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EFFECT OF LOW VISION ON OCCUPATION AND IMPROVING THE PROFESSIONAL LIFE OF ADULTS WITH LOW VISION DEVICES.

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ABSTRACT:

Background: The aim of the study is to allow people to continue their day-to-day tasks, reading is one of the most important things. It is achieved by providing of suitable optical devices and special training in the use of distance and near vision.

Method: The study encompassed 46 patients with various diseases ranging from 20 to 65 years of age. Each patient underwent eye examination, which included determining their magnification requirements and providing them with suitable low vision devices. Reading speed, quantified in words per minute, was assessed by having the patients read from the M.N. Reading Chart after they had been equipped with the previously mentioned devices.

Results: In this prospective study, patients with partial vision showed improvement in visual acuity and reading speed after receiving low vision management. The average best-corrected distance visual acuity of the better eye was 6/36 +/- 6/9. Among those who used optical aids, 58% saw improvement in vision. Reading speed increased from 8 +/- 26 words per minute to 72 +/- 33 words per minute after utilizing magnification.94% of patients were able, to achieved reading ability with the magnification. In terms of mobility and orientation, some patient achieved fair to best mobility levels. 73.3% of patients were able to continue their jobs after receiving assistance.

Conclusion: A standardized reading speed measurement is crucial for evaluating the impact of low vision services on visually impaired patients. Our research indicates that providing suitable vision aids can improve reading ability, leading to significantly enhanced reading speed and daily mobility.

Key words: Low vision devices, M.N. Reading Chart, Visual acuity, words per minute, Magnification, professional life.

1. WHO HEALTH ORGANIZATION DEFINATION

"A person with low vision, who has impairment of visual functioning even after treatment, and/or standard refractive correction, and has a visual acuity of less than 6/18to light perception or a visual field of less than10 degree from the point of fixation, but who uses, or is potentially able to use, vision," how the WHO 1992 defines low vision [(20)].

Functional vision defects refer to a significant decreased in visual acuity caused by certain untreatable medical conditions. This condition results in reduced peak contrast sensitivity, insufficient visual resolution in differing illumination levels, limited field of vision, among other challenges. These compounding effects often obstruct activities of daily living, making tasks more difficult to perform.

Legal blindness is a term used to designate a degree of visual defects where even with corrective lenses, substantial visual constraints persist. Typically characterized by a visual acuity of 20/200 or poorer in the better eye with optimal correction, or a restricted visual field of 20 degrees or less, legal blindness indicates severe visual deficiency that hampers various aspects of daily life. These stringent criteria demonstrate the significant impact that such visual defects can have on an individual's ability to navigate and function in the world around them.

BARRIERS IN PROVIDING LOW VISION SERVICES:

In a study conducted by Dr. S.A Khan et al, focusing on the Perceived Barriers to the provision of low vision services among Optometrists in India [(2)], several significant challenges were identified. The research highlighted that a considerable number of Optometrists expressed concerns about the obstacles hindering the effective delivery of low vision care. The key barriers identified included the lack of adequate training in low vision interventions, insufficient awareness about the importance of low vision services, and the critical issue of non-availability of essential low vision devices, with a staggering 72.2% of respondents acknowledging this as a major constraint.

Cause of low vision

The disease progresses through distinct stages that gradually affect daily activities. Anatomical changes signal the disease's beginning, followed by vision impairment. As the condition worsens, visual disabilities can hinder daily tasks and require assistance for individuals with low vision. Healthcare professionals and caregivers should monitor the disease's progression and provide tailored support at each stage for optimal care [(1)].

2. METHODS

It is a prospective study that was carried out in a tertiary eye care institute in western Punjab from a period September 2023 to February 2024 in a low-vision clinic. The study will select participants from the low-vision clinic appointments, including new and returning patients. Prospective participants will receive a detailed briefing about the research. They will be formally enrolled after reviewing and signing the informed consent form. This process ensures participants understand the study's parameters and give voluntary consent. Upholding ethical standards and prioritizing participants' well-being is essential in this process.

