



Low Vision

A Concise Tutorial From Assessment
To Rehabilitation

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Low Vision

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Contents	Page	Contents	Page
Introduction.....	1	Chapter 3: Prescribing.....	18
Foreword.....	1	Low Vision Devices	18
Author Acknowledgements.....	2	Magnification.....	18
Chapter 1: Causes and Effects.....	3	Spectacles	18
Classification/levels.....	3	Loupes	19
Visual Acuity/Visual Field.....	3	Hand Magnifiers.....	19
Functional Criteria	3	Stand Magnifiers.....	20
Functional Implications	3	Telescopes	20
Legal Blindness.....	4	Filters	21
Causes	4	Electronic Devices	21
Prevalence	4	Adaptive Devices	22
Comorbidities	4	Vision Rehabilitation:	
Lifestyle Issues.....	5	Who, What, When, How, Where.....	25
The Law	5	Chapter 4: Integrating Low Vision	
Chapter 2: Assessment	7	into the Care You Offer	27
Importance of Early Detection	7	Space	27
Examining the Adult with Low Vision	7	Equipment	27
Case History	7	Staff	28
Testing Visual Acuity	7	Patients	29
Refraction	8	Conclusion	29
Predicting the Add.....	8	Brief Glossary of Terms (Appendix)	30/31
Function Tests	9	List of Illustrations (with Credits)	31
Low Vision Device Recommendation	10	Notes	32/33
Examining the Child with Low Vision	10		
Case History	10		
Testing Visual Acuity	10		
Ocular Motility, Binocularity and Fixation ..	11		
Visual Field Testing.....	11		
Refraction	12		
Color Vision Testing	12		
Contrast Sensitivity Testing.....	12		
Low Vision Devices for Children	12		
Sharing Information	13		
Developing a Plan and Sharing Information.....	15		
Case Studies.....	16/17		

Introduction

What this publication is about

This booklet provides a concise overview of the rapidly growing field of low vision care. While the themes of pediatric and adult low vision care could each be a tome in its own right, this work provides a succinct synopsis and practical information that many professionals will appreciate. If you are thinking of getting into low vision care, or are curious about how this important aspect of eye care relates to your practice, this booklet will be indispensable.

Definition of Low Vision

Simply stated, low vision is vision that cannot be improved to within normal limits with standard eyeglasses or contact lenses, medication or surgery. It is not the same as blindness, although current 'legal blindness' definitions in many regions include people who still have residual vision. Low vision can be defined functionally: it exists when a person with a vision problem that can't be improved through the use of conventional approaches has difficulty using vision to do everyday tasks. The World Health Organization defines low vision as follows: A person who has 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 (20/60) to light perception or a visual field of less than 10° from the point of fixation, but who uses or is potentially able to use, vision for the planning and/or execution of a task. [World Health Organization, WHO/PBL/93.27. Geneva: World Health Organization, 1993] Experts estimate that there are 3 times as many persons with low vision worldwide than people who are blind.

The Multi-Disciplinary Nature of Low Vision Care

The objective of low vision care is improving a person's ability to function on the tasks important to that person through the use of low vision devices (optical, non-optical and electronic) and a wide range of rehabilitation strategies. Diverse professionals are productive partners in the low vision rehabilitation process. These include ophthalmologists and optometrists, occupational therapists, low vision therapists, nurses, vision rehabilitation therapists, orientation and mobility specialists, physicians, orthoptists, ophthalmic technicians, opticians, social workers, psychologists, technology specialists, special educators and others. The patient and his or her family/significant others are important members of the rehabilitation 'team' and are vital to the process.

Understanding the role of each specialist in habilitation/rehabilitation, being aware of referral procedures and making a commitment to appropriate communication all help to enhance patient care and positive outcomes.

Low Vision: A Concise Tutorial from Assessment to Rehabilitation is the initiative of Richmond Products, Inc, in Albuquerque, New

Mexico and the Good-Lite Company in Chicago, Illinois. Richmond and Good-Lite develop, manufacture and market eye examination and testing solutions to a broad user base throughout the world. The low vision tutorial text was written by Mary Ann Lang, PhD and Karen Seidman, MPA of North Star Vision Group. North Star Vision Group conducts consultations and training worldwide to foster the development of high quality clinical and vision rehabilitation services. Alan Highley, Highley PR, Albuquerque, New Mexico was the editor of this booklet.

Foreword

Significance of Low Vision

Vision impairment affects an estimated 246 million people worldwide, 19 million of whom are children below the age of 15. [WHO] These staggering numbers are overshadowed by the devastating impact of vision loss on individuals, their families, friends and caregivers. Issues for people who have low vision include loss of independence, twice the rate of clinical depression in older adults with impaired vision, and correlated negative impact on health. Dealing with vision loss also influences professionals, who may experience frustration at not being able to 'cure' the problem and at not knowing what to recommend to these patients, some of whom may have been in the practice for years.

Low vision care (also known as low vision rehabilitation) once a low-incidence sub-specialty, is now a growing market, owing simultaneously to several factors:

- the surge in the older adult demographic in developed economies worldwide;
- the technological advances that have increased the survival rate of premature babies;
- the pharmaceuticals that have made it possible to manage but not yet cure prevalent eye diseases such as Age-related Macular Degeneration (AMD), and
- the technological breakthroughs that have allowed conventional and electronic low vision devices to be more effective and better accepted. For example, the general public now takes for granted the ability to enlarge images using tablets and smart phones so that many devices used by people with low vision no longer appear unusual.

Yet, the field still is viewed erroneously by many as time consuming, expensive, labor-intensive and requiring an elaborate cadre of professionals in-house in order to engage in the practice. However, others have more accurately recognized the importance of expanding their services to include low vision care in order to meet a burgeoning demand as well as to attract new patients. You may well ask what they know that you need to know. They know that:

- there are evidence-based tools that make patient assessment

Chapter 1

accurate and faster than they expected;

- making a reasonable investment in equipment will allow them to handle many low vision patients in their office or clinic;
- community-based providers can be part of an unofficial, on-demand 'team' to provide a range of services as needed by patients with low vision.

We trust that the information presented in this booklet explains low vision care and vision rehabilitation, including the procedures and equipment that assist in assessment and rehabilitation. It is our hope that this practical information will make it possible for clinicians from many specialties to help patients right away.

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Chapter 1: Causes and Effects

Classification/levels

The classification of low vision/vision impairment separates into two divergent branches:

- Classification according to visual acuity/visual field criteria
- Classification according to the functional implications of low vision diseases

Visual Acuity/Visual Field

In the US and in many countries visual acuity and/or visual field criteria are the basis for the classification of low vision. Most note a visual acuity of 20/60 or 20/70 (6/18) or poorer as denoting low vision. Visual field is also a criterion, in most cases noting a visual field of 20 degrees, or 10 degrees or less from the point of fixation, as distinct levels of vision impairment. An example from the International Statistical Classification of Diseases (ICD [<http://www.who.int/classifications/icd/en/>]), a standard diagnostic tool for epidemiology, health management and clinical principles, illustrates categories of vision impairment based on visual acuity and/or visual field.

Category of visual impairment	Visual acuity with best possible correction		Or central visual field	Classified as
	Maximum less than	Minimum equal to or better than		
1	6/18 3/10 (0.3) 20/70	6/60 1/10 (0.1) 20/200		Low vision
2	6/60 1/10 (0.1) 20/200	3/60 1/20 (0.05) 20/400		Low vision
3	3/60 1/20 (0.05) 20/400	1/60 (finger counting at 1 metre) 1/50 (0.02) 5/300 (20/1200)	10° or less but more than 5°	Blindness
4	1/60 (finger counting at 1 metre) 1/50 (0.02) 5/300		5° or less	Blindness
5	No light perception			Blindness
9	Undetermined or unspecified			Unspecified
* Visual field restriction criteria applicable even if visual acuity is better than for that category				

Fig. 1. Categories of severity of visual impairment according to the International Statistical Classification of Diseases

Functional Criteria

Classifications based on visual acuity/visual field are useful for the statistical analysis of trends or assignment of government benefits. However, classification based on functional parameters is more useful to the clinician and more effective for the patient. In the classification chart [Fig 1], for example, contrast sensitivity is not a factor, despite the fact that it has a profound impact on the person's ability to function in everyday life (Whittaker in Kooijman, Low Vision, 1994), (Arrighi in EurJOph, 2010), (Bodis-Wollner in IOC, Spring 1980). This classification also does not take into account studies that have shown that a best corrected visual acuity (BCVA) of 20/40 may be a more accurate and representative cut-off point for a visual acuity level at which people begin to have problems with daily activities (West et al, 1977). In fact, in 2013 the American Academy of Ophthalmology revised its definition of low vision to include patients who have visual acuity of less than 20/40 or scotomas, field loss or contrast loss. (www.aao.org/ppp).

The World Health Organization classification encompasses the two parameters of visual acuity/visual field loss and functional ability:

- Low vision is visual acuity less than 6/18 (20/60) and equal to or better than 3/60 (20/400) in the better eye with best correction.
- 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 (20/60) to light perception, or a visual field less than 10 degrees from the point of fixation, but who uses, or is potentially able to use, vision for the planning and/or execution of a task for which vision is essential. (WHO, 1993)

Functional Implications

A functional approach is most helpful for clinical decision-making. The eye pathologies that result in low vision can be considered according to the effects they have on functional vision. In the early 1970s, Eleanor E. Faye, MD created a classification of low vision that is still in use today. While it is clear that there can be a range of variation in the subvarieties of the major diseases noted, this classification is a useful paradigm for anticipating prescribing and rehabilitation needs.

The basic categories noted by Faye are:

- Diseases that cause a LOSS of CENTRAL VISION – including diseases of the central retina (AMD) and of the optic nerve (Optic Nerve Compression)
- Diseases that cause a LOSS of PERIPHERAL VISION – including diseases of the peripheral retina (retinitis pigmentosa), the optic nerve (glaucoma, ischemic optic neuropathy) and neurologic problems (stroke, brain tumor)

Chapter 1

- Diseases that cause an OVERALL BLUR – including diseases that result in cloudy media involving the cornea and tear film (dry eyes, irregular astigmatism, corneal dystrophy, corneal edema), the pupil/iris (miosis, mydriasis, atrophy, polycoria, iridectomy), the lens (cataract) or the vitreous (hemorrhage, inflammation)

Legal Blindness

The term 'legal blindness' is problematic. In the US it is defined as:

- Visual acuity of 20/200 or worse in the better eye with correction, or visual field restriction to a 20 degree diameter or less in the better eye

It is important to recognize that low vision can always be distinguished from blindness. People with low vision do have some vision. Determining how useful the vision will be for daily activities and how/whether functional vision can be enhanced optically or electronically are among the goals of the low vision examination.

Causes

There are many causes of low vision. Some are congenital and others are acquired. The dominant causes found within different age groups also vary with regard to occurrence in developed or developing nations. Overall, the dominant causes of low vision in adults (excluding uncorrected refractive error) are macular degeneration, diabetic retinopathy, retinitis pigmentosa, cataracts, corneal opacity and glaucoma. To a lesser degree, some of these conditions may also cause low vision in children. Additional conditions causing low vision in children include albinism, amblyopia, strabismus, coloboma, optic nerve hypoplasia, Leber's congenital amaurosis, cortical blindness, congenital rubella syndrome, cancers such as retinoblastoma and retinopathy of prematurity. The effects of these conditions may result in life-long low vision. Retinal detachment, trauma, and acquired traumatic brain injury may also result in low vision and are gaining attention due to the increasing number of people engaging in very active sports and high speed activities, and incidents related to combat.

