doi: https://doi.org/10.19052/sv.4244

Interdisciplinary management of low vision by degenerative myopia: A case report

Manejo interdisciplinario de la baja visión por miopía degenerativa: reporte de caso

Karol Yissely Cortés Linares*
Luis Héctor Salas Hernández**

Received: 04-19-2017 / Accepted: 09-22-2017

ABSTRACT
Vision is the motor that drives the psychomotor development of a person. The absence or inadequate interaction with visual stimuli becomes a problem with high emotional, social, and economic repercussions. The diagnosis and treatment of visual or pathological alterations that lead to low vision should be managed by a multidisciplinary team, which includes an optometrist, an ophthalmologist, a psychologist, and a rehabilitator, in order to implement vision stimulation programs and to prescribe non-conventional optical and non-optical aids. In the present case report, the patient was diagnosed with degenerative myopia in both eyes. For this reason, she was referred to low vision assessment and visual rehabilitation. A complete examination was carried out and the existing alternatives for the correction of the problem were analyzed in depth. Finally, a non-conventional optical aid was adapted for far vision —3x telescope— and another one for near vision —1x microscope + 3x magnifying glass—; subsequently, the patient was discharged given that the objectives set during the treatment were met.

Keywords: low vision, degenerative myopia, vision, pathology.

* Optometrist, MSc in Vision Science, Universidad de La Salle, Bogotá, Colombia. kcortes10@unisalle.edu.co
** Optometrist, MSc in Visual Rehabilitation, and Teaching Researcher for the School of Optometry from Universidad Autónoma de Aguascalientes, Aguascalientes, México. luishectorsh@hotmail.com.

How to cite this article: Cortés Linares KY, Salas Hernández LH. Interdisciplinary management of low vision by degenerative myopia: A case report. Cienc Tecnol Salud Vis Ocul. 2018;16(1):127-40. doi: https://doi.org/ 10.19052/sv.4244

RESUMEN
La visión es el motor que impulsa el desarrollo psicomotor de las personas. La ausencia o la interacción inadecuada con el estímulo visual se convierten en un problema con altas repercusiones emocionales, sociales y económicas. Las alteraciones visuales o patológicas que conlleven a la baja visión en su diagnóstico y tratamientos deben tratarse por un equipo multidisciplinario, el cual se compone de un optómetra, un oftalmólogo, un psicólogo y un rehabilitador, con el fin de implementar programas de estimulación visual y de prescripción de ayudas ópticas no convencionales y no ópticas. En este reporte de caso, la paciente se diagnosticó con miopía degenerativa en ambos ojos; por tal razón, se remitió a baja visión para valoración y rehabilitación visual. Allí se efectuó un examen completo y se analizaron a profundidad las alternativas existentes para la corrección del caso. Finalmente, se adaptó una ayuda óptica no convencional para visión lejana —telescopio 3x— y una para visión próxima —microscopio 1x + lupa hoja 3x—, con lo cual se dio de alta a la paciente y se respondió a los objetivos planteados durante el tratamiento.

Palabras clave: baja visión, miopía degenerativa, visión, patología.

INTRODUCTION

The sense of sight is responsible for providing 80 % of the information in the environment required to be able to interact properly with it, giving us autonomy and promoting our development. In most cases, this development is closely related to what we are able to visually understand, so most of the skills that we possess, the knowledge that is acquired, and even the activities that we carry out somehow depend on our visual capacity (1).

At first, some authors used terms such as *severe visual impairment*, *subnormal vision*, *partial sight*, and *residual vision*, among others, to define the intermediate space between normal vision and the total or almost total absence of vision, characterized by a visual system with irreversible alterations and a loss of visual capacity that constitutes an obstacle in the development of people's lives (2,3).

A person with low vision is someone who has a functional visual impairment even after treatment or optical correction and who has a visual acuity of 6/18, as well as a visual field below 10 degrees, who is potentially able to use vision for performing any task (4). Most authors agree on this definition about low vision:

> Low vision is not a disease, but a condition resulting from an alteration in the visual system, where there is a deterioration of the visual function that cannot be completely remedied by conventional lenses, contact lenses or medical intervention, which lead to restrictions in the performance of activities of daily living (ADL). (5)

It is estimated that approximately 285 million people in the world suffer from some kind of visual disability; out of all of them, 245 million have a decreased visual acuity and 39 million suffer from blindness (2,6-8). From the total disabled population, 1.4 million were children under 15 years old in 2004 (6,9). In addition, the World Health Organization (WHO) estimates that approximately 1 to 2 million new cases of low vision are detected every year (4). The countries with a better and greater management of low vision patients are the United States and Australia (9).

Surveys carried out in Latin America show that the prevalence of blindness is 3 % in people older than 50 and that the prevalence of low vision is 10 %. There is a great difference in the prevalence of blindness and low vision between urban and rural areas, which is 1.4 and 6 %, respectively, in urban areas, as opposed to a prevalence of 4 and 12 % in rural areas (6).

