$  to  $\times 10$ . To introduce the concept of the telescope, the children are advised to practice focusing/viewing through the toy telescope for viewing distance objects. These telescopes are commonly used for seeing street signs and signals, bus numbers, and blackboards. The advantages of these telescopes include a good field of view, lightweight, limited or no aberrations and adjustable distance and near focusing.<sup>[19]</sup>

Half eyes spectacles are high-powered reading glasses that allow both eyes to read together.

These are hands-free magnifiers that provide a greater field of view and make it more comfortable for users to read and write. Handheld magnifiers (low vision resource center [LVRC], Hong Kong society for the blind [HKSB]) gives a better working distance and portability. Stand magnifiers (LVRC, HKSB) gives a comparatively wider range of magnification with a limited field of view. Dome magnifiers (LVRC, HKSB) provide more comfortability for continuous reading tasks at a convenient working distance.

Pocket magnifiers (LVRC, HKSB) are mostly used for spotting as they provide a wide range of magnification.<sup>[11]</sup> Portable video magnifiers (Freedom Scientific Company, USA) and full sized closed-circuit television having a magnification from  $\times 2$  to  $\times 25$ , offer the option of contrast change, and freezing of images.<sup>[20]</sup> Senorita can give magnification up to  $\times 32$  with 3–15 color contrast in which the images can be frozen and stored in computers for further necessities. Other devices like TOPAZ and Zoom ex provides magnification more than  $\times 100$  with 33 contrast shades and reads out the pointed line to the patient. Software like JAWS, MAGIC, and QWERTY keyboard are also suggested for patients like employees or students who have difficulty in using a regular sized computer monitor with

normal font size. In these cases, the computer monitor is called a visual display unit. Braille training is given to patients who fall under near blindness or total blindness visual impairment. Notex is used for identifying notes using tactile cues.

The patients were given a trial of single or combination of low vision optical and nonoptical devices depending on their presenting visual acuity, and the maximum improvement in the visual acuity was noted. A detailed explanation of the use of the device and adaptation training with the preferred device along with the instruction manual was given to patients to enable them to handle the device independently.

### Levels of visual impairment

The level of visual impairment was categorized based on the study recommended by the World Health Organization relating the visual acuity of the better eye with the best possible correction: Category 0: Mild VI with visual acuity better than 6/18, Category 1: Moderate VI with worse than 6/18–6/60, Category 2: Severe VI with worse than 6/60–3/60, Categories 3 and 4: Profound VI with worse than 3/60 to the perception of light, and Category 5: Blindness with no perception of light.<sup>[21-23]</sup>

### Statistical analysis

Descriptive statistics included median and inter-quartile range of the variables. Normality assumption was assessed using the Shapiro – Wilk test. Wilcoxon sign-rank test was used for the comparison of continuous nonnormally distributed variables of the same group. Mann–Whitney test was used for group comparison of continuous nonnormally distributed variables of two groups. All statistical analyses were performed using the Statistical Package for the Social Sciences (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). The alpha ( $\alpha$ ) level was set at 0.05.

## RESULTS

A total of 450 patients were classified based on visual field defects and categorized into 242 CFL (53.8%) and 208 PFL (46.2%). Overall, patients aged above 40 years were found to be higher with 185 (41.1%) followed by patients aged between 18 and 40 who were 169 (37.6%) and below 18 were 96 (21.3%). The majority of the patients in the CFL group were above 40 years of age 106 (43.8%), whereas in the case of the PFL group, 83 (39.9%) were aged between 18 and 40 years who belonged to the working age group. The median age of the overall patients was 34.5 years, the median age of the CFL group was 36 years and the PFL group was 34 years. Of these 450 patients, 323 (71.8%) were men and 127 (28.2%) were women. In the case of the CFL group, 171 (70.7%) were men and 71 (29.3%) were women, similarly, in the PFL group 152 (73.1%) were men and the rest 56 (26.9%) were women. There was no significant difference between the CFL and PFL groups in terms of age and gender ( $P > 0.05$ ). The majority of the patients 54.22% (244) were financially independent, whereas the remaining 46% (206) were