Prevalence

The World Health Organization's (WHO) "World Report on Vision", which is expected to be launched towards the end of 2018 will provide the latest information about visual impairment worldwide. This document should be available on the WHO website.

WHO Subregion	Total population (millions)	Prevalence of blindness (%)	No. of people with low vision (millions)	Prevalence of low vision (%)
Africa-E	360.965	1	10.573	3
Americas-B	456.432	0.3	7.6	1.7
Eastern Mediterranean-D	144.405	0.97	4.116	2
Europe-A	415.323	0.2	5.435	1.3
South-East Asia-D	1394.045	0.6	28.439	2
Western Pacific-B1	1374.838	0.6	26.397	1.9

Fig. 2. Estimates of low vision and blindness in WHO subregions. The capital letters following the subregion names provide a key to the countries surveyed to develop the information in the chart. The full information about prevalence and the specific countries surveyed can be found on the WHO website (844 Bulletin of the World Health Organization, November 2004, 82 (11))

Comorbidities

It is important to remember that, in the case of older adults, low vision often coexists with other medical conditions. Aging may involve changes in many body organs and systems. In addition, the four primary causes of low vision in adults, age-related macular degeneration (AMD), cataract, glaucoma, and diabetic retinopathy, are associated with pathological systemic changes. Arthritis, hearing loss, heart disease, stroke, amputation, and hip fracture are prevalent in the population of older adults and affect assessment and vision rehabilitation.

A study in the Journal of the American Geriatric Society (2011 Oct; 59(10):1802-9) looked into the ways that comorbidity affects older adults' experiences in health service and presented a framework to assist clinicians in providing services. The five broad themes it identified can be useful to professionals addressing low vision in older adults. The chart [Fig. 3] summarizes these themes.

Theme	Description
Good Days, Bad Days	fluctuating health status
Communication Barriers	sometimes due to impairments, sometimes due to situation
Feeling Overwhelmed	pragmatic and emotional concerns of person with low vision and caregivers
Delays	tendency of comorbidities to delay progress and to add inconvenience
Companion Involvement	positive value in overcoming barriers

Fig. 3. Comorbidity effects in older adults

In children, common comorbidities may include deafness, physical handicaps, cerebral palsy, cognitive impairment and Down Syndrome. Professionals involved in low vision care can provide more effective service to older adults and children with low vision by anticipating the functional implications that these comorbidities can have on low vision device use, adjustment to vision loss, clinical low vision care and rehabilitation.

Lifestyle Issues

Surveys have consistently shown that people's fear of vision loss is second only to their fear of cancer (http://www.eyersearch.org/resources/NEI_factsheet.html) and that twice as many people fear losing vision than the number who fear premature death (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC20080307/> twice-as-many-people-fear-blindness-more-than-premature-death) It isn't surprising, therefore, that low vision affects every aspect of a person's life. In studies of older populations with impaired vision, elderly people reported poorer levels of functioning for activities of daily living, symptoms of depression and feelings of anxiety as compared to the general older population as well as compared to older patients with different chronic conditions. Older people who report vision loss are more likely to experience comorbid conditions than people without vision loss, with serious consequences for overall health, ability to perform tasks, and to participate in social roles (Crews, Jones, & Kim, 2006). Among the significant quality-of-life issues reported by adult patients are: loss of the ability to read, to see faces, to see television, to play cards, to identify medications, to go to the movies, to drive and to live independently.

Vision impairment impacts children in a variety of ways. For example, toddlers whose vision is within normal limits will communicate with one another by imitating each other (Trevathan & Aitken, 2001) even hours after observing their counterparts (Hanna & Meltzoff, 1993). However, children with impaired vision can have difficulty modeling conduct and, consequently, difficulty with social interactions when their capacity to observe is limited. Concept development also may be restricted because low vision may impede access to information and may curtail the child's interest in exploring the environment (Bishop, 2004). Years of lost economic productivity when vision impairment goes uncorrected significantly impacts the child, the family and society (Gilbert, et al, 2008). Recent estimates suggest that the global annual loss in GDP

(Gross Domestic Product) may be as high as \$22,764 million.

Low vision impacts the workplace, as well. Unfortunately, severe underemployment is characteristic of the population of working age people who are visually impaired and those who are legally blind (<http://www.afb.org/section.aspx?FolderID=2&SectionID=7&DocumentID=1529>) Legislation such as the Americans with Disabilities Act (1990) and similar legislation worldwide (see sidebars) guarantee equal opportunity for individuals with disabilities in a range of areas including employment, government services, public accommodations, transportation, and telecommunications, however implementation is always an issue. Co-worker sensitivity and practical adaptations are often all that is needed to make the workplace user-friendly for the person with vision impairment, but these may be challenging for the employer. Getting to work may be an issue for the worker with impaired vision, as well. A thorough low vision examination geared to assessing the applicability of adaptive software, environmental modifications and independent mobility can equip a person with low vision for workplace success.

The Law

In the United States three main laws address low vision.

IDEA. The first is the Individuals with Disabilities Education Act (IDEA). IDEA was enacted by Congress in 1975 to ensure that children with disabilities have the opportunity to receive a free, appropriate public education like other children. IDEA has evolved and been amended many times. There are now rich opportunities and stringent time frames outlined and required throughout the US. Implementation of IDEA takes place at the local school district level. Up to date, detailed information about IDEA can be found on the website for the National Dissemination Center for Children with Disabilities (www.nichcy.org)

Social Security. Patients in the US who are blind or have low vision may be eligible for financial assistance from the Social Security Administration. For Social Security benefit purposes, the term 'legally blind' is used. A person is considered to be legally blind if his or her vision cannot be corrected to better than 20/200 in the better eye or the visual field is 20 degrees or less in the better eye. Even if a person's vision does not meet the legal definition, he or she may still qualify for benefits if the vision problem alone or combined with other health problems prevents the person from working. Full information can be obtained from Social Security: The Official Website of the U.S. Social Security Administration.

Americans with Disabilities Act (ADA). Passed in 1990, the ADA provides people with disabilities with protections against discrimination in employment, public services, public transportation, telecommunications, and places of public accommodation. Regarding vision impairment, ADA proclaims that people with impaired vision have the same rights as anyone else to participate in a wide variety of activities. However, the ADA provides relatively little in the way of removing environmental obstacles to such participation. (Asch, Gartner, Lipsky, Lighthouse Handbook on Vision Loss and Vision Rehabilitation, 2000)

Chapter 1

Internationally the laws related to low vision vary enormously. In some of the Scandinavian countries comprehensive health, education, and rehabilitation provisions are coordinated and provided for all citizens. Low vision clinical and other services are included in these plans. In other parts of the world, services, coordinated care, and legal protection may not exist or may be minimal.

The World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB) have worked together with a wide array of organizations worldwide to develop and implement Vision 2020: The Right to Sight.

Vision 2020 is a coordinated plan to define the problems of vision impairment and to address them in an effective fashion by the year 2020. Low vision is specifically addressed in the Vision 2020 plan. From its inception, the developers of Vision 2020 realized that success in addressing vision impairment would not be possible without the commitment of national Ministries of Health. To that end, the Vision 2020 agenda was presented at the World Health Assembly. In May 2003, the World Health Assembly unanimously passed resolution WHA 56.26, which urged Member States to commit themselves to supporting the Global Initiative for the Elimination of Avoidable Blindness by setting up, not later than 2005, a national Vision 2020 plan, in partnership with WHO and in collaboration with nongovernmental organizations and the private sector, thus giving a highly visible international impetus to the prevention of avoidable blindness. National Ministries of Health, regional representatives for Vision 2020 (www.iapb.org/vision-2020 and additional Vision 2020 websites), and your local professional associations (e.g., Low Vision Rehabilitation Committee of the American Academy of Ophthalmology, Pan-American Low Vision Society, Low Vision Section of the American Academy of Optometry, Vision Rehabilitation Section of the American Optometric Association) are the best sources of information about law and practice in your particular nation or region.

Legislative Developments in Brazil Benefit People with Disabilities

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In Brazil, a Declaration of Human Rights dates back to 1948. This was followed in 1988, 1989 and 2002 by legislation and decrees that further defined and established guidelines. These included provisions for people with impaired vision. For example, Ordinance #1679 of 1999 detailed the adaptations and support that a student with visual impairment would need in the academic setting: Braille, large type, use of optical aids and electronic devices, extra time, presence of a Leader.

In 2008, a National Health Policy for People with Disabilities was put forth as Ordinance #3128 (24 December 2008). This policy determined the accreditation guidelines for low vision services and established the State networks of care for people with vision loss. It stipulated that Vision Rehabilitation Services must have adequate physical facilities and equipment, and a multidisciplinary team suitably qualified and trained. Further, it mandated that the habilitation/rehabilitation of people with impaired vision must proceed in a system that coordinates and integrates with regional health care, as well as access to optical aids.

A constitutional amendment was added to the Brazilian constitution in 2011 that institutes a National Plan for the Rights of People with Disabilities. This plan strives to remove limitations by articulating, integrating and promoting policies, programs and actions that encourage the full and equal rights of persons with disabilities. It makes reference to the International Convention on the Rights of Disabled Persons of the United Nations of 2006, formally adopted by Brazil in 2007. The provisions of the 2011 amendment deal with the domains of education, work, social assistance, accessibility, health and habilitation/rehabilitation.

Protecting the Rights of Persons with Disabilities in Colombia, South America

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Colombia, South America

Fundación colombiana para la discapacidad visual

Statutory Law No. 1618

27 February 2013

“...to guarantee the full exercise of the rights of disabled persons.”

Two prior pieces of legislation by the Colombian government, in 2007 and 2009 respectively, dealt with these issues, but the 2013 law seeks to expand the former provisions. It mandates steps that must be taken in pursuit of “human dignity, equal opportunity, respect, justice, inclusion, protection, solidarity, pluralism and accessibility, acceptance of differences...” Law 1618 specifies the rights of disabled children and adults as well as the responsibility of Society (defined as the family, private businesses, non-governmental organizations, guilds and society in general) and it highlights the specific responsibilities of various governmental departments and agencies in furthering this goal.

Chapter 2: Assessment

Importance of Early Detection

Early detection of low vision is important for two essential reasons. The first is that the eye diseases that result in low vision require treatment in order to do whatever is possible to control vision loss. This includes the latest treatments for macular degeneration, glaucoma and diabetic retinopathy to slow their progress, and cataract surgery as well as treatment for other anterior and posterior conditions. The second reason is that the earlier that vision loss is detected – particularly in progressive conditions -- the better the patient's vision will be, the greater the range of available optical and vision rehabilitation solutions and often, the easier the patient's adaptation.

In addition to the difficulty many people – especially older people -- have understanding that any vision loss should be attended to speedily, patients often have trouble distinguishing between the subspecialty care they get to control their eye disease and the specialty of low vision care/vision rehabilitation. Studies have documented the public's lack of awareness of these services worldwide and the resulting long and debilitating time many patients suffer through without receiving care. A concomitant difficulty is the delay and sometimes failure of some ophthalmologists, optometrists, nurses and other gatekeepers to refer patients for vision rehabilitation due to lack of knowledge about the availability and/or benefit of these vital services. You can help:

- by clarifying these issues for your patients;
- by delivering basic or comprehensive low vision care yourself or knowing who in your community offers these services;
- by providing care in a timely way or referring your patients as soon as you discover that function is impaired.