According to the WHO (4), a person is considered to be legally blind when their visual acuity is 20/200 or less in the better-seeing eye after the best conventional correction, or when their visual field is 20° or less in the better-seeing eye. A person is identified as having low vision when visual acuity is 20/60 or less after the best correction and their visual field is less than or equal to 10°, which restrains the patient from performing ADL. August Colembrander offers another classification of low vision according to visual acuity—that is, moderate, severe, and profound—, which goes from 20/60 visual acuity to light perception (Table 1).

TABLE 1. **Classification of low vision according to visual acuity by August Colembrander**

Moderate	Severe	Profound
20/60-20/160	20/200-20/400	20/500-light perception

Low vision itself is not a disease, but the result of a pathology, and therefore it cannot be cured without treating the main cause of this condition. Some of these pathologies are: Macular degeneration, retinitis pigmentosa, leucomas, cataract, diabetic retinopathy, glaucoma, degenerative myopia (*myopia magna*), aniridia, hemianopsia/hemianopia, and macular hole.

These reasons lead us to understand that a patient with a visual impairment requires a different clinical management; as a result, the tests performed during the examination and the measurement of visual acuity should now cover other needs in terms of size of the stimulus used and separation of the characters in the ETDRS chart adapted to a distance of less than 6 meters (3). To measure visual acuity in patients with low vision, the following should be taken into consideration:

- Distant vision should be tested at 4 m.
- Near vision test should be tested at 25 cm.
- Allow the patient to move their head as they please (eccentric vision).
- If the patient cannot see the optotypes of the chart at 4 m, proceed to bring it closer to 1 m.
- Have patience.

The following charts are used for measuring visual acuity in low vision:

- *Distant vision*: Early Treatment Diabetic Retinopathy Study (ETDRS) and Feinbloom.
- *Near vision*: ETDRS, Colenbrander, Berkeley Rudymentary Vision Test (BRVT) and Lea Hyvärinen.

Since low vision cannot be corrected with conventional optical aids, the treatment and visual rehabilitation consists of a set of procedures aimed at obtaining the maximum possible use of the remaining vision by enlarging the size of the image that is produced in the retina, through amplification systems; this way, we can stimulate more retinal cells so that the brain can interpret this image (10). To determine what type of magnification and unconventional optic aid the patient may need, we must start with the emmetropization of the patient. Two methods are used to determine the refractive status of a patient with low vision:

Radical retinoscopy (objective method): The procedure will be the same as in a static retinoscopy, the only difference being the working distance of the examiner, which is now 33 cm, and the compensatory working distance lens. The patient is asked to keep looking forward.

Noticeable Minimum Difference (NMD) (subjective method): This is a subjective retinoscopy method that is used to find the dioptric power of the sphere, the cylinder and the direction of the axis when static retinoscopy is impossible to do, making it difficult to interpret the retinal reflection. To obtain the NMD, the following formula must be used:

$$\text{NMD} = \frac{\textit{snellen denominator}}{\textit{Testing distance}} \qquad (1)$$

6 m = 30
5 m = 25

4 m = 20
3 m = 15
2 m = 10
1 m = 0.5

Example: A patient has a 20/40 visual acuity in his left eye at 4 m.

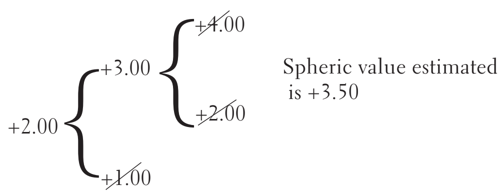
$$NMD = \frac{40}{20} = \pm\, 2{,}00\ D$$

Starting from a sphere of mathematical NMD ± 2.00 spherical power:

1. Place a +2.00 lens in front of the eye and then a –2.00 lens.

2. Ask, "Is your vision better or worse?"

3. After obtaining the value of the positive or negative sphere, it is necessary do refractive tuning.



We start from +2.00 and place two lenses (the first one with one dioptric power above and the second one with one dioptric power below) in front of the patient, who sees worse with +1.00, so we move it up to +3.00. We increase and decrease the value by 1.00 D, and if the patient sees worse with both (+4.00 and +2.00), the spherical power is between +3.25, +3.50 and +3.75, so we set it to an intermediate value of +3.50.

To find the value of axis and cylinder power, we recommend using the Jackson's Cross Cylinder (JCC) manual. Starting from the power as in NMD, first axis and after power.

1. Rotate the JCC equidistant of 90° until you find the correction axis.

2. Ask again, "Is your vision better or worse?"

Example:

0° - 90°
10° - 100°
20°

3. As with the JCC, turn the cylinder in the 3 last movements: 15, 10 and 5 degrees after finding the axis.

To find the cylinder power, start with the value of mathematical NMD and follow the same process followed with the sphere power (1). After having determined the refractive state of the patient in farsighted patient, there are five methods of magnification, which are: 1) Linear magnification, 2) distance magnification, 3) angular magnification, 4) magnification by projection, and 5) total magnification. With the aid of these methods, the patient will be able to perform ADL (2).

Linear magnification: Linear magnification is achieved by increasing the size of the object; if we double the size of an object, the retinal image will double and so will the visual acuity (7).

