ORIGINAL ARTICLE

Assessment of Low Vision Aids for Low Vision Patients

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Abstract:

Purpose: To evaluate assessment of low vision aids for low vision patients.

Methodology: All patients with VA less than 6/18 in the better eye after medical or surgical treatment and / or best available correction were included in the study. Low vision devices including telescopes stand magnifiers, hand magnifiers and closed-circuit television (CCTV) were used during the low vision assessment. Specific type and design of low vision device was selected to meet the activities according to the specific and professional needs of each case.

Results: Total number of patients included in this study were 126, in which 65.07% were males and 34.93% were females. About 58.74 % patients were improved to WHO category I (6/18 or better) with low vision devices, 23.81 % patients improved to category II, 9.52 % improved to category III and 7.93 % to category IV. Considering near VA, with low vision devices, about 75.50 % improved to category I (1M or better), while 20.74 % improved to WHO category II (<1M to 3.2M) and 3.76 % to category III (<3.2M).

Conclusion: Low vision aids if selected according to the needs of low vision patients are useful tools to help low vision patients in terms of some improvement in vision to carry out some specific daily works and are an effective means of providing visual rehabilitation. *Al-Shifa Journal of Ophthalmology 2022; 18(3): 154-161.*

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Introduction:

The National Eye Institute United States of America defines low vision as a visual impairment not correctable by standard glasses, contact lenses, medication or surgery, which interferes with the ability to perform activities of daily living.[1]

WHO defines low vision as people having vision worse than normal but better than legal blindness.[2] WHO working definition of LVA (Bangkok, 1992) defined low vision as "A person with low vision is one who has Impairment of visual functioning even after treatment and/or standard refractive correction, and has a visual acuity of less than 6/18 to light perception, or a visual field less than 10 degrees from the point of fixation, but who uses, or is potentially able to use, vision for the planning and/or execution of a task". [3]

A visual impairment can cause disabilities by significantly interfering with one's ability to function independently, to perform activities of daily living and/or to

travel safely through the environment.[4] An impairment of the visual system can present at birth, or develop shortly thereafter.[5] Visually impaired children are often developmentally delayed in the areas of gross and fine motor skills and perception.[6] The common causes of low vision are uncorrected refractive errors, corneal dystrophies, macular dystrophies, glaucoma, diabetic retinopathy, retinal detachment, macular degeneration, albinism and retinitis pigmentosa which have severe social and economic effects on individual's life.[7]

Because low vision cannot be improved by more traditional methods (i.e., the use of glasses, contact lenses, etc.) persons with low vision often rely on the use of a number of different instruments, called low vision devices, and tailored equipment for improving vision.[8].Only about 20-25% of those who could benefit from these treatment options present to low vision Optometrist.[9]

Low vision devices are categorized as optical, non-optical and electronic. Low-vision non-optical devices include a number of adaptations, such as reading stands, absorptive sunglasses, supplemental lighting, typoscopes, and tactile locator dots. They are often recommended as part of a low vision examination. They can be used in combination with magnifiers and other low vision optical devices that can help with reading and a variety of tasks. Optical low vision devices involve the use of one of many types of lenses e.g. magnifying eyeglasses, hand magnifiers and magnifying lamps to improve vision. Hand-held or spectacles-mounted telescopes are useful for seeing longer distances, such as across the room, to watch television and can also be modified for near (reading) tasks. Closed circuit television or CCTV involves enlarged images display on screens. Electronic devices are available in portable and desk formats. They combine a camera and a screen to magnify printed pages, pictures or other small objects. [10]

This study has been done in order to find the low vision devices as a helping tool in terms of vision improvement in patients with low vision. Many studies have been done regarding low vision, its causes and prevalence but before this study not much work has been done on visual outcome of low vision devices in low vision patients in our population.

Materials and Methods:

It was a hospital based descriptive, cross-sectional study and was carried out at eye OPD, Qazi Hussain Ahmad Medical Complex, Nowshera. The population under study was those visiting Eye OPD, whose presenting visual acuity was less than 6/18 in the better eye with best available correction and not correctable by standard glasses, contact lenses, medication or surgery. The duration of the study was one year i.e. 1st Jan 2019 to 31st Dec 2019. All the consecutive patients of both genders and any age were included in the study. All patients with VA ≥6/18, mentally retarded, patients who didn't communicate and severely ill patients were excluded from the study.

First the Visual Acuity was taken on standard retro-illuminated Log MARChart at 4m and, if necessary, at 3m or 2m in each eye separately. Near reading cards, FEINBLOOM chart for the partially sighted, the THUMBLING E, and the LEA CARDS were used for measurement of near vision and in patients who could not read English, depending on the level of cooperation. If VA could not be measured with these charts, then a sequential approach was used with the following tests e.g. counting fingers, hand movement, light perception. For the purpose of this study, WHO definition for low vision was used to categorize the far vision as: mild or category I (visual acuity worse than 6/12 to 6/18), moderate or category II(6/60 < VA < 6/18, 10°< VF < 20°), severe vision impairment or category III (3/60 < VA< 6/60, 5° < VF < 10°), and blindness or profound vision impairment or category IV

(VA < 3/60, VF < 5°).While near acuity data was presented in three groups. Ist group 1M (newspaper print size) or better which would allow access to most printed materials, 2nd group < 1M to 3.2M (display materials); which will allow only limited access to ink print and 3rd group <3.3 M. All of these Visual acuities were converted into equivalent Snellen acuities in order to follow WHO categories.