Examining the Adult with Low Vision

The low vision examination differs from the routine eye health examination, and has its own unique tools and procedures. It complements but does not take the place of on-going disease treatment. The low vision examination's goals are three-fold:

- (1) to understand and quantify the patient's reduced vision;
- (2) to improve function by prescribing low vision optical and non-optical devices that match the patient's abilities and daily living needs;
- (3) to recommend vision rehabilitation interventions, including re-training in daily living activity skills, safe travel skills and counseling, as necessary.

The result of the low vision examination is not a cure for the eye disease; rather what is sought is a positive impact on the patient's quality of life despite the patient's vision loss. As discussed in

earlier chapters in this book, the causes of low vision include retinal diseases, optic nerve damage, media opacities and brain injury. Regardless of the cause, the low vision clinician can make an important difference to the patient and his/her family by conducting a thorough examination, explaining findings and prognosis, referring patients for vision rehabilitation and prescribing helpful devices that improve the patient's ability to function in the home, at work, school and in the community.

The low vision examination includes the following components:

- Case history
- Checking visual acuity
- Refraction and predicting the add
- Function tests: Central visual field, binocular function, contrast sensitivity, peripheral visual field and color testing (as applicable)
- Evaluation of low vision devices
- Selection of appropriate devices
- Instruction in device use
- Referrals for additional vision rehabilitation services
- Prescription
- Dispensing
- Follow-up

Case History

Low vision care is particularly task-oriented. As a result, the low vision case history includes the patient's ocular and medical history but also asks detailed questions about any difficulties the patient may be having with daily activities, both at near and at distance. The low vision clinician will want to know about general health issues, such as diabetes, Parkinsonism, neurological problems such as Multiple Sclerosis, or a history of stroke, as these can affect his/her recommendations. In addition, there will be questions about whether lighting, glare and contrast present difficulties, and any problems there may be with work, school, hobbies or other interests. The patient's own opinion of his primary and secondary goals in seeking help for his low vision is important information that shapes the low vision clinician's approach and intervention.

Testing Visual Acuity

The specialized tests that are used for visual acuity testing generally present more optotypes (letters, numbers or symbols) on a line and more lines for the patient to read than traditional tests. The geometric progression of the layout of optotypes on charts with LogMAR design (Logarithm of the Minimum Angle of Resolution) with controlled size and spacing of letters, space between letters and

line spacing, makes these the research standard and best for clinical work. In low vision care, test distances are closer than in regular vision testing, and the clinician's goal is to record a measurable acuity, even if it is very low. Charts exist that will allow visual acuity measurement to as low as 20/1600; therefore, Finger Counting (FC) as a recorded measurement should be avoided. Projector charts generally are not used, both because they do not present optotypes at high enough contrast and because the test distance is not effective



Function Tests

Other tests are performed to further flesh out an understanding of the patient's functional vision.

Amsler Grid – This test of the central 30 degrees of visual field is used binocularly first, then monocularly. The test is done at 33cm with a +3.00 add in place over the patient's best correction. The Amsler Grid is used in low vision care to locate scotomas, to get an idea of their size and density and to compare OU, OD and OS – information that will be useful in prescribing. It helps the clinician understand whether the patient will perform best with a monocular or a binocular correction and/or low vision device. The sensitivity of the test can be improved by doing the test binocularly first, by using a grid of a different color (especially red) that will allow the patient to 'see' his scotoma more vividly or by using a lower contrast grid.



Fig. 7. Amsler grid with recording form

Contrast Sensitivity Testing – This test is essential to low vision care because its results predict the need for increased magnification, illumination and/or contrast enhancement. It predicts which is the better eye, what the patient's binocular potential is, and overall, what the likelihood of success is going to be with optical devices. Changes in contrast sensitivity also validate patient's complaints that there has been a change in vision which is not otherwise borne out by visual acuity testing. Contrast sensitivity function has been noted as a better predictor of patient performance in the real world than visual acuity (Rosenthal, BP. Visual Acuity vs Contrast Sensitivity Optometric Management 3/1/06) and often its results are more important to the patient's functional vision than those of visual acuity testing. (Faye, EE. Lighthouse Handbook on Vision Loss and Vision Rehabilitation, 2000)



Fig. 8. Contrast sensitivity tests

Color Testing – Color is not routinely tested in the low vision exam of the adult (it is always tested in children), but may be a part of the adult battery if the case history or patient's objectives indicate. In addition to standard color tests (Farnsworth/Ishihara/HRR) there is a large-disc version of the D-15 test that is a more useful size for testing low vision patients.



Fig. 9. Panel 16 quantitative color vision test

Glare Testing – While not routinely done, the impact of glare on visual acuity may be tested if the case history, diagnosis or patient's objectives indicate. Glare lights may be attached to the distance chart illuminator or a Brightness Acuity Test (BAT), Brightness Acuity Meter (BAM) or other external light source can be used to determine the extent to which glare diminishes visual acuity and performance. Results will influence prescribing options.

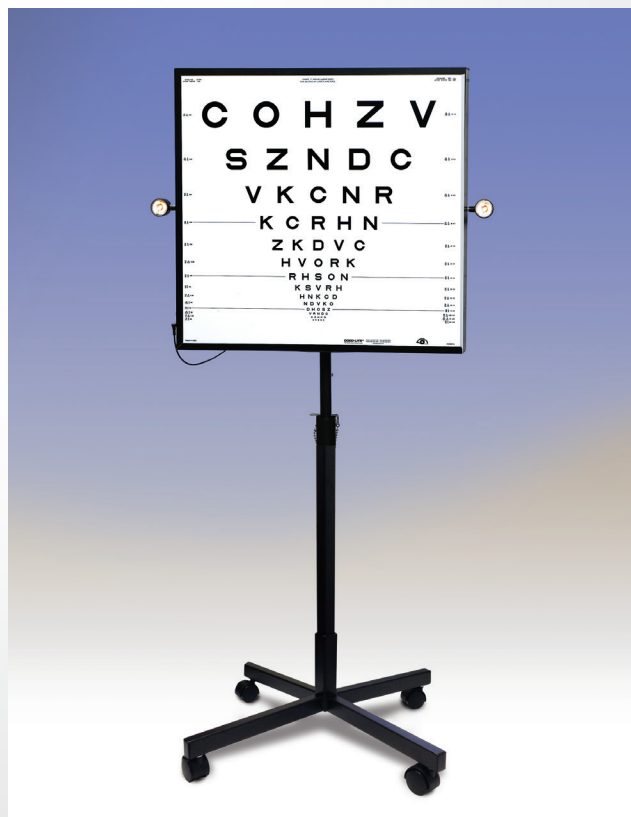


Fig. 10. Distance chart with glare lights

Chapter 2

Low Vision Device Recommendation

Once the history is taken and the appropriate testing is completed, the clinician is ready to recommend low vision devices. The patient's objectives for distance, intermediate and near activities are considered, as well as the results of the tests of visual function and the predicted magnification. The characteristics and limitations of the various optical devices such as field of view and working distance are important to include in the decision process. Optical devices will be discussed in an upcoming chapter. Instruction in device use is crucial to the ultimate success of the low vision examination.

Examining the Child with Low Vision

The goal of the pediatric low vision examination is threefold: (1) to understand the child's vision (in the context of what is appropriate for the child's age), (2) to address the interventions needed for the visual tasks the child has or will have, and (3) to educate the parents/teachers/other professionals in the child's life about the child's condition and low vision recommendations. Like the low vision examination of the adult, the examination of the child requires special equipment and techniques.

The components of the pediatric low vision examination are:

- Case history
- Visual acuity testing
- Ocular motility, binocularity and fixation testing
- Visual field testing
- Refraction
- Color vision testing
- Contrast sensitivity testing
- Eye-hand coordination testing
- Low vision device recommendation
- Device instruction
- Recommendation of other services
- Counseling parents/teachers/other professionals
- Follow-up

Case History

The pediatric case history is the foundation of the low vision examination. The clinician will obtain most information from the adult (parent, grandparent, caregiver) who has brought the child to the examination. Questions should be asked concerning the child's

ocular history, medical history, developmental history, and whether the child is receiving any other services such as occupational therapy, physical therapy or speech therapy. The clinician will want to know the child's educational history, as well. Some children are able to answer some questions on their own. Include the child whenever possible.

Testing Visual Acuity

Children will be tested at distance and at near, as appropriate, using specialized charts. The selection of the appropriate test depends on the child's age and abilities.

When testing infants to about 18 months of age, preferential looking tests such as Teller Acuity Cards and LEA Gratings are used. The infant's ability to see detail in a moving stimulus can be evaluated with an Optokinetic (OKN) Drum, and gross object awareness can also be evaluated using balls or toys of various sizes.



Fig.11A. LEA GRATINGS, a preferential looking test (front and back)



Fig.11B. LEA GRATINGS, a preferential looking test in use



Fig. 12. Optokinetic (OKN) drums

Preferential looking tests are applicable for some toddlers (18 months to 3 years), but tests of recognition acuity can also be introduced, such as the LEA Symbols which are not culturally-bound and use the simple symbols of a square, apple, house and circle as optotypes. The LEA Symbols have the distinction of all blurring to circles when the child can no longer distinguish the optotype. During testing the child can either name the symbols, point to the appropriate symbol on a response card held in the lap, or touch, lift or otherwise indicate the 3D puzzle piece that confirms the symbol seen.

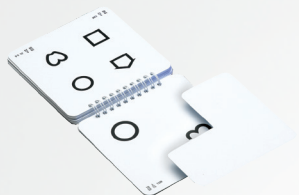


Fig. 13. LEA Single Symbol Book



Fig. 14. LEA Puzzle

For pre-schoolers (3-5 years of age) LEA Symbol presentation is available for low vision (to 20/1600), in distance charts in LogMAR format (to 20/200), single symbol and crowded symbol books (to 20/200) and on near charts, flash cards and domino cards. Another advantage is that the 3D puzzle and domino cards that are part of the LEA Symbols test system give the illusion of a play situation while the child learns the symbols or engages in the test. Symbols are also presented in crowded format to mimic continuous text. Similar to the LEA Symbols, LEA Numbers are another option and are available for low vision, standard distance testing and near testing.



Fig. 15. LEA Numbers low vision book



Fig. 16. Continuous text chart

Some children under 5 years of age and most school-age children (+5 years of age) can recognize letters and can be tested using the HOTV letters, numbers or other standard distance and near letter and distance charts in LogMAR format. Continuous text at an appropriate level can also be used.

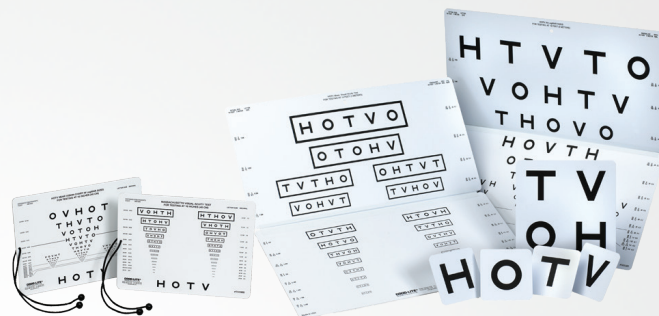


Fig. 17. HOTV Near and Distance Charts

Ocular Motility, Binocularity and Fixation

Many targets can be used for testing ocular motility, binocularity and fixation in the child with low vision. A penlight or transilluminator, finger puppets, the child's favorite toy or other objects are effective. The clinician will assess basic fixation and following and may check for binocular alignment using the Hirschberg or Krimsky tests, and for angle deviations and amblyopia using the Bruckner test. A cover test will also be done.