financially dependent on others. In general, the majority of the patients belonging to students and employed profession were approximately 30% (114) and 40% (179), respectively, followed by homemakers and retired with 13.4% (59) each. Almost 40% of the patients in both CFL and PFL groups were employed. Myopia was the most common refractive error in both CFL (50.8%), and PFL (52.4%) groups followed by hyperopia 19.8% and 18.6% in CFL and PFL groups, respectively. Around 62% of the participants in both groups reported difficulty in near vision and 7.9% of the people in the CFL group and 13.5% in the PFL group had complaints of distance vision. Difficulty in both distance and near was reported in 19 patients of the CFL group and 38 patients in the PFL group. Overall, patients with moderate visual impairment were found to be higher with 41.8% (188), followed by severe visual impairment of 34% (153), 20.4% of mild visual impairment, and 2.2% profound and near blindness ranked the least with 1.6%. The majority of the participants with CFL (43.4%) and PFL (40%) have moderate visual impairment, as shown in Table 1.

The median duration of symptoms was more than 4 (8) years in the CFL group when compared to 2 (4) years in the PFL group. Out of 450 patients, 242 (53.8%) patients were found to have CFL and 208 (46.2%) had PFL. Of the 242 cases with CFL, atrophy-related conditions were 54.1%, followed by hereditary macular degeneration 22.4%, age related changes

**Table 1: Baseline characteristics of subjects with low vision due to central field loss and peripheral field loss**

| Details                       | Variables            | Frequency                          |                                    |
|-------------------------------|----------------------|------------------------------------|------------------------------------|
|                               |                      | CFL ( <i>n</i> =242), <i>n</i> (%) | PFL ( <i>n</i> =208), <i>n</i> (%) |
| Age                           | Median (IQR)         | 36 (37.8)                          | 34 (29.2)                          |
|                               | <18                  | 50 (20.7)                          | 46 (22.1)                          |
|                               | 18-40                | 86 (35.5)                          | 83 (39.9)                          |
|                               | >40                  | 106 (43.8)                         | 79 (38.0)                          |
| Gender                        | Male                 | 171 (70.7)                         | 152 (73.1)                         |
|                               | Female               | 71 (29.3)                          | 56 (26.9)                          |
| Patient profile               | Students             | 70 (28.9)                          | 44 (21.2)                          |
|                               | Discontinued studies | 5 (2.1)                            | 2 (1.0)                            |
|                               | Unemployed           | 6 (2.5)                            | 12 (5.8)                           |
|                               | Employed             | 96 (39.7)                          | 83 (39.9)                          |
|                               | Housewife            | 27 (11.2)                          | 32 (15.4)                          |
|                               | Farmer               | 1 (0.4)                            | 4 (1.9)                            |
| Refractive error              | Retired              | 34 (14.0)                          | 25 (12.0)                          |
|                               | Myopia               | 123 (50.8)                         | 109 (52.4)                         |
|                               | Hyperopia            | 48 (19.8)                          | 39 (18.6)                          |
| Task difficulties             | Distance             | 19 (7.9)                           | 28 (13.5)                          |
|                               | Near                 | 150 (62.0)                         | 127 (61.1)                         |
|                               | Both                 | 19 (7.6)                           | 38 (18.3)                          |
|                               | Computer             | 5 (2.1)                            | 2 (1.0)                            |
| Category of visual impairment | Mild                 | 51 (21.1)                          | 41 (19.7)                          |
|                               | Moderate             | 105 (43.38)                        | 83 (39.90)                         |
|                               | Severe               | 80 (33.05)                         | 73 (35.09)                         |
|                               | Profound             | 5 (2.06)                           | 5 (2.40)                           |
|                               | Near blindness       | 1 (0.41)                           | 6 (2.88)                           |

IQR: Interquartile range, CFL: Central field loss, PFL: Peripheral field loss

13.6% and macular scar with 9.9%. Cone dystrophy (21.1%) was the major cause of low vision among atrophic changes and Stargardt disease (12.5%) was the majority in hereditary macular degenerative changes. In the case of PFL group with 208 cases, 81.7% had retina-related changes and 18.3% had optic nerve-related changes. Of the 170 retina-related diseases, 81.2% (169) had RP. Out of 38 patients with optic nerve-related problems 15.9% (33) had glaucoma and others, as given in Table 2.