SAMPLE SIZE DETERMINATION:

$n= (Z^2 P(1-P))/d^2$

where, n=sample size

Z= statistic for a level of confidence

P=Expected prevalence or proportion

(If the expected prevalence is 20% then P=0.2) and
d=Precision (If the precision is 5% then d=0.05)
where z value is constant
z=1.96

STUDY POPULATION: All low vision patients who have difficulty during their daily professional work.

Inclusion Criteria
- All type of occupational patients with low vision
-Age group 20 to 65 years
-Ocular diseases which cause low vision e.g. Diabetic Retinopathy, glaucoma, Retinitis pigmentosa, etc.

Exclusion Criteria
-Developmental delay, multiple disabilities, and vision impairment
-Visual acuity of both eye PL- and visual field less than 10 degrees

Clinical Procedure
Age, eye conditions, near and distance vision, LVD usage, and occupation were recorded for each participant. Evaluations took place at a low vision clinic with volunteer participants.
Evaluation of reading: The eye-to-screen distance, image size, and item size are all expressed in cm. The distance between the subject's eyes and the reading material is known as the eye-to-screen distance. The overall amount of magnification, including relative distance magnification, that a subject requires to complete a visual task is known as equivalent power. The equivalent power that is consumed is calculated by taking the product of these two.
Magnification requirement for near will be calculated by formula

$$\frac{\text{Best corrected visual acuity}}{\text{Target visual acuity}} \times \frac{100}{\text{working distance}}$$

The Minnesota Low Vision Reading Test (MN read), developed by Legge, Ross, and Luebker in 1989, is a standardized tool used in clinical settings to assess the reading proficiency of individuals with low vision. The primary objective of the MN read test is to provide low-vision patients with a quick and accurate evaluation of their minimal reading speed. This assessment is crucial in understanding how visual deficiency impacts an individual's ability to read effectively.
The formula for calculating reading speed involves considering the correlation between words per minute and comprehension. Each sentence in the M. N. READ ACUIT CHARTS consists of ten standard-length words, which simplifies the calculation.
The basic formula for determining reading speed is 600 divided by the time in seconds. A more precise assessment can be achieved by adjusting the formula to account for mistakes. The revised formula is reading speed equals 60 multiplied by (10 minus the number of mistakes) divided by the time in seconds. If the number of mistakes exceeds ten, the reading speed is considered to be zero.
Writing proficiency is essential for efficiently performing daily tasks such as managing finances, taking notes during work meetings, and creating to-do lists.
Distance visual acuity will measure using the Early Treatment Diabetic Research Study (ETDRS) chart with the patient’s best refractive correction for distance
All Data were obtained with specifically designed data sheets, and stored in a relational database (Microsoft Office access). Results were indicated descriptively as mean values,

standard deviation and range. Comparisons between reading speed before and after the provision of low vision aids were performed using the t-test for the dependent sample. The Correlation between reading speed and magnification power was estimated by using Spearman's rank order correlation coefficient. P-value < 0.05 WAS regarded as indicator of local statistical significance. Statistical analysis was performed using SPSSWIN 14.0 (SPSS Inc. Chicago USA).

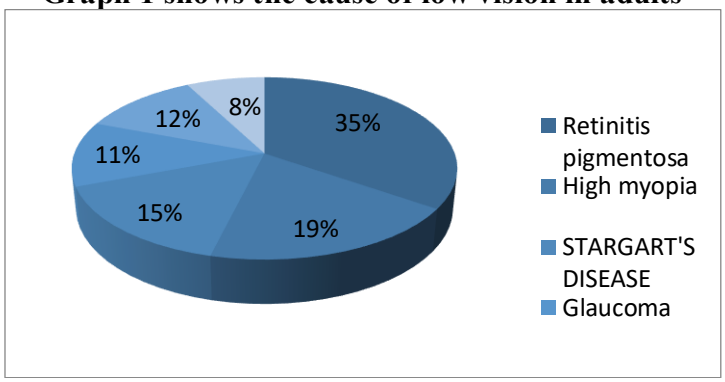
3. RESULT

In a recent study, the unaided distance visual acuity (VA) was found to be 1/60 ± 6/18 on Snell's chart, while the distance VA with low vision aids (LVA) improved to 6/36 ± 6/9 on the same chart. Out of all participants, which consisted of patients with varying visual defect, a total of 18 individuals demonstrated an increase in their distant VA after interventions.