Visual Field Testing

Younger children can be tested using a portable arc perimeter with fun targets, and also through gross confrontation screening with colored objects in a lighted room. Techniques for using lighted targets in a dim room in a preferential looking scenario can also be very helpful. Older children can be tested using standard confrontation testing (having the child indicate when he/she sees the clinician's wiggling or stationery fingers), or by using the Flicker Wand [Fig. 18A]. Goldmann perimetry, presented as a game, is also effective with older children. The Amsler Grid can be used to test central visual field in children who can comprehend the instructions.



Fig. 18A. LEA Flicker Wand



Fig. 18B. LEA Flicker Wand in use

Refraction

Just as with adults, refraction is a critical part of the pediatric low vision examination. Of particular help when working with children is the use of interesting targets such as videos across the room, animated toys or having the parent keep the child's attention. These complement procedures such as the Mohindra Technique for near retinoscopy. This technique involves performing retinoscopy in a darkened room at 50 cm (20 inches) with the child fixating the retinoscope light monocularly (the other eye is occluded). Distance retinoscopic refraction is derived by adding -1.00 D to the value found by near retinoscopy. This allows the clinician to take into account the working distance and the state of accommodation in the dark. Cycloplegic refraction will be conducted on a percentage of children, in addition to keratometry.



Fig. 19. Color vision screening and testing

Color Vision Testing

While color vision testing is only sometimes performed during the examination of the adult with low vision, it is critically important when testing children. Since so much of the child's learning and concept development in the early years will be dependent on color, knowing whether there are any color deficiencies is important to the teacher, the parent and the child. Once again, the particular test for a child will be based on the child's age and abilities.

Contrast Sensitivity Testing

Contrast Sensitivity Testing is very important to the pediatric low vision examination and has prognostic value for the clinician. 'Hiding Heidi' is a test that presents a simple line drawing of a smiling girl's face in levels of contrast from 1.25% to 100%. The test is presented in a preferential looking format. The LEA Symbols are also available in a contrast test flip chart that presents one size symbol at five levels of contrast: 1.25%, 2.5%, 5%, 10%, and 25%. For older children who know letters or numbers, standard reduced contrast letter or number cards can be used.



Fig. 20A. Hiding Heidi Low Contrast Face Test

Low Vision Devices for Children



Fig. 20B. Hiding Heidi Low Contrast Face Test in use

Not all children with low vision use (or need) low vision devices. In considering whether to prescribe a device, the clinician evaluates whether the child can be taught how to use the device, whether the child can be responsible with the device, whether the parents are supportive, what the child's lifestyle is, whether a device is the best option to meet the child's needs, and cost. All low vision devices are possible clinician recommendations, including low vision spectacles, hand magnifiers, stand magnifiers and telescopes. Of these, dome magnifiers are particularly effective for children. Electronic devices offer significant advantages for children, in particular tablets that allow easy screen magnification, scalable font size and speech output.

Sharing Information

Once all of the evaluations have been completed, the low vision clinician takes the very important step of summing up the findings for the patient's parents/caregivers, and writing reports that help teachers and other professionals involved in the child's care.

Parents' focus on prognosis is understandable. However, in the case of very young children the recommendation may be to watch for changes over time. The most important step is to take the time to explain – and, if possible, to demonstrate – WHAT the child sees at the time of the low vision examination. This can enhance the interactions between parent and child or teacher and child, reducing frustration and increasing effectiveness.



Fig. 21. PowerDome dome magnifier

North Star Vision Group wishes to acknowledge the contribution of Michael Fischer, OD in the development of the process for the assessment and prescription for children with low vision described in this text. The reader is directed to the article below by Dr. Fischer for additional suggestions for working with children with low vision. Fischer, Michael. Low Vision Examination of Children.

[<http://www.lighthouse.org/for-professionals/practice-management/patient-management-pediatrics/low-vision-examination-children>]

Talking to Parents of Children with Impaired Vision

Judith Gurland, MD
New York, USA

- Remember this could be your child or grandchild
- Ask the child and then the parent(s) about specific needs and/or issues with learning
 - Types of learning material
 - Physical set-up of learning areas
 - Social issues related to vision impairment
- Remember to ask for and to listen for their concerns and their fears
- Speak quietly and at a normal pace: do not be patronizing or solicitous and be patient
- Let the child show you and the parent(s) what works visually for him/her
 - Adopting a particular head position
 - Using the low vision devices that the child prefers
- Offer to communicate with teachers
 - Look at schoolwork/books/other teaching material
- Stick to 'what's so' rather than making anything up but don't be cruelly honest either
- Remember to speak with and include the child in at least some of the conversation
- Check in with the parent(s) and child during the conversation to assure that they are still listening and that they understand what you are saying
- MAKE and KEEP eye contact with the parent(s) and/or the child when you are interacting with them
- TURN OFF ALL ELECTRONIC EQUIPMENT – both yours and theirs. You do not want to be distracted by an incoming call!
- Ask if they have questions and address them, as best you can, and then ask if you have actually answered them
- If appropriate, have the parent experience what the world may look like to their child
- Become familiar with available vision rehabilitation services, relevant websites, local or internet support groups and share these with families when appropriate



North Star Vision Group LLC

North Star Vision Group, LLC's Low Vision Exam Flow Chart™

What Will You Do? Steps In The Low Vision Exam	Why? Rationale	What Will You Use? Chart Or Technique	How This Differs From A Routine Eye Exam	Special Considerations For Children
History ↓	To determine presenting complaint(s); establish constraints/needs/goals	Intake/History form	In addition to routine questions, the LV History inquires about difficulties with daily tasks and activities.	Getting information from parents, caregivers, teachers – those who are with the child daily – is important.
Entering Acuity ↓	To establish point of reference; Baseline against which to evaluate effects of treatment	- LogMAR distance chart - Near chart: single word, number, symbol, reading distance	Projector charts and Snellen charts are NOT routinely used.	Optotypes or test objects that are not culturally-bound and that make the test situation fun are preferable.
Refraction ↓	Starting point to improve distance and/or near vision To give patient best vision possible, even if it is not within 'normal' limits, in order to increase device and ADL options	- LogMAR distance chart - JND (Just Noticeable Difference) - ETDRS single letter, number, symbol or single letter/number book	Closer test distances and specially designed charts are used. A greater JND interval is used so that the patient can perceive the difference.	A lens bar may be faster to use than trial lenses, but the disadvantage is that it is also an interesting item for a young child to grab. Fun frame occluders can facilitate monocular refraction. Getting the parent or caregiver's help to hold young children or to cover each eye as needed is useful.
Predict the add (for 1M print or other goal-size print or activity) ↓	To improve functional vision for goal-related tasks	- Single letter, number, symbol chart (with cord) - Continuous text	Concentrates on the additional magnification the patient will need in order to do daily tasks.	When appropriate, a child who faces a lifetime of low vision device use should be introduced to magnification. In addition, electronic devices already popular with the child's peers may offer an acceptable option.
Do Function tests: - Contrast Sensitivity - Amsler Grid - Visual Field - Color ↓	To quantify and understand aspects of vision that may affect final Rx and rehabilitation recommendations	Function tests: - Letter/number contrast test - Amsler charts manual (optional) - Goldmann, Humphrey or Octopus - Confrontation - Large D-15	Tests are performed because they have direct application to the functional difficulties the patient may have, and to address the prescription of low vision devices.	Child-friendly optotypes are available for contrast testing. Confrontation testing can also be done with familiar objects. Color identification is particularly important for young children, because color is often made a key component in early learning. Color test using child-friendly optotypes is available.
Trial of Devices and Recommendation ↑↓	To match device to task; to evaluate patient's initial response to each type of device	Sequential presentation of devices	More than one device may need to be prescribed for a patient. Unlike routine spectacle Rx's, low vision devices are each task-specific. The case history elicited from the patient and discussion during the exam help with device recommendation.	Consider the child's readiness to use a low vision device and whether there is support to use a device from parents or caregivers before prescribing. Dome magnifiers are a helpful starting device for many children.
Training in device use (LV Instruction) ↑↓	To develop patient's skills and understanding; provide guidance to patient/family; assess proficiency; make plan	Dedicated LV instruction session as part of initial visit, and as focus of subsequent visits; report back to doctor	Critically important in low vision care so the patient can understand exam findings, ask questions, evaluate device recommendations and be engaged in the learning process. Using real-life items (newspapers, local utility bills, hobby-related items) allows patient to see potential to integrate device use into daily life. Demonstrate lighting/ contrast enhancement.	If a child is competent to be prescribed a low vision device (consider age, maturity, need, parental support) the child, the parents and/or caregiver should have instruction in how to use and care for the device. The child's teacher may also benefit from this information about device(s), so that he/she can reinforce the child's use of the device in the classroom setting, if appropriate.

What Will You Do? Steps In The Low Vision Exam	Why? Rationale	What Will You Use? Chart Or Technique	How This Differs From A Routine Eye Exam	Special Considerations For Children
Referral ↓	To engage those professionals who provide counseling, Orientation & Mobility, ADL training, visual skills enhancement in order to help patient reach goals	In-house or external network	Unlike the subspecialty referrals made intermittently in routine care, other vision rehabilitation specialists are integral to low vision care and should always be considered. All specialists do NOT have to be within the same practice.	Other vision rehabilitation specialists are integral to low vision care and should always be considered for youngsters. Often these services are provided through the school system, however, it should not be assumed that they are in place. A recommendation from the vision care professional may be needed to initiate appropriate support services for the child.
Follow up ↑↓	To troubleshoot; intervene as necessary	Return visit(s); phone call(s); online contact	Unlike routine care, the low vision episode of care nearly always includes follow up initiated by the clinician and/or instructor. Explain to the patient that a change in vision or visual demands may require a new device recommendation. Encourage patients to stay in touch with you to ask about new devices they hear about or see online.	Children who will use low vision devices should be seen for follow up until the instructor and clinician are satisfied that the device can be used properly. Explain to parents/caregivers that the child should return for additional low vision care whenever visual demands change, for example, when textbook text size gets smaller as the child progresses in school.
Dispensing	To make sure the patient receives the prescribed device(s)	Dispenser will reinforce correct device use with patient	Important to have the capability to dispense in-house or have a definite source of devices in the community. Drop-shipping to the patient is not advisable unless you schedule the patient to bring the device for a follow up visit so you can reinforce correct use.	Important to have the capability to dispense in-house or have a definite source of devices in the community. Drop-shipping to the patient is not advisable unless you schedule the patient to bring the device for a follow up visit so you can reinforce correct use.