Overall, 71.3% of the low vision patients preferred LVD. Of both, groups, 76% of the patients preferred LVD in the CFL group and the PFL group preferred 65.9%. Almost 34% of the patients in both CFL and PFL group have preferred half eyes and Ashperics reading spectacles, followed by 32.5% in CFL and 28.1% in PFL preferred dome magnifiers. More than 90% of the patients in both groups reported vision improvement with optical devices, whereas <10% of electronic portable devices were required for visual improvement. LVD were highly preferred by the retired population (81.4%) to meet their daily living activities, followed by more than 76% by both employed and housewife population. The most preferred magnifier for the employed population was a half eyes spectacle magnifier both in the case of CFL (20.8%) and PFL (22.9%) group, followed by stand and dome magnifiers. Electronic portable video magnifiers were preferred more in the CFL group (8.2%) when compared to the PFL group (6.6%). Among the student population, a dome magnifier was more preferred in the CFL group (47.1%), whereas in the PFL group, half eyes spectacle magnifier (29.5%) was preferred for reading purposes. Students in the PFL group also preferred video magnifiers (9.1%) more

than students in the CFL group (1.4%). The retired population preferred half eyes spectacle magnifier in the case of the CFL group (64.7%), whereas in the PFL group, the preference for spectacle magnifier and dome magnifier was almost similar (16%). Homemakers in the CFL group preferred more spectacle magnifiers (37.0%) and the PFL group preferred dome magnifiers (31.2%), as shown in Tables 3 and 4.

The overall presenting median distance visual acuity was 0.8 (0.3) logMAR pre- and post-LVD trial and the presenting near visual acuity was 0.5 (0.2) logMAR and 0.4 (0.2) logMAR, respectively. The presenting near visual acuity of participants in the CFL group was 0.4 (0.3) logMAR which improved to 0.3 (0.0) and in the case of the PFL group the near visual acuity improved from 0.4 (0.3) logMAR to 0.3 (0.1) logMAR with a  $P < 0.0001$  logMAR which has statistically significant improvement after low vision intervention with a  $P < 0.05$ , as shown in Table 5. Figure 1 represents the box- and-whisker plot of distance visual changes of CFL and PFL patients, which helps interpret the distribution of data. Similarly, Figure 2 represents the box-and-whisker plot of near visual changes of CFL and PFL patients.

## DISCUSSION

This study highlights the comparison of visual characteristics and LVD preference in participants presenting to low vision care clinics. Patients with low vision may have difficulty with activities of daily livings, leading to a lower QoL and possible loss of independence.<sup>[24]</sup> This study is intended to elucidate the importance of LVD in individuals with impaired vision and its significance in daily living activities. The demographic details,

**Table 2: Ocular conditions causing central field loss and peripheral field loss**

| Visual field loss             | Classification              | Sub-classification   | n (%)                       |           |
|-------------------------------|-----------------------------|--|-----------------------------|-----------|
| Central field loss (53.8%)    | Age related (13.6%)         | Dry age-related macular degeneration                           | 9 (3.7)                     |           |
|                               |                             | Scarred choroidal neovascular membrane                         | 24 (9.9)                    |           |
|                               | Atrophy (54.1%)             | Foveal ischemia  | 15 (6.3)                    |           |
|                               |                             | Foveal schisis   | 7 (2.9)                     |           |
|                               |                             | Macular dystrophies  | 17 (7.0)                    |           |
|                               |                             | Cone dystrophy   | 51 (21.1)                   |           |
|                               |                             | Chronic central serous retinopathy                             | 10 (4.1)                    |           |
|                               |                             | Parafoveal telangiectasia                                      | 2 (0.8)                     |           |
|                               |                             | Central areolar choroidal dystrophy                            | 3 (1.2)                     |           |
|                               |                             | Foveal R atrophy   | 10 (4.1)                    |           |
|                               |                             | Rpe alterations involving fovea                                | 11 (4.6)                    |           |
|                               |                             | Pigment epithelial detachment                                  | 1 (0.4)                     |           |
|                               |                             | Macular coloboma   | 1 (0.4)                     |           |
|                               |                             | Foveal hypoplasia  | 3 (1.2)                     |           |
|                               |                             | Heredomacular degeneration (22.4%)                             | Heredomacular degeneration  | 7 (2.9)   |
|                               |                             |  | Stargardt's                 | 30 (12.5) |
|                               |                             |  | Myopic macular degeneration | 16 (6.6)  |
| Vitelliform disease           | 1 (0.4)                     |  |                             |           |
| Macular scar (9.9%)           | 24 (9.9)                    |  |                             |           |
| Peripheral field loss (46.2%) | Retina related (81.7%)      | Retinitis pigmentosa   | 169 (81.2)                  |           |
|                               |                             | Laurence-moon-bardel-beidel syndrome with retinitis pigmentosa | 1 (0.5)                     |           |
|                               |                             | Secondary glaucoma   | 33 (15.9)                   |           |
|                               | Optic nerve related (18.3%) | Anterior ischemic optic neuropathy                             | 5 (2.4)                     |           |

