Low vision aids

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Abstract
Visual impairment is a challenging problem worldwide. Low vision impairs the social life of patients. Low vision aids can improve patients’ social life. Lack of awareness about low vision aids in practitioners as well as patients remain a barrier to their use. The article highlights the use of different kinds of low vision aids with their advantages and disadvantages.

Keywords: Low vision, low vision aids, vision loss.

Introduction
As per the International Statistical Classification of Diseases and Related Health problems (ICD-10) published by World Health Organization (WHO), visual disturbance and blindness is classified as H53-54.9. Low Vision (Visual impairment Categories 1 & 2) is defined 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 of 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”. Blindness (Visual impairment Categories 3, 4 & 5) is defined as visual acuity of less than 3/60 or a corresponding visual field loss of less than 10 degrees in the better eye with best possible correction. The term visual impairment includes both blindness as well as low vision. Visual impairment is a pressing public health challenge, with blindness being one of the most common disabilities worldwide. Globally, the number of people of all ages visually impaired is estimated to be 285 million, of whom 19 million are children. The burden of childhood blindness may not seem to be large in number, but it is the second largest cause of blind-person years worldwide (following cataract).

Low Vision Aids
An optical/non-optical device that improves or enhances residual vision by magnifying the image of the object at the retinal level. Rehabilitation depends to the type of visual loss and also on individual's choice or expectations. Reading has been identified as the most common problem in patients with low vision. Improvement in reading for distance as well as for near has been reported using optical aids in several studies.

Indications for low vision aids
- Children: Albinism, ROP, Congenital malformation, Optic neuropathy.
- Young adult: Keratoconus, Ocular injuries, Late manifestation of congenital malformation.
- Old age: Glaucoma, ARMD, Diabetic maculopathy, Macular degeneration, Chorioretinitis, Optic atrophy, Myopic degeneration.

Types of Devices
1. Optical 2. Non-optical
Basic principle of LVA - Optical LVAs are based on the fact that with sufficient magnification, the normal retina surrounding the damaged central retina can be used for central vision.

Optical LVA:
- Magnifying spectacles
- Hand magnifiers
- Stand magnifiers
Telescopes
Other optical devices

Magnifying Spectacles
Magnification by a convex lens is obtained by bringing the object within its focal length. An erect, virtual and magnified image is produced. High plus lens is used to magnify the images (Figure 1).

- Magnification is 1/4th the power of the lens.
- Suited for near and intermediate distance.
- Mono-ocular or binocular

Fig. 1: Magnifying spectacles

Instructions for use - Patient should be instructed to hold the material very close and then move it out and scan the lines one by one. Light must be properly adjusted.

Advantages
- Cosmetically acceptable.
- More comfortable and easy to use.
- Both hands are free to hold the reading material.
- Field of vision is large.
- Simultaneous both near and distance vision.

Disadvantages
- Spherical aberration.
- Higher the power, closer the reading distance.
- Close reading distance causes fatigue and unacceptable posture.
- Patients with eccentric fixation are unable to fix through these.
- Illumination problem.

Hand magnifiers
- Indicated for spot or short-time tasks in patient with field of vision reduced to 10 degrees or more.
- Used for near vision (Figure2).
- Available from + 4.0 to + 40 D

Fig. 2: Handheld Magnifiers

Instructions for use - The patient should be shown how to put the magnifier flat on the reading surface to begin with and raise it until the image is clear and distorted.

Advantages
- Working distance is more.
- Accommodation is not required.
- Easy to manipulate for viewing eccentrically.
- Some have light source which further enhances vision.

Disadvantages
- It occupies both hands.
- Not useful in absence of manual dexterity.
- Field of vision is limited as compared to spectacles.
- Need to be held at the correct distance.

Stand magnifiers
It forms a virtual image a short distance behind the lens. The patient needs to place the stand magnifier on the reading material and move across the page to read. It has a fixed focus (Figure 3).

Fig.3: Stand Magnifiers

Instructions for use - Patient should be taught to place the stand magnifier flat on the reading material, and look at the image through reading glasses or bifocals to converge the divergent rays coming from the magnifier lens. Because of the reduced aperture of these magnifiers the eye must be closer to lens surface to obtain the full width of the reading field.