Fig. 22. North Star Vision Group, LLC's Low Vision Exam Flow Chart™ Copyright © 2013 by North Star Vision Group, LLCSM Used under license from North Star Vision Group, LLCSM

Developing a Plan and Sharing Information

Patient-centered care is essential for low vision services to be successful since low vision care focuses on optimizing the functional effectiveness of the patient. It is, therefore, important to find out what the patient views as the problem and what his or her goals are. The care plan that is developed should respect and respond to individual patient preferences, needs, and values. During the history-taking at the start of the assessment, critical information about what the patient sees as the problem and what his or her goals are is shared. Information derived from the clinical assessment is used to refine the details about the problem and goals and to develop the care plan. The low vision professional works with the patient to:

- Agree on the problem
- Negotiate reasonable goals
- Generate options

- Decide on a mutually agreeable and feasible regimen

In addition, the low vision professional should:

- “Test” the patient’s understanding of what he/she has to do to practice
- Screen for readiness - how confident is the patient that he/she can comply?
- Keep the patient on track – by phone, email, follow up visits

It helps to keep in mind that adults learn best when:

- They have a sense of control (feel safe).
- They are involved in the learning process (can set their own goals, be given freedom to explore options).
- The task is personally meaningful.

Chapter 2

Treating patients as partners, involving them in planning their health care and encouraging them to take responsibility for their own health has been shown to improve satisfaction with care, compliance and clinical outcomes. The following case studies help to illustrate this.

CASE STUDY #1

Patient: Hana (female)
Age: 45 years old, unmarried
Diagnosis: Diabetic retinopathy

Chief complaint: Inability to read.

History: Hana was an avid reader. She lost her job one year prior to her vision loss. She subsequently started a new job as a librarian but now feels that the extensive reading required and helping library users has become very difficult.

LV Examination: Hana was tested using the Early Treatment Diabetic Retinopathy Study (ETDRS) LogMAR distance chart at 2 meters. Her visual acuity was measured to be 2M/40 OD (equivalent to 20/400 at 2 meters) and 1M/40 OS (equivalent to 20/800 at 1 meter). She was not helped with any refractive correction. With the ETDRS near chart at 40cm, the predicted add for 1M print was +20D for the OD. Her contrast sensitivity was tested using the Mars Letter Contrast Sensitivity chart, and found to be 0.96 OD (severe loss), 0.40 OS (profound loss), and 1.00 OU (severe loss).

LV Recommendations: Although the predicted add was +20D, Hana's reduced contrast sensitivity required a higher add. She was tested with a +24D (6X) aspheric microscopic spectacle for her right eye and was able to read 1M continuous text slowly. This was prescribed for her for short term reading tasks. She was also prescribed a hand-held, focusable, monocular 4x telescope for distance spotting, including searching the library stacks. A consultation was arranged with a job site specialist to evaluate and help her maximize her work environment. She will meet with a technology specialist to learn about the accessibility features of her work computer and will also get information about speech output software that may speed up her reading at work.

Outcome: Hana was taught to use the spectacles and the telescope. Her reading with the spectacles was slow at first but she gradually gained speed and accuracy. She was very pleased with the telescope, but found that it was difficult to use when she was in less well-illuminated parts of the library. Although she was very anxious about having the job site specialist visit her at work, she found that consultation to be very helpful. With her employer's permission and support, she is having speech output software installed on her work computer.

CASE STUDY #2

Patient: Ray (male)
Age: 70 years old, married
Diagnosis: Age Related Macular Degeneration

Chief Complaint: Had to stop driving

History: Ray is an active 70 year old man. He is in good general health. He was not a candidate for AMD treatment. Prior to his vision loss, Ray was very involved in driving his wife and other family members to social gatherings, on shopping trips and to appointments of all kinds. The progression of his AMD has caused him to have to stop driving, an occurrence that he said, "totally changed my life." Normally an outgoing person, Ray has become withdrawn.

LV Examination: Ray was tested using the ETDRS LogMAR distance chart at 1 meter and his visual acuity was measured to be 1M/40 OD, OS and OU (equivalent to 20/800). With the ETDRS near chart at 20cm, the predicted add for 1M print was +40D. He was not helped with any refractive correction. Amsler Grid testing revealed large central scotomas in each eye. His contrast sensitivity was tested using the Mars Letter Contrast Sensitivity chart, and found to be 0.48 OD, OS and OU (profound loss).

LV Recommendations: While driving is no longer possible, in discussion with the Low Vision clinician it was discovered that Ray would still be interested in performing routine car maintenance. He was shown two types of videomagnification (CCTV) systems. Ray discovered that he could view the markings on the tire gauge and other tools when magnified on the CCTV screen, with reverse polarity (white letters on a black background). He was also able to use the CCTV to read some of the maintenance manuals, although in some the print was too small. His adult son, who accompanied him to the examination, offered to photocopy those manuals to make the print larger. The ability to raise the contrast on the CCTV screen was also an advantage to Ray. He was also shown a 12X (+44D) illuminated stand magnifier for short term reading along with a reading stand.

Outcome: After receiving training in the use of the devices, Ray purchased a CCTV and set it up in his garage, where he now reviews maintenance manuals and performs routine maintenance. His son continues to photocopy any pages where the print is too small, in preparation for Ray to use his CCTV. He uses the illuminated stand magnifier less frequently than the CCTV, but likes to have it at his desk. His mood has improved considerably.

CASE STUDY #3

Patient: Marco, (male)

Age: 7 years old

Diagnosis: Congenital cataracts; prematurity

Chief complaint: Readiness for next grade in school

History: Marco was born prematurely and was diagnosed with congenital cataracts. However, he was unable to have timely cataract extractions due to other health issues and developed deprivation amblyopia. At his last low vision examination, one year ago, after discussion with Marco's parents, the clinician prescribed spectacles and introduced Marco to a 1.8x dome magnifier. Since he will begin first grade soon, his parents are concerned that the smaller text size will be difficult for Marco to read.

LV Examination: At this reexamination visit, Marco's uncorrected distance vision was first evaluated using LEA Symbols.

Results at Distance:

OD: 3/120 Manifest trial frame refraction: OD: -1.00-2.00x90 3/60

OS: 3/150 Manifest trial frame refraction: OS: -2.50-2.50x90 3/95

At near, Marco was tested using the LEA Symbols near vision card.

Results at Near:

OD: 6.3M/.40 (a Snellen equivalent of 20/250)

OS: 8M/.40 (a Snellen equivalent of 20/400)

Marco's contrast sensitivity was tested using the Mars Numeral Contrast Sensitivity test, since Marco was proficient in identifying numbers. He was found to have a moderate loss of Contrast Sensitivity in each eye: OD: 1.48 OS: 1.08.

LV Recommendations: Since many first grade beginning reading primers use text with a print size between 3.2M and 4M, Marco has to be able to see at least 1.6M size print in order to achieve comfortable reading of the larger size text. Note that this is not at the threshold of Marco's acuity because we know that reading continuous text will be more challenging than single symbols/letters. In order to go from 6.3M to 1.6M, Marco needed a four-fold improvement in his reading acuity to read the target print size comfortably. Several low vision devices that provided 4 times magnification (+16D) were tried. Marco read best with a +16D (4x) dome stand magnifier. He was able to read 3.2M LEA symbols easily and could spot 1.6M print with effort. Task lighting was important for Marco. A reading lamp with an adjustable arm and a 60 watt incandescent bulb was recommended and Marco and his parents were shown how to position the lamp. Marco's parents will discuss this with his teacher. A +20D illuminated hand magnifier was also prescribed for spotting smaller text with poor contrast or to use when Marco is in a poorly illuminated environment. An electronic, portable tablet is also a good option for Marco, especially as he gets older. Marco's parents will consider arranging for this to be a joint gift from several family members at Marco's upcoming birthday.

Outcome: Marco was able to enter first grade. He has been allowed to have a lamp on his desk at school. His parents' discussion with Marco's teacher led to the teacher showing Marco's magnifiers to his classmates. They now do not treat these items as 'weird' and sometimes ask Marco if they can borrow them. Marco will have special permission to use a tablet in class, should he receive one for his birthday.

In the case of children with low vision, research has also indicated that family-centered practice is critical to the success of early intervention. The family-centered approach is most effective when it addresses both the development of the child and the concerns and priorities of the family. Educators are also integral to the success of low vision interventions for many children. Information from teachers and their suggestions for the low vision care plan can enhance the effectiveness of that plan. Many low vision professionals find it helpful to share a written copy of the assessment results and the prescription for devices and skill development with parents and teachers where appropriate.



Fig. 23. Pediatric LV examination tools. Top to bottom: fixation cubes, eye patches, and pediatric Fun Frames occluding glasses

Chapter 3: Prescribing

Low Vision Devices

Low Vision devices are an important part of the vision rehabilitation solution for patients with impaired vision. Considerations in device prescription include:

1. The patient's distance/intermediate/near task objectives, as described/discussed with the patient during the history and the low vision exam;
2. The results of the tests of visual function;
3. The amount of magnification required for the target print size or object size, as determined during the low vision exam;
4. The optical properties of the device(s) being considered;
5. The patient's capabilities, economic concerns and preferences.

Unlike routine eyeglass prescriptions that can be made to help a patient for distance, intermediate and near, most low vision devices are task-specific. As a result, many patients with low vision are prescribed more than one device for their daily tasks. The optimal use of low vision lenses requires that patients hold the material to be viewed at the specific focal distance dictated by the power of the lens. Instruction in device use, task application and maintenance/care is essential to successful low vision care.

Magnification

Magnification is an essential tool in low vision care.

Options include:

- Relative Size Magnification — enlarging the actual size of an object;
- Relative Distance Magnification — Moving the object of regard closer to the eye so that a larger retinal image is created; and
- Angular Magnification — the ratio of the angle of subtense of the image formed by an optical instrument compared to the actual object.

Low vision optical devices can be grouped into the following categories:

- Spectacles
- Loupes
- Hand magnifiers
- Stand magnifiers
- Telescopes
- Electronic devices

- Filters

Most devices are stock items. Each category has distinct advantages and disadvantages.

Spectacles

The stock spectacles prescribed for low vision range from +4.00D to +80.00D. Low vision prism spectacles (full frame / half frame) are available in powers from +4.00D to +14.00D. Each has 2 diopters of base-in prism built in to facilitate binocular convergence at these higher powers: +4=6BI, +5=7BI, +6=8BI, +8=10BI, +10=12BI, +12=14BI, +14=16BI. Lens materials include plastic, glass and hi-index, and there are several frame styles available.

Higher power low vision spectacles are also available. These include high plus full field spectacles, microscopic aspheric spectacles and a range of higher power microscopic lenses, including microscopic doublet lenses. The standard high plus full field series comes in powers of +10.00D, +12.00D, +14.00D, +16.00D, +20.00D in full frame styles for monocular use. The microscopic aspheric series includes 6x (24D), 8x (32D), 10x (40D), 12x (48D), also to be used monocularly.

The advantages of low vision spectacles are that they are relatively lightweight, relatively cosmetically acceptable and inexpensive. Their main advantage is that they allow the patient's hands to be free. The disadvantages of low vision spectacles include the close working distance, the difficulty of maintaining focus, particularly in higher powers and for patients who may experience hand or head tremors, significant aberrations above +16D, and the fact that distance prescriptions cannot be incorporated into these stock lenses.

A number of other specialty microscopic spectacles can be prescribed for near work, including doublet lens systems, wide angle microscopes, hi add bifocals and press on adds. The highest power microscopes go up to +80.00D.