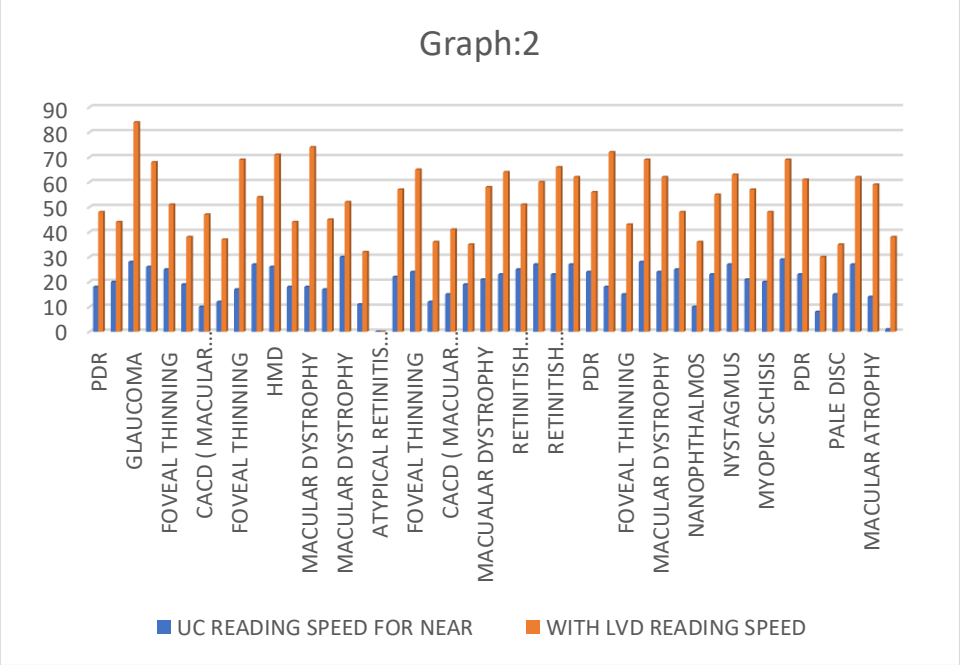
Among the recommendations made by the healthcare professionals conducting the study, 15 patients were prescribed telescopic glasses, while another 17 were advised to use both telescopic glasses and high spherical near glasses concurrently. Moreover, 15 patients were provided with Argus magnifiers exclusively to aid their vision.

Specifically, the Galileo system, a specialized optical device, was allocated to five cases, whereas 17 individuals received magnifiers to assist with their visual defects. Five out of the 17 cases were given binocular glasses, while the remaining 11 were suggested to use spectacles for near vision correction.

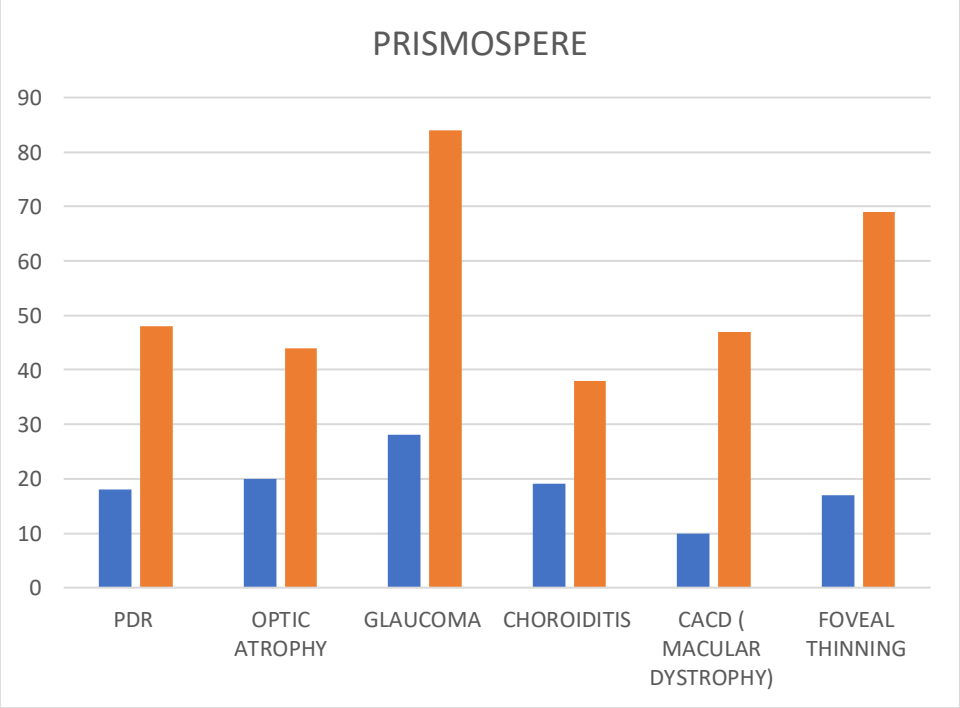
Graph 1 shows the cause of low vision in adults