Retinoscopy was performed on all patients, followed by subjective refraction using standard techniques. The best corrected distance and near acuity, the refractive error and the eye to chart distance was recorded for the better eye. Detailed anterior and posterior segment examination by slit lamp and indirect ophthalmoscopy was carried out for all patients by consultant ophthalmologist to make a diagnosis of underlying condition responsible for low vision. The major predisposing condition for each person in the better eye was assigned as the cause of visual impairment. All patients were then assessed with low vision devices using the better eye. Low vision devices including telescopes stand magnifiers, hand magnifiers and closed-circuit television (CCTV) were used during the low vision assessment. Specific type and design of low vision device was selected to meet the activities according to the specific and profession needs of each case. Visual functions specifically improvement in near and far visual acuity was assessed after applying specific low vision aid in each patient. The participants who were already using the low vision devices were reassessed for any possible improvement with same or new low vison devices.

After complete examination we collect the whole information that included details of objective assessment and subjective assessment for low vision patients. All the information was recorded in a specially designed proforma. Data was analyzed using SPSS version 20.0. Descriptive statistics were calculated for all variables. Frequencies and percentages were calculated for categorical variables like gender. Mean + Standard deviation were concluded for numeric variable like Age. AP-value of <0.05 was considered as significant. All the results were presented in the form of tables.

Results:

In this study, the total number of patients examined were126 whose VA was less than 6/18 with best correction. In which 82 were males and 44 were females.

In age wise distribution of low vision, in age group 5-10 years there were 11 (64.70%) males and 6 (35.30%) female, in age group 11-16 years there were 15 (68.18%) males and 7 (31.82%) females, in age group 17-39 years there were 31 (67.39%) males and 15 (32.61%) females and in age group 40 and above there were 25 (60.97%) males and 16 (39.03%) female. (table No: 1)

While considering un-aided VA 58.73 % patients were visual impaired WHO category II (< 6/18 to 6/60), 22.22% were sever visual impaired in WHO category III (<6/60 to 3/60) and 19.05% were blind in WHO category IV (<3/60). With refraction in 61.90% patients VA improved to WHO category II, 19.05% patients remained in WHO category III and 19.05 % patients in WHO category IV. About 58.74 % patients were improved to WHO category I(6/18 or better) with low vision devices,23.81 % patients improved to category II, 9.52 % improved to category III and 7.93 % to category IV.P value < 0.05.(Table No: 2).

Considering near VA, with low vision devices, about 75.50 % improved to category I (1M or better), 20.74 % improved to WHO category II (<1M to 3.2M) and 3.76 % to category III (<3.2M).P value < 0.05.(Table No: 3).

Percentage of patients using different types of low vision devices for far and near is shown in table No: 4 and table No: 5.

Table-I Age wise distribution of low vision among different age groups

Sr.	Age group (years)	Males	Males%	Females	Females %	Total
1	5-10	11	64.70%	6	35.30%	17
2	11-16	15	68.18%	7	31.82%	22
3	17-39	31	67.39%	15	32.61%	46
4	40 & above	25	60.97%	16	39.03%	41
Total		82	65.07%	44	34.93%	126

Table-II Comparison of unaided distance VA, VA with glasses, and VA with LVDs

VA	Unaided V A(n%)	VA with glasses after refraction (n%)	V A with LVDs (n%)
6/18 or better	0 (0.00%)	0 (0.00%)	74 (58.74%)
<6/18 to 6/60	74(58.73%)	78 (61.90%)	30 (23.81%)
<6/60 to 3/60	28 (22.22%)	24(19.05%)	12 (9.52%)
<3/60	24 (19.05%)	24 (19.05%)	10 (7.93%)
Total	126 (100%)	126 (100%)	126 (100%)

P Value: 0.045

Table-III Comparison of presenting near VA and Near VA with LVDs

VA	Presenting near VA n%	Near VA with LVDs n%
1M or better	25 (19.84%)	95 (75.50%)
<1M to 3.2M	81 (64.28%)	26 (20.74%)
<3.2 M	20 (15.88%)	4 (3.76%)
Total	126 (100%)	126 (100%)

P Value 0.024

Table-IV Patients using different types of LVDs for distance

Types of LVDs for distance	Patients used LVDs for distance n%
Telescope	92 (73.01%)
Ocutech telescope	34 (26.99 %)
Total	126 (100 %)

Table-V Patients using different types of LVDs for near

Type of LVDs for near	Patients n%
Glasses (including FONDA glasses)	64 (50.79 %)
Stand magnifier	15 (11.91 %)
Hand held magnifier	12 (9.53 %)
CCTV	18 (14.28 %)
Ocutech telescope with cap	17 (13.49 %)
Total	126 (100 %)