**Table 3: Preference of low vision devices among participants with central field loss based on occupation**

| Field loss  | Category of low vision devices | Types of low vision devices           | Student (n=70)                          | Discontinued studies (n=5) | Unemployed (n=6) | Employed (n=96) | Housewife (n=27) | Farmer (n=1) | Retired (n=34) |
|-------------|--------------------------------|---------------------------------------|---|----------------------------|------------------|-----------------|------------------|--------------|----------------|
| CFL (n=184) | Opticals 169 (91.8%)           | Half eyes and aspherics (n=57), n (%) | 2 (2.9)                                 | 0                          | 3 (50)           | 20 (20.8)       | 10 (37)          | 0            | 22 (64.7)      |
|             |                                | Dome magnifiers (n=55), n (%)         | 33 (47.1)                               | 1 (20)                     | 0                | 15 (15.6)       | 4 (14.8)         | 0            | 2 (5.9)        |
|             |                                | Cut away stand (n=28), n (%)          | 3 (4.3)                                 | 2 (40)                     | 0                | 15 (15.6)       | 3 (11.2)         | 1 (100)      | 4 (11.8)       |
|             |                                | Stand magnifiers (n=1), n (%)         | 0                                       | 0                          | 0                | 0               | 0                | 0            | 1 (2.9)        |
|             |                                | Pocket magnifiers (n=23), n (%)       | 1 (1.4)                                 | 0                          | 0                | 17 (17.7)       | 3 (11.2)         | 0            | 2 (5.9)        |
|             |                                | Handheld magnifiers (n=5), n (%)      | 0                                       | 0                          | 0                | 3 (3.1)         | 0                | 0            | 2 (5.9)        |
|             |                                | Electronic 15 (8.2%)                  | Portable video magnifiers (n=15), n (%) | 1 (1.4)                    | 2 (40)           | 0               | 7 (7.3)          | 2 (7.4)      | 1 (100)        |

CFL: Central field loss

**Table 4: Preference of low vision devices among participants with peripheral field loss based on occupation**

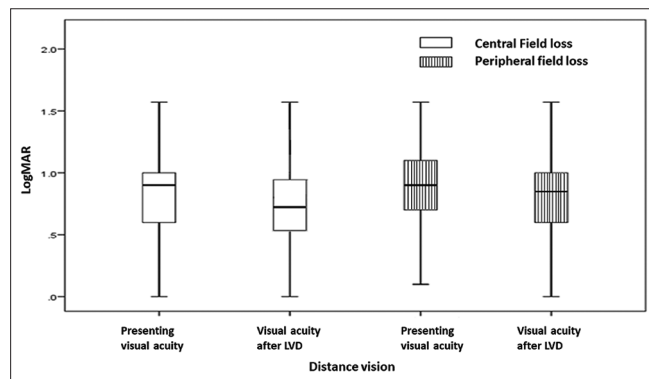
| PFL (n=137)          | Category of low vision devices | Types of low vision devices           | Student (n=44)                         | Unemployed (n=12) | Employed (n=83) | House wife (n=32) | Farmer (n=4) | Retired (n=25) |
|----------------------|--------------------------------|---------------------------------------|--|-------------------|-----------------|-------------------|--------------|----------------|
| Opticals 128 (93.4%) |                                | Half eyes and aspherics (n=44), n (%) | 13 (29.5)                              | 1 (8.4)           | 19 (22.9)       | 6 (18.7)          | 1 (25)       | 4 (16)         |
|                      |                                | Dome magnifiers (n=36), n (%)         | 6 (13.6)                               | 2 (16.7)          | 14 (16.9)       | 10 (31.2)         | 0            | 4 (16)         |
|                      |                                | Cut away stand (n=29), n (%)          | 7 (16)                                 | 1 (8.3)           | 15 (18.1)       | 3 (9.4)           | 0            | 3 (12)         |
|                      |                                | Pocket magnifiers (n=16), n (%)       | 3 (6.8)                                | 2 (16.7)          | 8 (9.6)         | 3 (9.4)           | 0            | 0              |
|                      |                                | Handheld magnifiers (n=3), n (%)      | 1 (2.3)                                | 0                 | 2 (2.4)         | 0                 | 0            | 0              |
|                      |                                | Electronic 9 (6.6%)                   | Portable video magnifiers (n=9), n (%) | 4 (9.1)           | 0               | 2 (2.4)           | 1 (3.1)      | 0              |