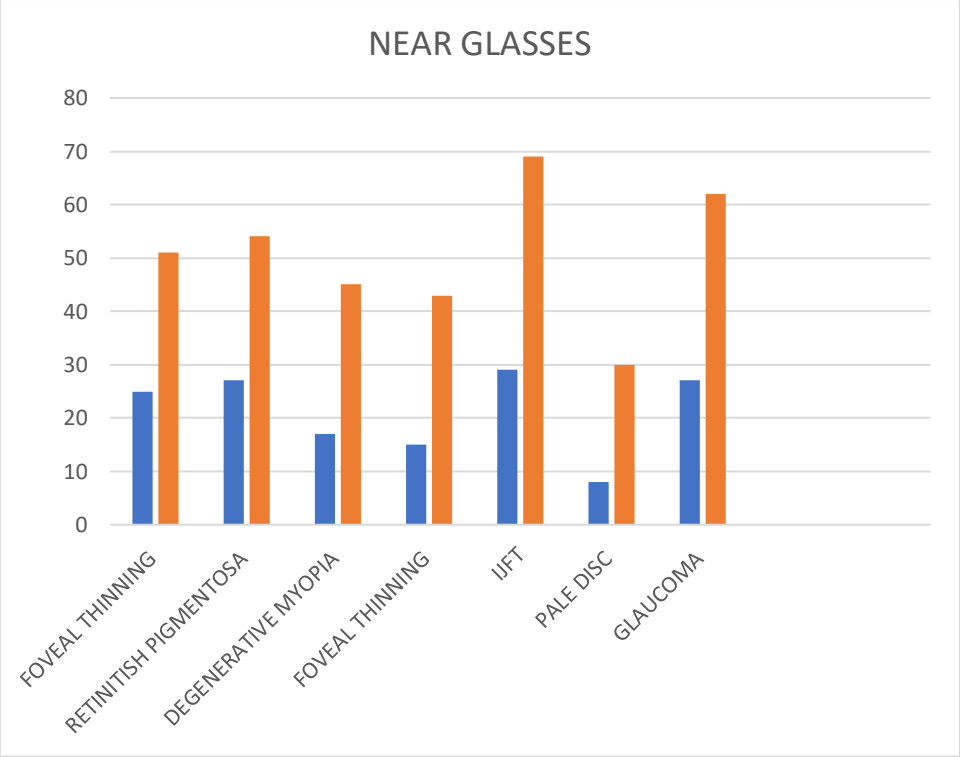
The data presented in Graph 2 showcases the mean reading speed in words per minute (wpm) for a specific group, both without and with appropriate LVAs. Initially, the mean reading speed stood at 8 wpm with a standard deviation of 28 wpm. However, after the implementation of suitable low vision aids, there was a substantial improvement in reading speed, with the mean rising to 72 wpm and a standard deviation of 33 wpm. Noteworthy is the significant increase in reading speed after the incorporation of low vision aids, as indicated by a p-value of 0.000, highlighting the effectiveness of these aids in enhancing reading capabilities within this group. The substantial improvement from 8 wpm to 72 wpm underscores the importance and impact of utilizing appropriate assistive technologies for individuals with low vision, ultimately leading to a notable enhancement in their reading skills and overall quality of life.