Distance magnification: This magnification is achieved by moving closer to the object, so that every time we bring an object closer to the eye, the retinal image increases in size. The relation is such that when we approach an object by half the distance, the retinal image doubles it size. If we reduce the distance to a fourth, the retinal image increases by four, and so on (7).

Angular magnification: This magnification occurs when we look through a telescope made of two lenses. The objective lens is the one in which the rays enter through the telescope and the eyepiece lens is the one closest to the eye. These lenses are placed in such a way that the primary focus of the objective lens coincides with the secondary focus of the eyepiece lens. The result is an afocal system of (infinity-focused) angular magnification (1,6).

Magnification by projection: An object is magnified by its projection on a screen. An example of this magnification could be the slides of a presentation being projected on a screen or the closed-circuit television (CCTV) magnifiers (7).

Total magnification: When using several magnification systems, total magnification is the product of magnifying each of them. Amplifications are represented by the letter *x*, so if we double a text (2x) and reduce the distance from 40 to 20 cm (2x), the resulting total magnification will be: 2 × 2 = 4x. This also gives us a reference of the dioptric power used: 1x = 4 D (7).

These magnification systems are the main base to calculate and prescribe the type of optical aid that our patients may need for distant, intermediate, and near vision, among which we can find:

Microscopes (Ms): The microscope is a convergent lens especially designed to minimize aberrations and to be used at 25 cm or less. It is based on the relative distance magnification, so this dispositive does not increase anything by itself, but it does allow us to see the object clearer when we approach it, and this action is the one that produces the magnification (5).

People with low vision and degenerative myopia improve their performance in near vision by removing their glasses. Since it is said that they have a physiological microscope, their visual system without optical correction is positive (2). The magnification of a microscope (*Ms*) is found with Formula 2 below:

$$F\,(D) = \frac{100}{\textit{cm (dist.from which the patient wishes to read)}} \quad (2)$$

Telescope (TS): This device is based on the principle of angular amplification; it is the only one that helps a person to develop nearsighted (60 cm to 6 m) activities. There are several types of telescopes, such as afocal (Keppler) telescopes, which are focused at a distance of more than 6 m, and the Galileo's telescope, which is prefocused at a maximum distance of 6 m. Both of these aids should incorporate the patient's emmetropization refractive values (5). Magnification in a telescope is calculated with the following Formula 3:

$$ATs = \frac{\textit{visual acuity of the patient}}{\textit{visual acuity of the objective}} \quad (3)$$

Having *ATs* as the telescope magnification, in which the visual acuity objective will always be 1 m for nearsighted vision or 20/50 farsighted vision.

Telemicroscopes (Tms). These devices are telescopes focused at a distance of 60 cm or less, providing an intermediate distance. For distances between 25 and 60 cm, it is recommended to use telemicroscopes, as they have a limited vision field as compared to the microscope and they provide a greater operating distance than the microscope.

To calculate a *Tms*, we must depart from the *Ts* and *Ms* magnification. Magnification in a telemicroscope is calculated by the following Formula 4:

$$ATms = ATs \times AMs \quad (4)$$

Where:

ATms = amplification of the telemicroscope.

ATs = the telescope magnification.

AMs = the microscope magnification.

Magnifying glass. A convex lens that allows increasing the size of objects by looking through it and which is held by hand or through another kind of support. The object must be placed at the focal length of the lens in the case of hand-held magnifying glasses so that the virtual image provided by the hand-held magnifier acts as if it were from infinity (10). The focal length is found with Formula 5:

$$\text{Focal length} = \frac{100}{\textit{D or magnification of the magnifiying glass}} \quad (5)$$

Closed-circuit television (CCTV): A CCTV increases the size of the image by electronic devices, formed by a monitor, a camera and an optical system. The monitor is usually black and white and has certain distinctive features, such as a command to reverse polarity, white letters on black background (reverse polarity) or black letters on white background. It also has commands to control lighting, brightness and contrast (1).

However, it is important to mention that rehabilitation for a low vision or blind patient should include guidance and mobility techniques that will allow the patient to move for long or short distances, indoors or outdoors, supported by a walking stick. Visual rehabilitation does not include the recovery of sight; instead, it allows the patient to work with the remaining visual areas. Through these sessions, the patient will acquire visual skills such as location, visual sweeps, eccentric vision, perception of static and moving objects, and visual task planning, among others; the main objective of this process is to achieve maximum independence and reincorporation into society (10).

A visually impaired patient who has experienced an irreversible vision loss can develop a trauma and go through the five stages of grief, as described by Elisabeth Kübler-Ross: denial, anger, bargaining, depression, and acceptance (11). The psychological consequences of vision loss can be diverse and complex, and there is no single pattern of response (12).

One of the entities that causes visual impairment affecting older adults is degenerative myopia, since complications are more frequent at advanced ages, compromising sight and the performance of daily activities (13).

Myopia is estimated to affect 25 % of the world's adult population, with a high prevalence among Asians (14). Its incidence increases in eastern countries, especially in Japan, where it reaches up to 50 %. According to reports from the archives of the Spanish Society of Ophthalmology, myopia affects about 1.6 billion people worldwide (15).