Advantages
- Technically simple.
- They are a choice for patients with tremors, arthritis and constricted visual fields.

Disadvantage
- Small field of vision.
- Too close reading posture is uncomfortable for the patient.
- Difficult to use if the surface is not flat.

Bar magnifiers
- Contains plano - cylindrical lens.
- Magnifies the height of the letter which
becomes readable. Lies flat on the page, elongates the letter but don't separate them, magnifies in the vertical meridian only(Figure 4).
- Person with small central field who needs minimum magnification are benefitted.
- Available in low magnification power only.
- Power range 2 to 3.5 D.

Fig. 4: Bar Magnifiers

Telescope
They magnify the apparent size of distant objects, making them appear closer to the patient. The magnification ranges from 2x to 10x. The patient has to spot the object he wishes to see and then brings the telescope in front of the eye. The optics of the telescopic systems is based on two basic principles- Galilean or Keplarian. It could be hand-held, Clip-on/spectacle-mounted or abioptic design. Uses
- Reading from a blackboard (distance > 2m).
- Finding an entrance to a building.
- Watching games, television.
- Reading traffic signals, street signs, bus numbers.

Advantages
- One of the most popular device to enhance distance vision.
- Can be used in classroom for blackboard reading or outdoors.

Disadvantages
- Major drawback is the restriction in the field of view.
- Focusing requires good hand-eye coordination.

Bioptic telescope
It magnifying up to six times, which can be embedded into the spectacle glass. It allows the wearers to switch their sight between their regular vision and the magnified vision of the device by just a slight tilt of the head, similar to how one uses bifocal spectacles. Several recent studies have highlighted the effectiveness of bioptics for driving among the visually impaired patients. However, the evidence regarding the safety and efficacy of bioptic driving is still unclear, and laws surrounding it are ambiguous. Bioptic telescope use is legalised conditionally in some provinces in United States, Canada and The Netherlands.14

Other optical devices
Absorptive lenses - reduce glare and dark adaptation time(Figure5).

Fig. 5: Absorptive Lenses
Tinted lenses-Low absorptive high transmission are best for constant use Photochromatic lenses- Use for light sensitive person.15
Filters – Contrast can be enhanced by using spectacles with yellow and amber filters.
Polarization- Reduces glare.

Visual field enhancement devices
- Fresnel prism - retinitis pigmentosa.
- Hemianopic mirrors.
- Central scotomas and eccentric viewing - prism incorporated into reading glasses by diverting the light.

Non-optical devices
- Approach magnification
- Lighting
- Contrast enhancement
- Increased size object
- Electronic magnifiers (CCTV, LVIS, V-max)
- Writing and communication devices
- Orientation and mobility LVAs

Approach magnification
Partially sighted patients should be encouraged to move as close as possible to the object(Figure 6).
Illumination
Positioning
- To the side of better eye.
- Moving light closer.
Higher levels of illumination is required: macular degeneration Glaucoma Diabetic retinopathy Retinitis pigmentosa Chorioretinitis.
Reduced illumination required
- Albinism.
- Aniridia.

Contrast Enhancement
- Using a typoscope
- Contrast modification of visual environment

Relative size devices
Large print material, Enlarged clocks, telephones, Calendars, computer keyboards Large type playing cards (Figure 8)

Advantages
- Higher magnification up to 70x.
- Binocularity.
- Patient can sit at comfortable reading distance.
- Hands are free for writing, etc.

Disadvantages
- Expensive.
- Need more training and practice.

Computer Education Software
- JAWS screen Reading software: It converts a normal personal computer into a talking computer so that one can learn to operate the computer independently.
- Connect out load internet and e-mail software: Access to internet through speech and braille output.
- MAGIC 8.0 screen magnification system with Speech: It has a magnification range of 2x to 16x and it also reads the information aloud.