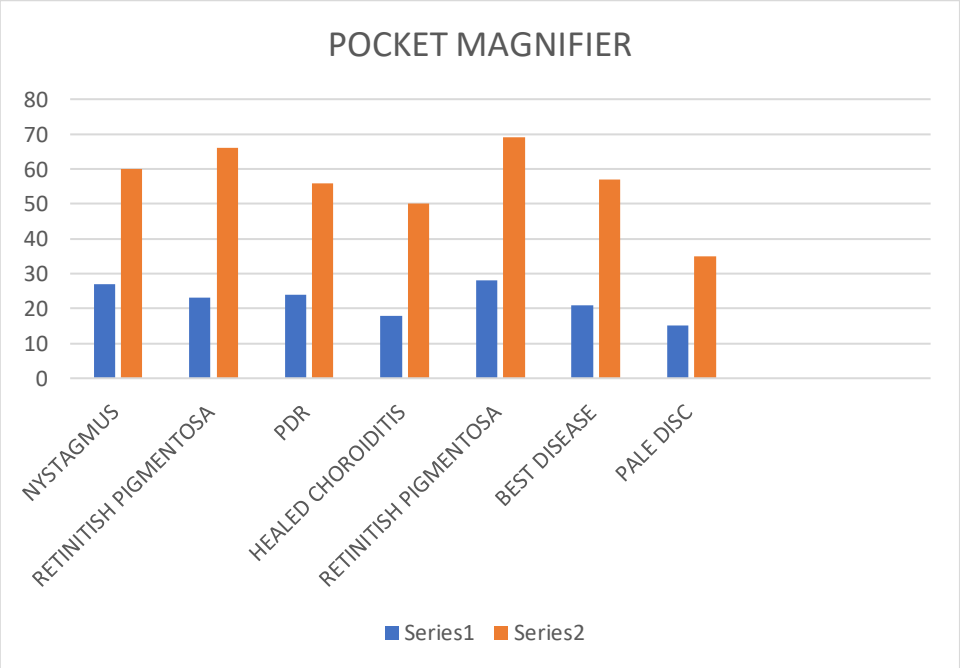
Graph:2 Comparisons of reading speed with different LVAs in 46 patients with different types of diseases.



It is noted that patients with glaucoma may benefit from utilizing prismosphere reading speed with LVA due to the potential for enhancing their reading capabilities compared to conventional methods. This may be attributed to the specialized design of prismospheres, which can aid in improving reading speed and comprehension for individuals affected by glaucoma.

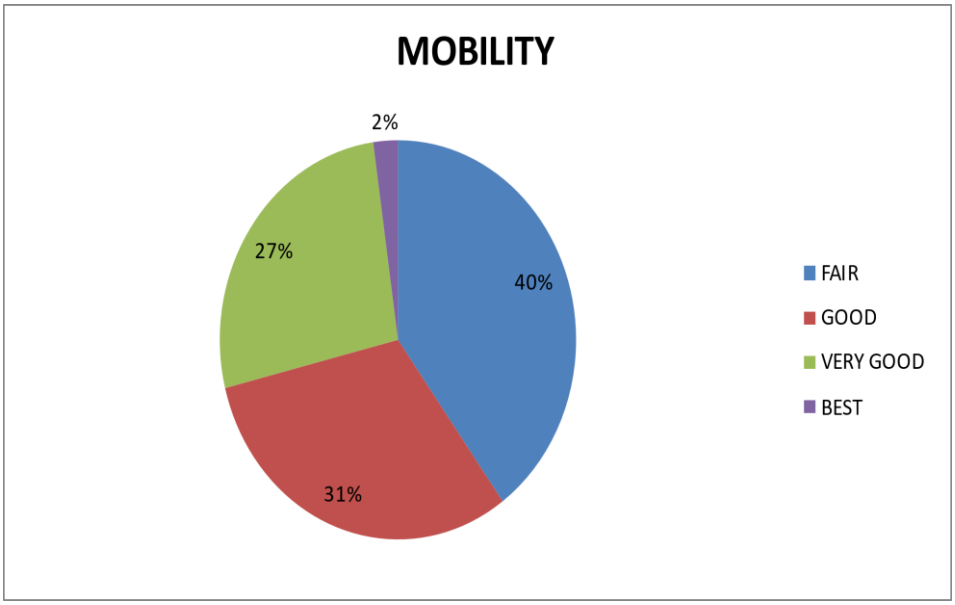


Additionally, for those diagnosed with IJFT (idiopathic juxta foveal telangiectasia), the use of near glasses may prove to be a suitable solution in enhancing their visual acuity and facilitating better near vision tasks.