Myopia is a multifactorial condition with an incidence that varies across populations of different ancestral origins. Despite the continuing debate on the relative importance of genetic factors, population-based studies of refractive disorders in recent decades have revealed substantial variations in the presence of ametropias in relation to level of education, age, gender, ethnic group, and social status (15). A refractive defect is characterized by the fact that the image is formed in front of the retina and, consequently, the image of a point is not another point, but a diffused circle that causes a blurred vision. It can be classified as refractive (an error due to curvature of the ocular surfaces or refractive index), axial (error in axial length), or mixed (16).

Myopia magna is an ocular disease characterized by an excessive and progressive elongation of the eye, followed by degenerative changes that affect the sclera, choroid, Bruch's membrane, retinal pigment epithelium, and sensory retina (17). Changes in the fundus of the eye usually occur when the ametropia is higher than 6 diopters and the length of the axial axis is larger than 25 mm. Ophthalmoscopically speaking, a clinical picture called "myopic chorioretinitis" is observed, in which there is a generalized chorioretinal atrophy, which can affect the macula (Figure 1); as a result, visual acuity will be reduced, with the presence of degenerations predisposing a retinal detachment (18). Complications will appear when the retinal injury affects the central area, resulting in greater visual impairment proportional to the degree of injury.

The posterior staphyloma is a characteristic feature in highly myopic eyes; it is characterized by a protrusion area in the posterior ocular wall,

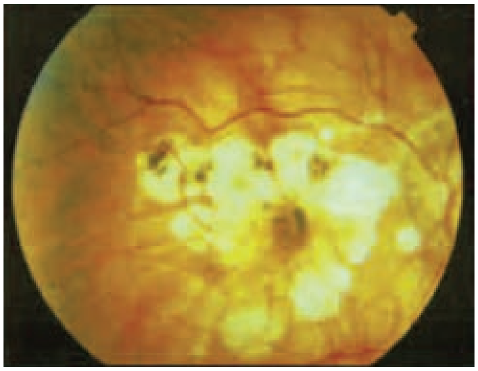


FIGURE 1. **Fundus of the eye of a 69-year-old woman with *myopia magna*, in which myopic chorioretinitis is observed, with macular affection and peripheral atrophy of the retinal pigment epithelium**

which gets thinner and bigger at the same time. It has been described that, in these cases, there is an altered arrangement of the collagen fibers of the scleral, as well as an immaturity of its histological structures. Myopic maculopathy causes central vision impairment, characterized by poor visual acuity, high sensitivity to light, and preserved peripheral vision (18).

Some studies have reported other pathologies arising from degenerative myopia, such as cataract in 50.8 % of cases, followed by angle-closure glaucoma with 26.2 % of cases in adults older than 50 years old. The main symptoms of a cataract are decreased visual acuity, contrast sensitivity, and altered color vision. On the other hand, the development of glaucoma due to an increased axial length results in a narrowing of the iridocorneal angle, making it impossible for the aqueous humor to circulate and causing the iris to compress the crystalline lens, and as the posterior chamber increases, the iris starts to bulge, obstructing the angle of filtration (19) and thus increasing the intraocular pressure and producing symptoms and signs like hyperemia, tearing, photophobia, and perception of halos (16).

CASE PRESENTATION

The patient is a 69-year-old housewife who was diagnosed with myopia in both eyes as a child. Once she reached adolescence, she was diagnosed with degenerative myopia, after which she started optical correction, first with ophthalmic lenses and then with rigid, gas permeable contact lenses for 30 years. However, she then suspended its use due to complications.

Information about techniques developed was provided to the patient who signed the informed consent of free and voluntary.

This case report obeys the requirements set out in the Helsinki Declaration, which refer to the protection of life, health, dignity, integrity, the right to self-determination, privacy and confidentiality of information people who will participate.

Eye background

The patient had the following history: retinal hemorrhage with greater macular involvement in the right eye compared to the left eye, cataract surgery plus intraocular lens (IOL) implantation in the right eye six months before the date of the low vision evaluation, and hyper-acute cataract in the left eye. During her last check-up with the ophthalmologist, she was treated with an optical correction and was assessed for posterior left eye cataract surgery, but no surgical procedure was performed. She then went to the low vision clinic, where a complete assessment was done, with the following clinical findings:

The patient was diagnosed with degenerative myopia, presbyopia, OS hyper-acute cataract and low vision, and the optical correction in use in both eyes is −21.00 D.

The patient's main goal is to improve her farsightedness; she wants to be able to move independently in and out of her house or watch TV, and she wants to be able to recognize faces. As a secondary goal, she wishes to perform near vision activities, such as reading, playing card games, and using her cellphone. The patient moves by touching the walls and furniture inside her house and she is always escorted by a relative while outside; she also uses sunglasses, and while she says that her vision is impaired when using them, she prefers to do it because the sunlight causes her to have photophobia.

Her visual acuity in far sighted vision without correction was evaluated using the ETDRS test at a distance of 1 m, allowing the patient to perform head movements (i.e., nasal, temporal, inferior or superior) in order to locate her eccentric vision achieving a better discrimination of the stimulus presented, obtaining the following visual acuity (Table 2).