Fig. 24. Types of low vision spectacles in different frames

Loupes

Clip-on and headborne loupes are monocular or binocular magnifiers that attach to the patient's own glasses or are worn on the head. They allow the desired magnification with a more comfortable working distance. Flip-up styles allow the magnifying lenses to be moved up and out of the way when not needed. Hands-free use and working distance are the greatest advantages. Disadvantages include fragility of the loupe; difficulty of attaching the loupe to the glasses and cosmetic appearance.



Fig. 25. Spectacle mounted and headborne loupes

Hand Magnifiers

Many patients with low vision are prescribed hand held magnifiers. They are portable and familiar. With hand magnifiers, the material is held at the focal point of the lens and the image is at infinity. The patient must use his/her distance prescription with the magnifier.

When selecting a hand magnifier the clinician will consider the magnifier's optical design (spherical, aspheric / bi-aspheric, aplanatic doublet); illumination (non-illuminated / illuminated); illumination type (tungsten/LED); and the ergonomic needs of the patient (type of handle / type of pocket magnifier). Hand magnifiers are available in powers from +5.00D to +60.00D. The advantages of hand magnifiers include portability, the favorable eye-to-lens distance and the possibility of having illumination included in the magnifier. Disadvantages include the need to use one hand to hold the magnifier and the need for the patient to maintain the focal distance of the lens. Another disadvantage that patients note is the fact that lens diameter gets smaller as lens power increases.



Fig. 26. Non-illuminated and pocket hand magnifiers

Stand Magnifiers

Stand magnifiers provide a solution to the problem of maintaining the focal distance of the lens by fixing the lens into a stand that pre-sets the appropriate distance. The patient places the stand magnifier directly on the page, looks directly into the lens and moves the magnifier along the line to read. A reading prescription is used with the stand magnifier, because the material is inside the focal length of the lens. This creates a virtual image that is at a finite distance. An angled reading stand can create a more comfortable reading environment for the patient who uses a stand magnifier.

When selecting a stand magnifier the clinician will consider the power that the patient needs, applicability to the task, the required eye-to-lens distance and field of view, and whether the system will be illuminated or non-illuminated. Battery and plug-in styles are available, as well as tungsten, halogen, xenon and LED light sources. Like hand magnifiers, the size of the stand magnifier lens is inversely related to the power of the lens – a larger lens is a weaker lens. Low power stand magnifiers, such as dome magnifiers and bar magnifiers, are often useful for children.



Fig. 27. Dome, bar and illuminated stand magnifiers

Telescopes

Telescopes are the low vision device of choice for patients' distance needs, and some can also be used for near. They may be monocular or binocular, hand held or spectacle mounted, fixed focus or focusable. Galilean and Keplerian systems are used in low vision care. Galilean systems have a plus objective lens and a minus ocular lens. They are lighter weight and have a shorter barrel than Keplerian systems, and are available in lower powers (2X to 4X). Keplerian systems utilize plus lenses as the ocular and objective lenses, and use prisms or mirrors to invert the image. They are available in powers from 3X to 14X. The barrel of Keplerian telescopes is longer and they are comparatively heavier than corresponding powers that use Galilean design. The difference in the location of the exit pupil in both designs dictates the distance from the eye that the telescope must be held, and the ease or difficulty the patient may experience in centrally positioning the telescope.

Telescope power is determined with the following formula:

$$\text{Telescope Magnification} = \frac{\text{Diameter of Objective lens (mm)}}{\text{Diameter of Exit Pupil (mm)}}$$

The markings on the barrel of most hand held telescopes give the clinician or the user the telescope's magnification, the diameter of the objective lens in millimeters (which indicates the light-gathering ability of the telescope), and its field of view.

All telescopes share the following characteristics. They offer the advantages of magnification at a variety of distances, portability, applicability to distance and sometimes to near tasks and usefulness for spotting signs, bus numbers, etc. at distance. The disadvantages of telescopes include: the reduction of the field of view, more so as the power of the telescope increases; the loss of light and contrast for the patient when looking through the system; the potential difficulties of use for patients with central field loss and/or loss of contrast; and the need to learn to manipulate the telescope.



Fig. 28. Hand-held and spectacle mounted telescopes

When selecting a telescope for a patient with low vision, the clinician considers whether the patient has a stable or a progressive condition, the patient's task objectives, the level of acuity, visual field limitations (constriction/scotomas), magnification required, and the patient's age and motor abilities.

Filters

Filters (also known as absorptive lenses) are used to manage glare and to enhance contrast. They absorb/transmit light at different spectral frequencies and can be extremely helpful for use indoors and/or outdoors. Filters are available in full, wrap-around styles that block light entering from the front, sides and above. Some are sized to fit over the patient's spectacle prescription. Filters are also available in versatile flip-up and clip-on styles. Photochromic glass lenses can be made up as single vision lenses, bifocals or trifocals.



Fig. 29. Filters for adults and children

Electronic Devices

The advent of mainstream portable electronic devices that allow anyone to magnify, have text read aloud, control font size, color and contrast has brought about big changes. Low vision patients who use tablets, notepads, smartphones and the like are finally in the position to have the same tool as the general public can use. These devices are added to a wide range of videomagnification systems, called CCTVs, that date back to the early 1970s. CCTVs have improved significantly over the years, with technological advances helping to make them more portable, versatile, with smaller/larger screens, crisper displays and lower cost. Some features of currently available electronic devices include: Handheld cameras, color display options, headborne video displays, head mounted systems, miniature flat screens, self contained portable units, simplified controls and miniature LCD magnifiers, in addition to greatly enhanced desktop models.

Computer accessibility is also a valuable tool for patients with low vision. In addition to add-on programs that give access to computer navigation and resident software, many useful features are now standard – built into both Macs and PCs. These include the ability to magnify selected parts of the screen, or the entire screen, as well as speech output. Many of the larger monitors that are currently available now provide clear, enlarged images, helpful for some patients.



Fig. 30. Portable and desktop videomagnifiers

Understandably, high-tech electronic device development is an area that is constantly changing and improving. At this writing, ingenious tracking systems mounted on eyeglass frames are allowing users with vision impairment to see beyond their current ability and to identify items, colors, street signs and even faces.



Fig. 31. Portable mini videomagnifier

Adaptive Devices

To complete a survey of devices for low vision it is important to incorporate the range of other devices that are not optical but are enhancements that benefit patients of all ages and which, in some cases, will be critical to the successful use of optical devices. These include task lighting and illumination controls, writing devices (such as bold-tipped pens, letter/envelope/check writing guides, signature guides), positioning devices (such as reading stands or lap desks), contrast enhancement tools (such as yellow filters, contrasting paint/tape), and kitchen tools (such as cutting boards, measuring cups) that provide contrast with the ingredients for which they are routinely used. Some adaptive devices make use of relative size magnification (such as large numeral clocks, watches, timers, calculators). Other items help with medical issues (such as a recording/voice output device that will tell a patient what is in a particular medicine bottle, and tactile, self-adhesive dots to use as markers).



Fig. 32. Top to bottom: high-contrast measuring spoons, "talking" alarm clock, cordless task lights, large numeral calculator, writing guides

Using Technology with Older Adults who have Low Vision

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Current technology removes significant barriers for older adults with low vision, allowing them to engage in activities that would have been impossible just a few years ago. Another advantage is that electronic options are in the mainstream and don't stigmatize the user with low vision. For example, despite their small screens and keypads, several features built into smart phones and tablets make them easily accessible to users who are blind or visually impaired. Leading the industry are Apple products that provide greater accessibility to users with vision loss through their VoiceOver and Zoom programs.

VoiceOver is a screen reader that uses text-to-speech to read aloud what is onscreen, confirm selections, typed letters and commands, and provide keyboard shortcuts to make application and web page navigation easier.

The Zoom app magnifies everything onscreen from two to five times its original size, while maintaining their original clarity.

An additional option that increases accessibility is the 'Large Text' option that allows the user to select a larger font size (20-56 point) for any text appearing on their device.

Many individuals with vision loss see better with the high contrast setting of white on black. Reversing the polarity is often the only change needed to allow an individual with a visual impairment to easily read on their phone or tablet.

Finally, for drivers with vision loss who are still eligible for drivers' licenses, talking GPS technology allows drivers to maintain their attention on the road and the traffic around them when traveling in unfamiliar environments.



North Star Vision Group, LLC's Low Vision Devices Chart™

Type of Device	Characteristics	Prescribing Considerations	Advantages	Disadvantages
Spectacles	Stock LV spectacles Powers range from +4.00D to +80.00D Four types: 1. LV prismatic spectacles (full frame / half frame) available in powers from +4.00D to +14.00D 2 diopters of base-in prism in to each lens facilitates binocular convergence: +4=6BI, +5=7BI, +6=8BI, +8=10BI, +10=12BI, +12=14BI Lens materials include plastic, glass and hi-index Variety of frame styles 2. Full field high plus spectacles come in powers of +10.00D, +12.00D, +14.00D, +16.00D, +20.00D in full frame styles for monocular use 3. Microscopic aspheric spectacles The series includes 6x (24D), 8x (32D), 10x (40D), 12x (48D), for monocular use 4. Specialty microscopic spectacles for near work, including doublet lens systems, wide angle microscopes, hi add bifocals and press-on adds	Consider whether It is too difficult for the patient to maintain focus, particularly in higher powers Watch for patients who may not be good users because they experience hand or head tremors or have difficulty maintaining the focal distance	Relatively light weight Relatively cosmetically acceptable Inexpensive Patient's hands are free	Close working distance Difficulty maintaining focus, particularly in higher powers Significant aberrations above +16 diopters Distance prescriptions cannot be incorporated into the stock lenses Difficulty maintaining focus, particularly in the higher powers
Loupes	Clip-on and headborne loupes are monocular or binocular magnifiers that attach to patient's own glasses or are worn on the head. Powers from +1.00D to +10.00D	Consider whether it is too difficult for the patient to attach the loupe to the his/her glasses The LV doctor and/or the instructor should work with the patient to be sure he/she can manipulate the loupe	More comfortable working distance than spectacles Flip-up styles allow the magnifying lenses to be moved up and out of the way when not needed Patients' hands are free	Fragility of the loupe Difficulty of attaching the loupe to the glasses Cosmetic appearance
Hand Magnifiers	Hand magnifiers are available in powers from +5.00D to +60.00D Material is held at the focal point of the lens and the image is at infinity	Consider the magnifier's optical design (spherical, aspheric / bi-aspheric, aplanatic doublet); illumination (non-illuminated / illuminated; illumination type: tungsten/LED); and the ergonomic needs of the patient (type of handle / type of pocket magnifier) The patient must use his/her distance Rx with the magnifier	Familiar Portable Favorable eye-to-lens distance Possibility of having illumination in the magnifier	Need to use one hand to hold the magnifier The patient must maintain the focal distance of the lens Lens diameter gets smaller as lens power increases Field of view gets smaller as lens power increases Size of the stand magnifier lens is inversely related to the power of the lens – a larger lens is a weaker lens