Similarly, individuals with Retinitis pigmentosa might find pocket magnifiers to be beneficial in magnifying and clarifying images, improving their overall visual experience and aiding in tasks that require closer examination.

Mobility chart



These tailored low vision aids can play a significant role in improving the quality of life and daily functionality for patients dealing with various eye conditions, offering them enhanced visual support and assistance in their day-to-day activities.

Table 1 Comparative analysis of UCVA and BCVA for distance with LVA

Group	N	MEAN	Std. deviation	SEM
1.	42	1.102	0.568	0.08765
2.	40	0.43	0.3582	0.05664

Difference: Mean-0.6724, SEM-0.155
95% confidence interval for difference: 0.4625 to 0.8823
t = 6.375 with 80 degrees of freedom; P=0.000

Table 2 Comparative analysis of UCVA and BCVA for near with LVA

Group	N	MEAN	Std. deviation	SEM
1.	37	0.4432	0.3228	0.05307
2.	46	0.187	0.2267	0.03342

Difference: Mean- 0.2563, SEM-0.06042
95% confidence interval for difference: 0.1361 to 0.3765
t = 4.242 with 81 degrees of freedom; P=0.000

Table 3 Comparative analysis of Reading speed with and without LVAs for near

Group	N	MEAN	Std. deviation	SEM
1.	34	19.94	6.485	1.112
2.	34	50.82	14.85	2.546

Difference: Mean: -30.88, SEM:2.779
95% confidence interval for difference: -36.43 TO -25.33
t = -11.114 with 66 degrees of freedom; P=0.000

4. DISCUSSION

A prospective study was undertaken at a low-vision clinic with the aim of exploring the efficacy of optical devices in assisting patients to read materials such as newspapers, books, medicine labels, and expiry dates, as well as enhance their ability to write legibly for communication purposes such as handling daily payment bills and dialling phone contacts. Moreover, the study also delved into how these aids impacted the management of financial transactions and affairs, including identifying currency and carrying out banking tasks.

The field of low vision service is expanding beyond traditional disciplines such as ophthalmology, optometry, occupational therapy, and sociology. This interdisciplinary approach is reshaping conventional practices related to research, education, and service delivery for individuals with visual defects. By integrating insights and expertise from various disciplines, low vision service aims to enhance the quality of life and independence of visually defects individuals.

In our current research, we have conducted a comprehensive analysis of the impact of customized LVAs on the enhancement of reading abilities in individuals with visual defects. The findings reveal a significant advancement in reading proficiency among the participants who received tailored magnifiers. Notably, the study indicates a remarkable 65% success rate in achieving reading ability post the provision of these magnifier's, in contrast to the limited 35% reading capability exhibited by the same individuals prior to their intervention.

Our study underscores the substantial potential of adapted low vision devices in empowering individuals with visual defects to engage in reading activities more effectively. Through the personalized selection and utilization of low-vision devices, these individuals are able to experience a substantial improvement in their reading skills, thereby enhancing their overall quality of life and independence.

In our study, it was noted that 35% of the patients exhibited a visual acuity range between 6/9 and 6/12 in their better eyes. The crucial aspect for enhancing reading capabilities was found to be the variation in the visual aids prescribed to the patients. Notably, our patient cohort included individuals with higher magnification needs, demonstrating a preference towards optical visual devices. This choice was justified by the observation that reading within a limited field was considerably more challenging without such devices.