Portable Electronic Low-Vision Aids
Interest is increasing among the patients and the physicians in portable electronic low-vision aids. Some of these devices are Optelec Compact+, Optelec Compact 4HD, Schweizere Mag43, and Eschenbach Mobilux Digital, Aumed – EYE-C.
One portable artificial vision device (OrCam) is an optical character recognition device, capable of recognizing text, monetary denominations, faces, and can be programmed to recognize other objects. It consists of a miniature camera and an earpiece that can be mounted on the spectacle frame. When activated OrCam can click pictures and even read aloud any text found on the pictures that can be heard by the user via the earpiece. (16) The Or Cam was recently made commercially available in the United States and its usefulness has been elucidated in a recent study. (7)

Smart Phone/Tablet/Electronic Readers
With a widely available internet access, internet-ready devices like smart phones and tablets are being commonly used worldwide and off late are being increasingly used as visual aids. These devices are incorporated with features of image enlargement, high contrast screens, invert colors and bespoke apps. The textural characteristics like font size, format, word spacing, line spacing, color can also be manipulated. Several recent studies have shown that with proper training these devices can be a valuable tool for low vision patients especially as a reading aid.
Another exciting ongoing development is the Google glass technology and research is on way for its use in cases of visually impaired.

Mobile friendly low vision apps
Claria Zoom- Easy to see interface for the visually impaired.
impaired. Such as - big characters and color themes
Low Vision Clear Sight - Multi-featured application
for low vision having options to view enlarged
contacts, camera, calculator, clock and GPS with bold
color themes
Eye – D- For visually impaired it is intelligence based
smart phone assistant app. It helps user to be location
aware, explore and navigate to nearby places of
interest.
Zoom Plus Video magnifier - It enlarges text and
allows changing colors and contrast of the text and
background like video magnifier.
Macular Society, Low Vision keypad free, blind and
senior music player etc. are few more which can be
used.

Mobility assisting devices
Patients with low vision suffer a major problem of
mobility and following devices can be useful
● Long canes  ● Strong portable lights

Life skill devices-
● Pre-set insulin syringe: the patient feels the
pre-set level notes and knows how much to
inject even if he is not able to see the markings.
● Notex: scientifically accepted device for
currency identification
● Needle threader: it helps in easy threading.
● Talking clock and watches: these are readily
available in the market at low cost. They have
raised buttons with speech output option

Why to prescribe
The prescription of low vision devices gives the
person-
● Independence.
● Increase adaptation to the daily activities
material.
● Exposure to enriching experinces.
● It constitutes an important factor for
socioeconomic and cultural integration.

How to prescribe
A careful clinical history is important to setting goals
based on real expectations. A person who participates
in selecting the aid is more likely to learn how to
handle it.
● Determine the best corrected VA for near/distance.
● Determine the visual acuity that the patient
requires.
● Calculate the magnification needed to achieve
the goals
Select the aid according to the characteristics of the
device : the needs , goals, and clinical aspects of the
patient.
To achieve better acceptance of any aid , consider the
person needs, goals and ability to handle the aid, as
well as the weight, cost, and timing of prescription. It
is important for the person to be comfortable with the
aid proposed.
For reading activities, besides achieving vision for
certain size of optotype, the child should be evaluated
for reading. In the presence of eccentric fixation or
difficulties with proposed aid, training should precede
prescription.
Each category of visual device has its advantages and
disadvantages. In low vision daily practice, it is
common for a child to have more than one aid.
The patient should be monitored frequently to evaluate
the effective use of the aid prescribed and difficulties presented
in daily activities and to set up more advanced goals.

When to prescribe
Optical aids for near vision are introduced when the
reduction of the distance between the object and the
eye does not allow the necessary range or when the
accommodative effort is too large.
At school age, with VA up to 20/200, reducing the
distance between the object and the eye is
recommended until the second grade. From this stage,
a stand magnifier or a hand magnifier can be used for
reading small – print books such as dictionaries.
For VA less than 20/200 (0.1 log Mar), optical aids
should be prescribed earlier if the VA is less than
20/400 and central scotoma greater than 30 degree, a
video magnifier is indicated.
For VA equal to or less than 20/800 aids such as
Braille and computer sound system should be
included, with or without other resources. Orientation
and mobility technique should be encouraged at all
low vision level.
When a telescope is first prescribed, a manual,
monocular telescope with lower magnification is
recommended. The telescope can be prescribed for
reading blackboards, and later to use constantly at far.
It is important to let the child experiment with the
telescope in different situations.
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