Type of Device	Characteristics	Prescribing Considerations	Advantages	Disadvantages
Stand Magnifiers	Stand magnifiers have a fixed focal distance provided by the stand. Powers range from +1.50D to +76.00D Patient places stand magnifier directly on page, looks directly into lens and moves magnifier along the line to read Battery and plug-in styles are available, as well as tungsten, halogen, xenon and LED light sources	Consider the power that the patient needs, applicability to the task, the required eye-to-lens distance and field of view, and whether the system will be illuminated or non-illuminated Consider magnifier shape Consider ease of changing batteries/bulbs, if necessary, in illuminated styles The patient must use his/her reading (near) Rx with the stand magnifier	Patient does not have to maintain the focal distance of the lens since it is fixed by the stand Low power stand magnifiers, such as dome magnifiers and bar magnifiers, are often useful for children Portable, although some styles can be cumbersome	Lens diameter gets smaller as lens power increases Field of view gets smaller as lens power increases Size of the stand magnifier lens is inversely related to the power of the lens – a larger lens is a weaker lens Posture can become an issue if patient hunches over stand magnifier to use it. An angled reading stand can create a more comfortable reading environment for the patient
Telescopes	Telescopes are the LV device of choice for patients' distance needs; some can also be used at near Telescopes may be: • monocular or binocular • hand held or spectacle mounted • fixed focus or focusable Galilean and Keplerian systems are used in low vision care. Must be used while stationary Powers from 2X – 14X	Consider whether the patient has a stable or a progressive condition, his/her task objectives, the level of acuity, visual field limitations (constriction/scotomas), amount of magnification required, the patient's age and motor abilities	Provides magnification at a variety of distances Portable Can be mounted in a spectacle frame in the upper (biopic) position for seeing at distance Can be mounted in the central (full field) position for seeing at intermediate or distance Can be mounted in the lower (reading) position for seeing at near Useful for spotting street signs, bus numbers, etc. at distance, for reading music and other intermediate tasks, or for near/reading tasks	Reduction of the field of view, moreso as the power of the telescope increases Loss of light and contrast for the patient when looking through the system Potential difficulties of use for patients with central field loss and/or loss of contrast sensitivity Need to learn to manipulate the telescope Patients cannot walk around while looking through the telescope
Filters (absorptive lenses)	Filters absorb/transmit light at different spectral frequencies. Full, wrap-around styles block light entering from the front, sides and above Some are sized to fit over the patient's spectacle Rx Also available in flip-up and clip-on style. Photochromic glass lenses can be made up as single vision lenses, bifocals or trifocals	Consider whether the filter is to be used to manage glare or to enhance contrast, or both Can be extremely helpful for use indoors and/or outdoors Subjective choice is made by patient with guidance from clinician	Wide range of tints/colors Lightweight Different ways to use – clipped onto glasses, slipped behind glasses, or fit over glasses Effective at blocking glare and/or enhancing contrast	Durability Not scratch-resistant
Electronic Devices	Tablets Notepads Smartphones Small recording devices A wide range of videomagnification systems, called CCTVs that: • Magnify • Read text aloud • Control font size, color, contrast	Mainstream, portable electronic devices allow low vision patients to have the same tools as the general public uses	High contrast, ability to adjust many parameters important for best vision (contrast, brightness, background color, text color, font size) Speech output capability	Cost In some cases, weight and portability

Type of Device	Characteristics	Prescribing Considerations	Advantages	Disadvantages
Adaptive Devices	Include: Task lighting, illumination control, writing devices (i.e., bold-tipped pens, letter/envelop/check writing guides, signature guides, "talking" devices) Positioning devices (i.e., reading stands or lap desks) Contrast enhancement tools (i.e., yellow filters, contrasting paint/tape) Kitchen tools (i.e., cutting boards, measuring cups) that provide contrast with the ingredients for which they are routinely used. Medical issues (i.e. "talking" recording/voice output device records/stores info about each medicine bottle) Tactile, self-adhesive dots to use as markers Some adaptive devices make use of relative size magnification (i.e., large numeral clocks, watches, timers, calculators)	Consider use with standard low vision devices, such as reading stands with stand magnifiers Consider for communication enhancement such as writing guides, computer keyboard self-adhesive large print letters/numbers	Enhancements benefit patients of all ages and which, in some cases, will be critical to the successful use of optical devices	Knowledge of where to acquire adaptive equipment

Fig. 33. North Star Vision Group, LLC's Low Vision Devices Chart™ Copyright © 2013 by North Star Vision Group, LLCSM Used under license from North Star Vision Group, LLCSM

Vision Rehabilitation: Who, What, When, How, Where

In order for the patient to have a successful outcome, the provider of low vision care must consider to the original reasons that brought the patient to him or her. Low vision devices may not be the solution to the patient's needs or they may only be a partial solution. Many times, the missing component to enable the patient to participate in family, career, and community life is vision rehabilitation.

Vision rehabilitation is the term used for the training and counseling services that help a person with vision impairment to develop the skills and strategies needed to accomplish his or her own goals. It can help the patient to make the best use of existing sight and to use other senses more effectively to carry out daily tasks efficiently and safely. It can help the patient to do the things that originally brought him or her for professional help. And, it may even open up possibilities for doing things that patients did not think they would be able to do.

The role of the low vision clinician and staff is twofold: to make patients aware of what rehabilitation is and what it might do for them, and to help patients to connect to available vision rehabilitation services. For some vision specialists the challenge might be greater. They may find that vision rehabilitation services don't exist or are underdeveloped in their area. In this case, the vision specialist might locate other professionals in the community, such as occupational therapists, orientation and mobility specialists or special educators, who might assist the patient. Or, the vision

professional may decide to enhance his or her own practice by hiring or training someone to provide vision rehabilitation services. Vision rehabilitation services are generally provided by a team of professionals.

The titles of team members are different in different regions of the world and sometimes their roles are combined. Regardless of where they are or what they are called, however, their roles are important.

Low Vision Doctor - The low vision doctor assesses usable vision and prescribes low vision devices. The low vision doctor has another extremely important role. The low vision doctor is the gateway to the other team members.

Low Vision Therapist - The low vision therapist performs functional vision assessments (after clinical low vision examinations), teaches the use of functional vision, introduces non-optical devices, and provides instruction in the use of prescribed optical devices. This team member ensures that the patient and, perhaps family members, know how to use the devices properly to accomplish the specific tasks that the patient wants to carry out.

Orientation and Mobility Specialist - Orientation and mobility (O&M) specialists teach the patient to move and travel safely at home or outside the home. They teach the patient to use remaining vision and other senses, and, if needed, to use a sighted human guide, a cane, or dog guide.

Vision Rehabilitation Therapist - Vision Rehabilitation Therapists focus on adaptive living and communications skills.

They can teach the patient techniques such as safe new ways to prepare food, operate a stove, carry out personal grooming tasks, use a telephone, and manage medications and money. Making sure that the home is a safe environment is usually an area of great concern, especially for family members and friends. Adaptive home safety techniques developed as part of a vision rehabilitation plan can benefit everyone.

Vision Rehabilitation Assistant (Paraprofessional) - The team might also include a Vision Rehabilitation Assistant (VRA) who is a paraprofessional who works under the supervision of a Vision Rehabilitation Therapist or Orientation & Mobility Specialist to carry out the plan developed by the certified professional. The VRA helps the patient to apply and practice adaptive living, communication, and in-home orientation and mobility skills.

Occupational Therapist - The Occupational Therapist (OT) helps individuals achieve independence in many facets of their lives. Services typically include:

- Customized treatment programs to improve the patient's ability to perform daily activities;
- Comprehensive home and job site evaluations with adaptation recommendations;
- Performance skills assessments and treatment;
- Adaptive equipment recommendations and usage training;
- Guidance to family members and caregivers.

Counselor - Counselors may also be part of the vision rehabilitation team. Social workers or psychologists can help the patient to deal with the sadness and other feelings associated with the loss of sight. They can also help family and friends to understand the situation and to be supportive of the person with impaired vision. Sometimes support groups can be established to enable people with impaired vision to assist each other. Career counselors may also help patients to develop skills and strategies for keeping their current job or for preparing for a new career.

Optician - In many cases, the optician will play a role in enabling the person with low vision to function effectively. Accurate preparation of lens prescriptions, careful fitting of frames, and training in the use of prescribed optical and non-optical devices facilitate patient performance and satisfaction.

Adaptive Technology Specialist. As computers and other technology find their way into every area of life, the adaptive technology specialist assumes a larger role in the vision rehabilitation team. Computers have changed the world for people with impaired vision. With training, they can learn the latest technologies to access the Internet as well as E-mail and other online services.

All the members of the low vision rehabilitation team can provide multiple, coordinated interventions to assist a person with low vision to function more effectively.

Engaging Adults in Vision Rehabilitation

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Reading is a fantastic leisure activity. Adults who lose vision later in life lament the loss of the tranquility and adventure they once got from reading. I encourage older adults who have large central scotomas or constricted visual fields to pursue the skills needed for reading by explaining the mechanics of reading to them – demystifying eye movement, visual spans, letter and word recognition.

It has worked wonders! With a clear understanding of the problem and the solution, most persevere. It's so important for people to understand that practice is key: reading a large print book while learning to use eccentric viewing or taking time to develop fluency using high power prismatic half frame spectacles will be worthwhile.

Chapter 4: Integrating Low Vision Into the Care You Offer

Adding low vision care to a practice takes some planning. The four most significant considerations are: space, equipment, staff and patients.



Fig. 34A. Low vision examination room

Space

Since most low vision testing at distance is done at 4 meters (13 feet) or less, a standard eye care lane is often more than adequate for low vision care. Distance charts in a rolling, illuminated cabinet let the examiner adjust the test distance as needed. It is helpful, though not mandatory, to have a separate room that can be used for the part of the low vision process that involves training the patient to use low vision devices, and for patient/family education. Two rooms also allow the person who is doing instruction to work with a new or a follow-up patient in the instruction room while the clinician goes on to examine the next patient in the examining room. The low vision devices (discussed below) should be kept in a locked cabinet or closet in the examining room, so that they are safe and easily accessible to the clinician. An additional set of devices may be kept in the instruction room, so that the instructor does not have to interrupt the clinician during a low vision exam. Many people find it helpful to organize and store the devices by category: Spectacles, loupes,



Fig. 34B. Low vision examination room

hand magnifiers, stand magnifiers, telescopes, absorptive lenses/filters.

Try to envision your practice setting through the eyes of a patient with low vision. (Vision simulator glasses can help with this.) Is there adequate contrast between walls and floor? Are doorways clearly visible? Does furniture stand out or blend into the background? Is there adequate, adjustable lighting and bold-tipped pens in places where patients will need to read or sign forms?

Equipment

Standard eye care equipment such as trial lenses, a trial frame, retinoscope, ophthalmoscope, transilluminator, occluders are useful in the low vision examination, as well. As noted earlier, trial frame refraction is the most adaptable to the eccentric viewing needs of many patients with low vision, however a phoropter or an autorefractor may also be of use in some cases.

Other equipment is specific to low vision practice, including charts, low vision optical devices, non-optical devices, filters and some electronic devices. In many cases there is a range of prices for these items which come from different suppliers. Consider the possibility of having low vision devices in the examining room, in the instruction room and others available for sale to patients from a dispensary.

Following is a list of the generic equipment that would be helpful to have in an intermediate level low vision practice. Items noted with an asterisk (*) should also be considered for the instruction room in addition to local newspapers, utility bills and hobby-related items.