Furthermore, an essential point to consider is the superior quality of the current optical low vision devices in comparison to those utilized in prior research studies [6,7,8,9,10]. This improved quality likely contributed to the enhanced reading performance witnessed in our study. It is worth highlighting that our approach involved not just providing instructions on handling the low vision devices but also entailed thorough training sessions focused on reading with the aid for a minimum of 30 minutes before assessing reading speed and prescribing the visual devices.

The study included an analysis of the visual acuity at distance (VA) and near vision among all participants. The data revealed that the mean VA was 0.4 +/- 1.00 logMAR (p-value = 0.000), indicating a significant improvement. Similarly, the near vision acuity was found to be 0.4 +/- 0.9 logMAR (p-value = 0.000), showing a notable enhancement in near vision capabilities.

In the case of patients with middle-low vision who required near correction, binocular high spherical glasses were prescribed to address their visual needs. This intervention aimed to optimize their near vision performance and improve their overall visual function.

Overall, the findings of this study underscore the importance of tailored interventions, such as providing appropriate corrective glasses, in enhancing visual acuity and positively impacting the quality of life for individuals with visual defects. Further research and interventions focused on optimizing visual outcomes for patients with varying levels of visual acuity are warranted.

The results of our study unequivocally demonstrate the substantial impact of utilizing low vision devices on the reading speed and ability of patients with visual defects. Prior to the

implementation of appropriate vision devices, a significant majority of the individuals examined exhibited a minimal reading speed of less than 30 words per minute, thereby indicating a severe reading limitation. However, upon the adoption of adapted vision devices, a remarkable transformation was observed, with patients achieving a noteworthy reading speed of 72 words per minute, accompanied by a standard deviation of 33 words per minute.

One noteworthy aspect of our research lies in the revelation of the substantial benefits derived from providing low vision devices to individuals with visual defects, without necessitating extensive training in eccentric viewing techniques. Moreover, this advantageous outcome was discerned across a broad spectrum of patients possessing retained central fixation, underscoring the broad applicability and efficacy of utilizing low vision devices in enhancing reading proficiency among individuals with visual defects [14,15,16,17].

Graph no. 1 displayed a significant finding that accentuates the importance of suitable vision devices for individuals with defective vision. The data revealed that prior to utilizing the adapted vision aids, the reading speed of patients was consistently below 30 words per minute (wpm), signifying a lack of reading ability. However, upon implementation of the adapted vision devices, the patients demonstrated a marked visual defect, achieving a mean reading speed of 72±33 wpm, with a statistically significant p-value of 0.000.

This study's findings align with previous research conducted by reputable scholars like Trauzettel-Klosinski et al. in 1994 and Whittaker & Lovie-Kitchin in 1993, emphasizing the correlation between reading speed and fluency levels [10]. The results underscore the pivotal role of vision services through the tailored provision of low vision devices in enhancing reading abilities.

Moreover, the effectiveness of low vision devices has been corroborated by past studies utilizing vision-related questionnaires (McCabe et al. 2000; Frohlich & Lackerbauer 2006) and assessing reading speed post-macula translocation in a select patient group (Nguyen et al. 2007) [10]. These collective findings underscore the transformative impact of vision interventions in enhancing the quality of life for individuals with visual defects.

Magnifying optical lenses come in a variety of dioptric powers and are made from different materials to correct for weight, thickness, spherical aberrations, and variable light intensities [17]. These lenses can be used as loose lenses, mounted on optical frames, or used with various attachments. Increasing dioptric power in plus lenses reduces the viewing distance, making them ideal for tasks requiring near-resolution acuity, such as reading [18,19].

Telescopic devices, made up of plus and/or minus optical lenses, can also provide magnification. These devices can achieve normal resolution acuity levels for all viewing distances. However, they are suitable only for stationary tasks where mobility and orientation are not required. Additionally, telescopic devices help preserve binocularity, even at high levels of visual disparity [3].

Understanding the features and functions of magnifying optical lenses as well as telescopic devices can help individuals make informed decisions about which tools best suit their specific visual needs and requirements

Abbreviations:

LVA: Low vision aids
LVD: Low vision devices
UCVA: Uncorrected visual acuity
BCVA: Best corrected visual acuity
VA: Visual acuity
WPM: Word per minute

Acknowledgements:

Not applicable

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