PFL: Peripheral field loss

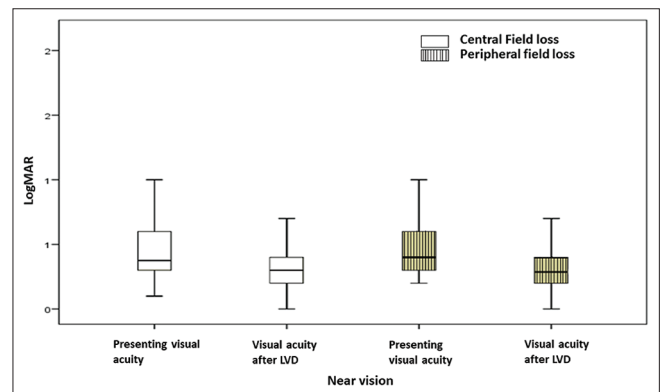
**Table 5: Comparison of visual acuity improvement in participants with central field loss and peripheral field loss after low vision intervention**

| Category              | Distance                 |               |       | Near                     |               |       |
|-----------------------|--------------------------|---------------|-------|--------------------------|---------------|-------|
|                       | Presenting visual acuity | BCVA with LVD | P     | Presenting visual acuity | BCVA with LVD | P     |
| Overall               | 0.8 (0.3)                | 0.8 (0.3)     | 0.042 | 0.5 (0.2)                | 0.4 (0.2)     | 0.000 |
| Central field loss    | 0.8 (0.4)                | 0.8 (0.4)     | 0.000 | 0.4 (0.3)                | 0.3 (0.0)     | 0.000 |
| Peripheral field loss | 0.9 (0.4)                | 0.9 (0.4)     | 0.043 | 0.4 (0.3)                | 0.3 (0.1)     | 0.000 |

IQR: Interquartile range, BCVA: Best-corrected visual acuity, LVD: Low vision devices



**Figure 1:** Comparison of distance visual acuity status before and after low vision intervention in patients with central field loss and peripheral field loss



**Figure 2:** Comparison of near visual acuity status before and after low vision intervention in patients with central field loss and peripheral field loss

age-wise classification, types of LVD preferred based on their occupation, and visual acuity improvement were reported in this study. There are various studies that have taken a single ocular condition based on visual field loss (CFL and PFL) for comparison, whereas in this study, all possible conditions causing low vision were included. So far, LVDs are not analyzed based on comparing CFL and PFL groups. To the best of our knowledge, this is the only study comparing huge subjects and the low vision intervention has been.

Previous literatures have studied the quality-of-life comparison, whereas studies related to visual parameters comparison in low vision are very limited. There was no significant difference between the CFL and PFL groups with regards to age and gender, which indicates that they are age- and gender-matched groups for analysis. However, there was a significant difference in terms of ocular conditions causing CFL and PFL with a  $P < 0.05$ , this implies the conditions are representative of the different populations. This report shows that people with

CFL has preponderance in accessing low vision care when compared to PFL.