TABLE 2. **Farsighted vision acuity with and without correction**

Distance visual acuity	Test & distance	Right eye (LogMar)	Left eye (LogMar)
Without correction	ETDRS at 1 m	0.90	0.78
With correction	ETDRS at 3 m	0.90	0.78

Near visual acuity without correction was measured with the Colembrander chart at a distance of 10 cm. The patient was also allowed to do head movements in order to reduce the distance to the text. Table 3 shows the visual acuity reported:

TABLE 3. **Nearsighted vision acuity with and without correction**

Near visual acuity	Test & distance	Right eye	Left eye
Without correction	Colembrander at 10 cm	3 M	6 M
With correction	Colembrander at 8 cm	3 M	2 M

After finishing the adaptation and calculation procedure of optic and non-optic aids, we obtained the following results after improving their visual acuity with correction at 3 m using the ETDRS chart: 0.90 LogMar eccentric vision (M: N-V: T) in the right eye and 0.78LogMar central vision in the left eye (Table 2).

Meanwhile, the near visual acuity with correction using the Colembrander test at 8 cm was 3M (M: N-V: T) in the right eye and 2M in the left eye (Table 3).

Determining the refractive state

We initially developed a radical retinoscopy; this procedure will be the same as in a static retinoscopy, the only difference being the examiner's working distance, which will be less than 33 cm, and therefore the compensatory lens will be changing too (1). After performing this kind of retinoscopy, we obtained the following values:

- *Right eye*: –5.75 Sph.
- *Left eye*: No shadows were observed because of lens opacity.

To determine the refractive status of the patient, we performed the Just Noticeable Difference (NMD) technique (1). To find the spherical dioptric power, the mathematical NMD was calculated, resulting in ±3.25 D. We then proceeded to apply the three steps described in the introduction to find out the value of the ametropia, and we obtained the following refractive state:

- *Right eye*: –6.00 Sph.
- *Left eye*: –18.00 Sph.

From this point, her treatment began with the calculation of an unconventional optical aid for distant vision, a 3X binocular telescope which improved her visual acuity, obtaining the following results: 0.60 LogMar eccentric fixation (M: N-V: T) in the right eye and 0.30 LogMar at 4 m with primer ETDRS in the left eye.

We explained to her how to use this device to recognize static objects, so that she would later be able to move while indoors (Figure 2).

During her first session, she was afraid to move by herself, but a few minutes later she was able

FIGURE 2. **Implementation of an optical aid for far sighted vision in a female patient**

to do it, recognizing the place and the possible obstacles, and finishing her first session feeling optimistic and satisfied.

On the second session, she took a long distance walk outside using the 2.5x binocular telescope and using the techniques of orientation and mobility with the *TS*. She mentioned that she was able to move around flat places and ramps, and she was also able to locate cars in motion while she was far away from them but reported difficulty and insecurity going up or down steps when she is already very close. She also said that, due to the great intensity of the sunlight, the telescope did not allow her to identify the steps correctly, so she preferred to use only her optical correction.

Our second goal was to provide the patient with a vision aid for nearsightedness. The patient had a physiological microscope due to her high myopia, which is why she reported improvement without the microscope at a working distance of 8 cm, but that she was not comfortable and reported visual fatigue. Therefore, with the microscope (*Ms*) we aim to gain working distance and improve reading activities, as well as a larger field of vision.

At first, we used a binocular microscope (*Ms*) of 1.5x, with a visual acuity of 1.5 m (M: N-V: T) in the right eye and 3 m at 16.66 cm in the left eye with the Colembrander chart (Figure 3). She also had a considerable cataract. The patient favors her left eye's vision, which we attribute to the more "normal" conditions of that eye, like central fixation. Therefore, the near vision activities will be performed with her left eye, providing more comfort in her near vision.

We proceeded to work using a 1x microscope + a 3x magnifying glass (Figure 4) as a trial to gain working distance, achieving a distance of 25 cm from the patient to the chart. A magnifying glass is also used to identify objects on desks, tables, as well as food, and to read at a comfortable distance and with greater speed.

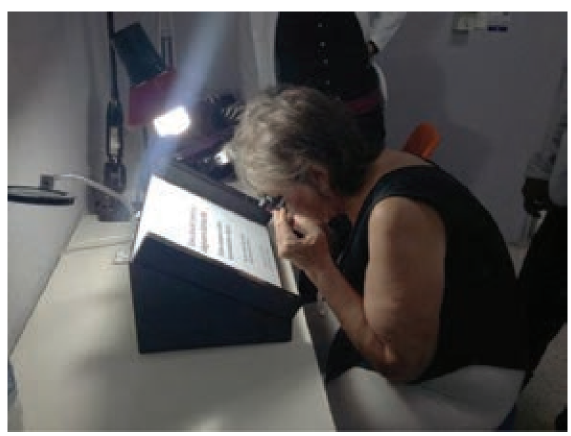


FIGURE 3. **Female patient with optical aid for near vision**

Finally, a CCTV of 2.5x was used (Figure 5a), which provided the patient with a significant improvement of the visual acuity in near vision. This electronic magnifier reduces the aberrations