Discussion:

The majority of patients with Low vision can have their visual functions enhanced by a combination of environmental modification and low vision devices. Environmental modifications include placing patients near window to give them better light while reading, or encouraging them to wear hats and caps to prevent glare especially when outdoor.[11]

Basic principle of all low vision devices is to magnify the objects. This principle of magnification is used in different ways to help low vision patients.[12] Some devices cause relative size enlargement of the objects e.g. large print text books. Other causes relative distance magnification by moving the object of interest closes to the eyes so to subtend a larger image on the retina. Some devices cause angular magnification in which there is apparent change of size of the object of interest, by using a magnifier or telescope systems.[13]Most important factor to improve the visual function is to increase the illumination. 90% of patients with low vision showed improvement in visual acuity by adjusting the illumination.[14]

The low vision devices available can be grouped into 3 main categories as optical, non optical and electronic. This study mainly concern with optical devices and that how many low vision patients can be improved with these devices. Various studies have found that optical low vision devices are an effective means of providing visual rehabilitation.[15]

Different types of magnifiers are used in different ways to improve the near visual acuity in patients with low vision. These can either be used with near vision spectacles where these have a longer working distance as compared to near spectacles. However greater the distance smaller will be the visual field.[16] Magnifiers are available as stand, hand-held, fibre-optic, illuminated, and dome-bar magnifiers. Hand-held magnifiers have the benefit that these are portable, have longer working distances and are not expensive. These are also helpful in eccentric viewing although these have limited field of view. On the other hand, stand magnifiers have both angular magnification and relative distance magnification. They can be used as fixed focus, focusable, with or without illumination and rest on a rigid mount.[17]As these devices are technically simple to use so are better choice for patients with paralysis, hand tremors, arthritis, or poor hand-eye coordination.[18]Omaret al. in their study prescribed hand held magnifiers as most frequent near low vision devices with percentage 54.2% of cases.[19] Gopalakrishnan S et al. in their study used handheld magnifier in 11%, pocket magnifier in 2%, and portable video magnifier in 4% low vision patients for spotting tasks. Bifocal spectacles were prescribed for 28% of patients to improve the clarity of vision.[20] In their study patients with healed choroiditis and healed retinitis showed a statistically significant improvement in near VA after the use of LVDs (52.2% and 71.7%, respectively) ($P< 0.05$).20 In our study FONDA glasses were prescribed in 50.79 % patients, stand magnifier in 11.91 % and hand-held magnifier in 9.53 % patients with significant improvement in near vision. Majority of patients were having visual improvement in the range of 1M to 3.2M.

Telescopic systems can be prescribed for near, intermediate and distant tasks. These work on the principle of angular magnification and magnify the apparent size of distant objects. Field of view decreases with magnification of objects.[21] Telescopes are not widely used by low vision patients because these devices are difficult to use, are expensive and are cosmetically unacceptable. Telescopes can be prescribed for one eye or both eyes. These are either hand-held, clip-on or spectacle-mounted.[22] Different designs telescopes include fixed focus, focusable, or autofocus. Focusable telescope can be used for near, intermediate distance and far.[23] Patients with retinitis pigmentosa have peripheral visual loss and

magnification with telescope may reduce their existing vision. Such patients may benefit from reverse telescopes that expand the visual field. This Field expansion can also be achieved by prisms.[24] Tremblay et al. designed a telescopic contact lens in 2013 that causes a shift from normal to magnified vision using 3D glasses and electrical polarization.[25] Rania GE et al. used spectacle-mounted Galilean telescopes as distance low vision aid in their study. Binocular telescopes were given to seven patients (46.7%) and monocular telescopes were given to eight patients (53.3%).BCVA in the better eye was markedly improved in all patients with four patients (26.7%) had vision near normal, eight patients (53.3%) had vision in moderate range and three patients (20%) had vision in severe range.[26] In our study we prescribed telescope to 92 (73.01 %) patients for far vision and Ocutech telescope with cap for near to 17 (13.49 %) patients. Majority of patients have their far vision improvement in the range of 6/60 to 3/60 while near vision improvement was in the range of 1M to 3.2M. However, compliance for use of telescope was poor as compared to magnifiers because these devices are difficult to use and patients found it cosmetically unacceptable.

Regarding electronic category of low vision devices, the primary electro-optical device is a standard closed-circuit television (CCTV). It uses a camera to capture and then display enlarged images on a computer screen.[27] Benefit of such devices is that magnification, brightness, contrast, change of polarity from black to white and voice command can also be controlled in these devices. While most CCTVs are desktop units, portable which may be hand-held or head mounted are also available. Smallfield S et.al showed in their study that electronic devices were administrated less frequently because they were more costly, their standby times were short and they were hard to repair if damaged.[28] In our study CCTV was prescribed only to18 (14.28 %) patients who were educated or students. Majority of these patients have their near vision better than 3.2 M with CCTV.

Conclusion:

Low vision aids if selected according to the needs of low vision patients are useful tools to help low vision patients in terms of some improvement in vision to carry out some specific daily works and are an effective means of providing visual rehabilitation.

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