More than 70% of the participants were male in both CFL and PFL groups, which shows better eye care access to the male when compared to females in India. The majority of the patients had myopia in both groups followed by hyperopia. The majority of the patients in the CFL group were above 40 years of age which could be due to the late onset of the conditions causing CFL, whereas in the case of PFL, 18–40 years age group was more which proves patients with PFL has visual disturbance much earlier than CFL. Despite minimum differences, a greater number of people were unemployed in the PFL group than CFL group. However, the student and employment ratio was almost similar in both the groups. PFL groups were involved more in agricultural tasks when compared to the CFL group.

Parth Shah *et al.*<sup>[25]</sup> have stated in a study that the efficacy of low vision rehabilitation has been relatively understudied. A working understanding of low vision services is important so that appropriate patients may be recognized and referred promptly. He has also stated in his study that reading difficulty is reported frequently among patients with low vision. This statement correlates with our study as more than 62% of the low vision patients reported difficulty in near vision.

Pardhan *et al.*<sup>[16]</sup> also state that patients with CFL will have more difficulty in grasping and reaching for an object when compared to patients with PFL. Similarly, this study also reports that patients with CFL had more difficulty with near and intermediate visual tasks when compared to the PFL group. The majority of the patients have moderate visual impairment followed by severe and mild visual impairment in both groups. This study provides an outlook of ocular conditions causing central and PFL which would have respective behavioral implications. As expected, atrophy-related macular conditions play a major part followed by hereditary macular conditions and age-related macular degeneration in the case of CFL, while in the PFL group commonly seen ocular condition was RP followed by glaucoma.

Many studies have found that the preference of LVD comparing single ocular conditions in each group. For instance, in a study of visual rehabilitation in Stargardt disease (CFL), the most preferred magnifier was the dome magnifier.<sup>[26]</sup> Our study contradicts this statement as both the CFL and PFL preferred more spectacle magnifiers. Although the difference is minimal, patients with CFL (76%) were found to prefer LVD for improving their visual performance more when compared to the PFL group (66%). Except for students in the CFL group, the rest all preferred half eyes spectacle magnifier for better near visual acuity, which indicates that the spectacle model magnifier is the most preferred magnifier which was also seen in previous literatures. This is because spectacle magnifiers are hands-free and provides maximum field of view and better cosmetic appeal. Students usually prefer dome magnifier due to their wider working distance and comfortable reading posture, which was noted in the case of CFL, whereas the PFL group

would have faced difficulty in focusing inside dome magnifier due to constricted peripheral vision. Mean magnification is the average amount of magnification of LVD required for visual acuity improvement. The mean magnification requirement in case of the CFL group was  $\times 2.6$  times, whereas for the PFL group, it was  $\times 1.87$  times. The mean magnification of requirement was higher in the case of CFL when compared to the PFL group. Despite, the visual impairment remains almost equal in both the groups, visual task difficulties differ between CFL and PFL groups. Further in-depth qualitative analysis is required to understand the nature of visual task difficulties. The LVD help in visual improvement irrespective of the ocular condition and field loss. With the advancement of electronic portable devices, patients with severe visual impairment also appreciate significant improvement in their visual acuity. There was a statistically significant improvement in visual acuity for distance and near in both CFL and PFL groups with the preferred LVD as shown in Figures 1 and 2. In conclusion, patients with low vision preferred to use LVD for better performance of their visual tasks. According to the perception of eye care practitioners and patients, there was an improvement in the QoL of low vision patients after accessing the LVC services. Patients articulated a better understanding of their eye condition after visiting the LVC clinic.<sup>[27]</sup> Low vision intervention helps in enhancing the quality of vision and thereby provides confidence and motivation to the patients with low vision.

## CONCLUSION

Visual rehabilitation is successful in various ocular pathologies. The use of LVD can help these patients, at least those with residual vision, where medical and surgical treatments have none or a limited role in restoring useful vision.

## Ethics approval

The study protocol was approved by the Institutional Review Board (Ethics committee) at Vision Research Foundation, Chennai. (Study code: 59-2007B, Approval date: January 17, 2020) Informed consent for this study was waived by the Ethics Committee and it adhered to the tenets of the Declaration of Helsinki.

## Consent to participate

Consent is waived by the ethics committee.

## Consent for publication

Consent is waived by the ethics committee.

## Data availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the policy of the ethics committee but are available from the corresponding author on reasonable request.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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