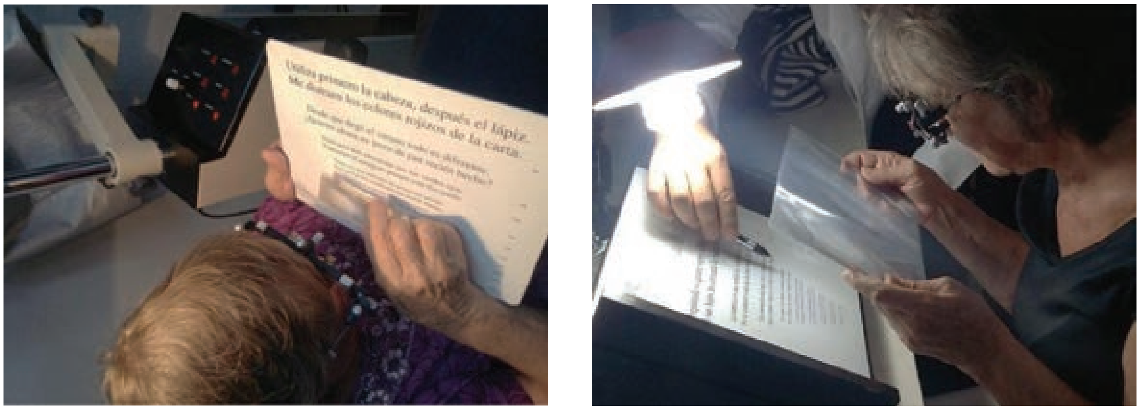
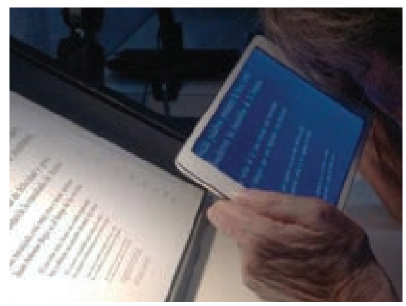


FIGURE 4. **Patient using near-vision optical aids, lx binocular microscope + 3x magnifying glass**

produced by the lenses and allows us to manipulate the amount of illumination, brightness and contrast of the text/object, as well as reversed polarity, white letters on a black background or black letters on a white background (Figure 5b). It also provides a larger working distance of 25 cm from the electronic magnifying glass to the text and of 6 cm from the magnifying glass to eye, with a final distance of 30 cm. This aid is also used for face identification or as a mirror tool (Figure 5c).

A

B



C

FIGURE 5. **A) CCVT of 2.5X implementation. B) Electronic magnification with inversed polarity. C) CCVT for face recognition and scanning in distant space for wandering**

After testing the different optical aids in distance and near vision, and taking into account the performance of the patient with each of them, the visual acuity achieved, the visual comfort, and the ergonomicsin working distance, we decided to prescribe the following aids:

- *Distance vision*: 3x binocular telescope (*Ts*).
- *Near-sighted vision*: microscope (*Ms*) 1x + 3x Loupe Sheet.

After calculating and prescribing the abovementioned optical aids, a total summary of the aid provided must be made in order to obtain the total value of amplification (*X*) required by the patient to perform their daily activities. This should be reflected in the clinical history of low vision as follows.

Management plan with non-conventional optical aid

To obtain the total magnification from all the non-optic aids given to the patient, it is necessary to multiply the magnification values from each aid. It is represented in the following formula:

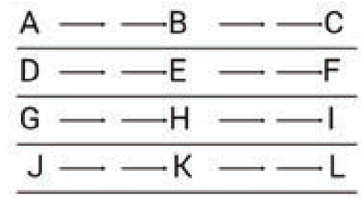
Total magnification = 3x × 1x × 3x = (*total magnification*) 9x

The patient is advised to use a CCVT magnification, more specifically an electronic magnifying glass for carrying out her near vision activities, since it showed more satisfactory results in visual acuity, handling of the device, and a working distance greater than the one achieved with the microscope.

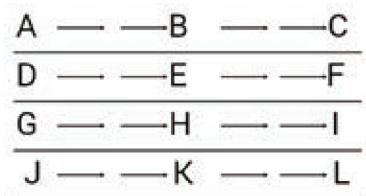
Finally, four sessions of visual therapy were carried out, aiming to improve the residual sight or preferential retinal locus to enhance the reading and writing process. Due to the pathophysiological conditions of the patient, there is a central visual field defect, eccentric fixation in the left eye and a cataract in the right eye, which causes slow and poor reading, and difficulty in text comprehension. Accordingly, a *Ms* and four near vision cards were used, where the letters and numbers are drawn in 3M vision size obtained with their *Ms*. They are highlighted with upper, lower and parallel lines, aiming to train and stabilize the change of fixation, pursuit and saccades eye movements, so that the reading speed will increase and the comprehension of the text will be easier for the patient.

In the first card or "start card," the patient is asked to read the letters, supported by the arrows and the horizontal line as guidance (Figure 6a); the second card, as shown in Figure 6b, is used when the patient can correctly read the first card, and it shows the horizontal lines of support disappear and only the arrows remain; the third card (Figure 6c) only has a horizontal line as guidance and the arrows have disappeared; and, finally, the last card has several letters and numbers where the patient is asked to find the letters hidden between the numbers, which helps the patient to integrate the eye movements with fixation, which is important for reading.

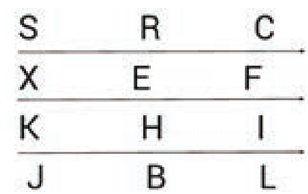
6a.



6b.



6c.



6d.

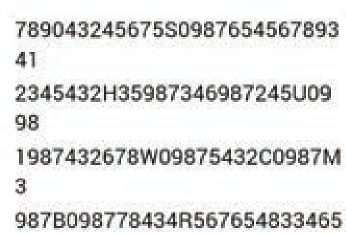


FIGURE 6. **Cards for near vision rehabilitation with magnifying glass or microscope**

DISCUSSION

According to the Pan-American Health Organization (20), the global distribution of the main causes of visual impairment is uncorrected refractive errors (myopia, hyperopia, or astigmatism) at 43 %, unoperated cataracts at 33 %, and glaucoma at 2 %. Approximately 90 % of the global burden of visual impairment is in developing countries. About 65 % of visually impaired people are older than 50, although this group of age barely accounts for 20 % of the world's population. As the aging of the population in many countries increases, so will the number of people at risk of age-related visual disabilities. Cataracts are currently the leading cause of visual impairment worldwide and represent almost half of cases of blindness in the world; in Australia, for instance, the disability rate associated to cataract prevails in people of 65 years old or older (21).

It is estimated that the number of children with visual impairment is 19 million, 12 million of which suffer from easily diagnosable and correctable refractive errors, and that approximately 1.4 million of children under the age of 15 suffer from irreversible blindness (2,16). In Mexico, according to the Health Ministry, more than 40 % of the population suffers from some type of ametropia (22).

One of the entities that causes visual impairment affecting older adults is degenerative myopia, because complications are more frequent at advanced ages, compromising sight and the performance of their daily activities; this was first explained by Baranano (13), with whom we agree since our patients do indeed have difficulty carrying out their daily activities.

According to Salas, one of the main goals with the patients with low vision is their incorporation to society and the accomplishment of ADL, allowing them to obtain the greater independence in their movements and identification of the surroundings in which he/she interacts. Achieving this performance means an improvement in a psychosocial and emotional environment.

On the other hand, considering what has been described by August Colembrander, a low vision patient is one who has had a significant decrease in visual acuity but with no compromise of his or her visual field.

Following the process indicated by Eleanor E. Faye in 2003, in order to start the low vision treatment, it is necessary to prescribe the conventional optical correction, as it is essential to start from emmetropization in order to be able to use unconventional optical aids. One of the most important aspects in treating low vision is to determine what type of magnification and unconventional optical aid the patient may need.

Starting from emmetropization, and after determining the refractive state in distant vision, there are five magnification methods that can be used, and which will help patients to perform ADL (2).

Once the patient is diagnosed with emmetropia, we start treatment with non-conventional optical aids and non-optical aids, with no more than four sessions scheduled once a week, just as Barañano suggests in his article, "Formación en baja vision," which was published in 2011. If necessary, we must also carry out ambulatory tests with a walking stick.

However, it is worth mentioning that the rehabilitation of a person with low vision or blindness, as indicated by Annelise Rosello et al. (17), should include guidance and mobility techniques that will allow the patient to move in long or short distances, indoors or outdoors, supported by a walking stick. It is also noteworthy that visual rehabilitation does not imply the recovery of vision—visual therapy only works with the remaining retinal visual areas. Through these sessions, the patient can acquire visual skills like location, visual sweeps, eccentric vision, perception of static objects, and moving and visual task planning.

Tay, Drury and Mackey (24) suggest that most patients with visual impairment also suffer from psychosocial problems, social rejection, lack of a legislature for the disabled, and poor social education to interact not only with visually impaired people but with people with some other type of disability. These types of situations cause disabled people to shy away from society and to marginalize themselves from everyday life; they feel that life loses its meaning. As a result, it is very important to motivate the patient, to introduce them to the implementation of an unconventional optical aid and show them, in a didactic way, that they can accomplish tasks that used to be difficult for them, like reading, writing, watching television, and moving by themselves, both at home and in outdoor spaces.

The main symptom of cataracts is the progressive loss of visual acuity. In addition, there is a decrease in contrast sensitivity and an alteration in the appreciation of colors (23). These alterations must be optimized with the use of selective optical filters, which must be tested in a subjective manner according to the pathology and the needs of the patient; these filters include the Corning filters for low vision.

Assistance to a low vision patient should be provided by an interdisciplinary team. The optometrist's performance is fundamental, which is why he must be properly prepared to provide the special handling required by a low vision patient.

The implementation of health policies towards the promotion and prevention of systemic diseases such as diabetes or hypertension can reduce the risk of suffering from low vision in our population.

Unconventional optical aids are the first choice of treatment for low vision patients, namely *Ts* for distance vision, *TMs* for intermediate vision, and *Ms* for near vision, which allow patients to perform ADL.

The patient was discharged after attending the four sessions with unconventional optical aids and fulfilling the objectives proposed in near and distance vision; she seemed positive, participative and motivated to use her non-conventional optical aids in ADL, with which she can become more independent in her movements and direction.

ACKNOWLEDGMENTS

I would like to thank optometrist Luis Héctor Salas for his support and willingness to help throughout the learning process in the field of low vision, and for providing me with the necessary tools for diagnosing and treating these patients.

I would like to thank University of La Salle for arranging my international mobility, allowing students like me to have enriching experiences for our profession.

Finally, I would also like to acknowledge the Autonomous University of Aguascalientes of Mexico for granting me access to their facilities and for enabling the development of my professional skills by interacting with their students and the low vision clinic.

REFERENCES

1. Grosvenor T. Primary care optometry. 3th ed. Oxford: Butterworth-Heinemann; 1996.
2. Salas-Hernández LH. Manejo interdisciplinario de la visión baja por microftalmos: reporte de un caso. Lux Médica. 2014;9(23):43-9.
3. Dickinson C. Low vision: Principles and practice. Oxford: Butterworth-Heinemann; 2000.
4. Organización Mundial de la Salud, reporte de datos de baja visión. 2014.
5. Barañano Á. Formación en la baja visión. Madrid: AVS; 2011.
6. Marín Ballesteros DM. Alternativas visuales en pacientes con baja visión. Cienc Tecnol Salud Vis Ocul. 2009;7(2):115-28.
7. Begoña Coco M, Herrera Medina J. Manual de baja visión y rehabilitación visual. Madrid: Panamericana; 2015.
8. Mouriño J. Rehabilitación visual y calidad de vida [thesis]. [Valladolid]: Universidad de Valladolid; 2013.
9. Silvestrone B. The Lighthouse handbook on vision impairment and vision and rehabilitation. Oxford: Oxford University Press; 2000.
10. Faye EE, Chan-O'Connell L, Fischer M, Freed B, Pang L. The Lighthouse clinician's guide to low vision practice. New York: Lighthouse International; 2003.
11. Cuadrado D. Las cinco etapas del cambio. Capital Humano. 2010;23(241):54-8.

12. Checa Benito J, Díaz Veiga P, Pallero González R. Psicología y ceguera: manual para la intervención psicológica en el ajuste a la discapacidad visual. Madrid: Organización Nacional de Ciegos Españoles (ONCE); 2003.
13. Boj Giménez PJ, Cacho Martínez P, García Bernabeu JR. Instrumentación óptica para baja visión. Madrid: Editorial Club Universitario; 1994.
14. Barañano Á. Apuntes sobre rehabilitación visual. Madrid: Organización Nacional de Ciegos Españoles (ONCE); 2008.
15. Ramke J, Brian G, Maher L, Qalo Qoqonokana M, Szetu J. Prevalence and causes of blindness and low vision among adults in Fiji. Clin Exp Ophthalmol. 2012;40(5):490-6.
16. Díaz Guzmán E, Cabrera Martínez E. Comportamiento clínico-epidemiológico de la baja visión en el adulto mayor. Rev Cubana Oftalmol. 2006;10(2):1-6.
17. Roselló Leyva A, Bernal Reyes N, Rojas Rondón I, Roselló Silva N, Lázaro Izquierdo Y. Caracterización de pacientes adultos mayores con diagnóstico de miopía degenerativa, baja visión y su rehabilitación visual. Rev Haban Cienc Méd. 2015;14(5):599-610.
18. Kanski J. Oftalmología clínica. 5th ed. Madrid: Elsevier; 2004.
19. Lápido Polanco SI, González Díaz RE, Rodríguez Rodríguez V, González Arias Y, Baldoquín Rodríguez W, López González M. Alteraciones del polo posterior en la miopía degenerativa. Rev Cubana Oftalmol. 2012;25(2):25-31.
20. Organización Panamericana de la Salud (OPS) [Internet]. Montevideo: OPS; 2013. Ceguera y discapacidad visual. Disponible en: http://www.paho.org/uru/index.php?option=com_content&view=article&id=770:ceguera-y-discapacidad-visual&catid=704:discapacidad accesibilidad&itemid=247.
21. Macnaughton J. Evaluación en la baja visión. Barcelona: Elsevier; 2006.
22. Quang Do V, Li R, Ma M, Pooley C, Trinh C, Peattie L, et al. Investigating cataract referral practices used by Australian optometrists. Clin Exp Optom. 2014;97(4):356-63.
23. Walt JG, Chiang TH, Stern LS, Doyle JJ. Characterization of the living environments of end-stage glaucoma patients and use of low-vision care services: A physician survey study. Visual Impairment Research. 2007;9:23-31.
24. Tay KC, Drury VB, Mackey S. The role of intrinsic motivation in a group of low vision patients participating in a self-management programme to enhance self-efficacy and quality of life. Int J Nurs Pract. 2014;20(1):17-24.