Testing Materials/Charts

- Single letter/number LogMAR distance Chart
- Single letter/number LogMAR near card*
- Single word/number pocket card*
- Continuous text – Adults/Children
- Contrast chart (letters, numbers or both)
- Amsler Grid
- Chart Illuminator (LED)
- Chart Illuminator Stand on Wheels

Tests For Children

- LEA Single Symbols Pocket Card*
- LEA Grating Paddles
- LEA Symbols Near Chart*
- HOTV Near Chart
- LEA Symbols Single Symbol Book
- LEA Symbols Distance Test
- HOTV Distance Chart
- LEA Symbols Contrast Screener
- Hiding Heidi Contrast Test

Chapter 4

Optical Devices (Stock Items)

Spectacles (Base in prism)

- +5=7biOU*
- +6=8biOU*
- +8=10biOU*
- +10=12biOU*

Spectacles (Aspheric High Plus)

- +12D OU*
- +16D OU*
- +20D OU*

Spectacles (Aspheric Microscopes)

- 6X OU*
- 8X OU*
- 10X OU*

Loupes

- +4D binocular*
- +6D monocular*
- +10D monocular*

Hand Magnifiers (Non-illuminated)

- +5D*
- +7D*
- +9D*
- +12D*
- +16D*
- +20D*

Hand Magnifiers (Illuminated)

- +16D*
- +24D*

Stand Magnifiers (Non-illuminated)

- +3.5D*
- +8D*
- +12D*
- +16D/4X Dome magnifiers*
- +17.6D*
- +20D*

Stand Magnifiers (Illuminated)

- +12D*
- +20D*
- +28D*

Telescopes

- 2.5X hand held*
- 2X binocular*
- 4x12 hand held*
- 6x16 hand held*

Filters/Absorptive Lenses (Small & Large Sizes)

- Grey (light, medium, dark)*
- Plum (light, medium, dark)*
- Yellow*
- Amber (medium)*
- Baby frames

Electronic

- iPad or other tablet*
- CCTV Color/B&W*
- Hand held electronic magnifier
- Laptop*/Desktop with standard accessibility features
- Smartphone
- Apps such as: TapTapSee, Seeing AI, AccessNote, ColorID, Aipoly Vision, etc

Non Optical Devices

- Large print*
- Reading stand/Lap desk*
- Reading/Writing/Signature Guides*
- Writing tools - bold tip pens*
- Daily living products (i.e. household items, clocks, watches)*

Patient/Family Education Materials

- Pamphlets about Low Vision/Eye Diseases*
- DVDs: Leo Learns by Doing*
- Vision Simulators*

Staff

As the prior section noted, the people who are involved in the delivery of low vision care worldwide have diverse titles and backgrounds. Rather than limiting the staff to particular professionals it is helpful to consider the constellation of services a patient with low vision is likely to need, and to think about who has (or could develop) the necessary skills. Remember that all service providers need not be under the same roof.

The low vision examination should be conducted by someone who is legally permitted to examine and prescribe the full range of low vision devices, including spectacles. This is most often an ophthalmologist or optometrist who has additional training in low vision care. While the low vision doctor can instruct patients to use low vision devices, when possible, it is helpful to have a different professional teach the patient and monitor progress. Depending on the instructor's qualifications, he/she may also teach daily living skills and/or orientation and mobility techniques, as needed. Opticians may become involved as dispensers of low vision devices and/or in device use training. Counseling for adjustment to vision loss, family interaction, depression or other emotional issues may be provided by a psychologist, social worker or other counselor, when necessary. Special educators may be drawn into the provider group when the patient is a child, along with speech, mobility, physical therapy and occupational therapy professionals.

Patients

Worldwide, few private practices are established exclusively for the purpose of seeing low vision patients. It is far more common for low vision care to be one facet of an eye care practice, whether it is a solo-, group-, community- or hospital-based practice. Colleges of optometry and non-profit organizations are also sites where low vision services may be offered. The prevalence of low vision problems among elderly people -- a population that may accept disability as a natural part of aging -- reduces the motivation to seek care for some. Despite this, available services do not meet the current need, and fall far short of the demand this growing demographic will continue to have. Many patients report lack of knowledge of vision rehabilitation services as a significant barrier to getting help (<http://www.lighthouse.org/research/statistics-on-vision-impairment/vision-rehabilitation-service-utilization/>).

How do patients learn about the services available? One way is by making sure that colleagues and practitioners who are in the same city but do not themselves offer low vision care have the information they need to make appropriate referrals of their patients for these necessary, specialized services. It is important to remember that even well-meaning colleagues may not fully appreciate what goes into low vision care, how helpful the intervention can be, who is a candidate and when to refer a patient. Providing this information to practitioners can boost referrals, as well as sending informative reports to colleagues on the results of their patients' low vision visits. Providing information to target populations, such as parents or older adults, via newsletters, local newspapers, blogs, webinars and radio programs also encourages service utilization.

Conclusion

The estimated 253 million people worldwide who have impaired vision are at risk. Vision impairment affects every aspect of a person's life at home, at work and in the community. It can result in depression, withdrawal, educational delays and issues, and underemployment. Eye care professionals, occupational therapists, orthoptists and others are in a unique position to intervene.

The WHO reports that it is estimated that the number of people with vision impairment could triple due to population growth and ageing between 2020 and 2050.

Low vision care and vision rehabilitation are indispensable in helping people with impaired vision improve their ability to function and to manage daily tasks. Rather than the time consuming, expensive, labor-intensive specialty that low vision care was thought to be in the past, today there are efficient, evidence-based tools, streamlined examination procedures and high quality, available and affordable optical, non-optical and electronic equipment that make low vision care far more accessible to

clinicians and patients. In those situations where a multidisciplinary team is not available under one roof, the use of community-based providers still makes it possible to have the kind of multidisciplinary team that is necessary for low vision care and vision rehabilitation.

The low vision examination of the adult and of the child detailed in this booklet are formal, replicable procedures. They differ from routine eye examinations in that there is a far greater emphasis on tasks, adaptation and improvement of function in low vision care. The availability of testing materials and equipment specific to the low vision evaluation of young children, older children and adults make possible and straightforward the assessment of near and distance vision, contrast sensitivity, binocularity, central and peripheral visual fields.

Prescribing low vision devices is a critical function and is based on examination results. Optical devices in the form of spectacles, loupes, hand held magnifiers, stand magnifiers and telescopes enhance the ability of people with low vision to function in their daily lives. The proliferation of electronic devices offers patients of all ages new and acceptable alternatives. All patients benefit from instruction in the use of any prescribed low vision devices. It is important to remember that low vision devices alone are not necessarily the answer for many patients. Vision rehabilitation in the form of instruction in daily living skills, communication skills, orientation and mobility (safe travel) skills, and psychological counseling often complete the circle of necessary services for the person with low vision. Counseling is also helpful for spouses, families and friends, who may be affected in ways nearly as profound as the effect on the individual.

The techniques and tools outlined in this booklet help practitioners to provide needed care for patients with vision loss. Appropriate low vision care and vision rehabilitation increase the possibility for people with low vision to function more effectively in the home, at work, at school and in the community at large.

Brief Glossary of Terms

Age-Related Macular Degeneration (AMD)

A progressive deterioration of the macula lutea, the central, posterior portion of the retina responsible for central, high resolution detail vision. AMD is a major cause of legal blindness worldwide, and the leading cause of vision loss in adults over 50 years of age in many developed countries.

Amblyopia

A reduction in the quality of central, corrected vision resulting from a disturbance in retinal image formation during the first decade of human life. It can also be called 'lazy eye'.

Amsler Grid

A suprathreshold target used to assess the central 20° of the macula. The grid contains horizontal and vertical white lines presented on a black background. The grid is sometimes presented with red lines, designed to enhance the sensitivity of the test.

Astigmatism

A vision condition that causes blurred vision due either to the irregular shape of the cornea or to the curvature of the crystalline lens.

Cataract

A clouding of the eye's naturally clear crystalline lens, associated with aging, injury, inherited genetic disorders, medical conditions such as diabetes, past eye surgery and long-term use of steroid medication.

Coloboma

An abnormality that occurs before birth, characterized by missing pieces of tissue, or a hole, in one of the structures of the eye, such as the iris, retina, choroid or optic disc.

Color Vision Deficiency (CVD)

The inability to perceive certain colors in their true or "natural" representations that results in confusion for the patient. CVD is mostly congenital, but can also be acquired.

Contrast Sensitivity

The ability of the eye to perceive the difference in luminance and/or color of an object (or its representation in an image or display) from its background. There is evidence that it is a predictor of real-world performance.

Glaucoma

A term describing a group of ocular disorders with multi-factorial etiology united by a clinically characteristic intraocular pressure-associated optic neuropathy. If untreated, glaucoma can lead to progressive, permanent vision loss and blindness.

Iridectomy

Surgical removal of part of the iris of the eye, most often performed to restore drainage of the aqueous humor in glaucoma or to remove a foreign body or malignant tumor.

Miosis

Constriction of the pupil of the eye, caused by certain drugs or pathological conditions OR resulting from a normal response to an increase in light.

Mydriasis

Dilation of the pupil due to a physiological papillary response or non-physiological causes such as disease, trauma or the use of drugs.

Optic Atrophy

The loss of some or all of the fibers of the optic nerve and the end result of any disease that damages nerve cells anywhere between the retinal ganglion cells and the lateral geniculate body (anterior visual system). Also called optic neuropathy.

Phoropter

An instrument commonly used during an eye examination, containing different lenses used to measure an individual's refractive error and determine eyeglass prescription.

Retinitis Pigmentosa (RP)

A group of inherited, degenerative eye diseases that cause retinal degeneration and lead to severe vision impairment and blindness. Forms of RP and related diseases include Usher syndrome, Leber's congenital amaurosis, rod-cone disease, Bardet-Biedl syndrome, and Refsum disease, among others.

Retinoblastoma

A rapidly developing cancer that develops from the immature cells of the retina and is the most common malignant tumor of the eye in children.

Diabetic Retinopathy

Damage to the retina caused by complications of the systemic disease of diabetes.

Strabismus

A visual defect in which one eye cannot focus with the other because of unequal alignment of the eyes due to muscular imbalance. Also known as squint, heteropia, cross-eye and wall-eye.

Visual Acuity

Sharpness or clarity of vision, measurable with a variety of standardized tests. Visual acuity is dependent on the sharpness of the retinal focus within the eye and the interpretive faculty of the brain.

Visual Field

The total area (above, below and to the sides) in which objects can be seen while the eyes are focused on a central point. The normal human visual field extends to approximately 60° nasally (toward the nose, or inward) from the vertical meridian in each eye, to 100° temporally (away from the nose, or outwards) from the vertical meridian, and approximately 60° above and 75° below the horizontal meridian.

List of Illustrations and Credits

Fig. 1. Categories of severity of visual Impairment according to the International Statistical Classification of Diseases

Fig. 2. Estimates of low vision and blindness in WHO subregion. North Star Vision Group based on WHO 844 Bulletin

Fig. 3. Comorbidity effects in older adults. North Star Vision Group based on Journal of the American Geriatric Society, Oct, 2011

Fig. 4. Distance chart in movable illuminator stand, Good-Lite

Fig. 5. Radical retinoscopy, Richmond Products

Fig. 6. Near vision test cards with cord, Good-Lite

Fig. 7. Amsler grid with recording form, Richmond Products

Fig. 8. Contrast sensitivity tests, Good-Lite

Fig. 9. Panel 16 quantitative color vision test, Good-Lite

Fig. 10. Distance chart with glare lights, Good-Lite

Fig. 11A. LEA GRATINGS, a preferential looking test (front and back), Good-Lite

Fig. 11B. LEA GRATINGS, a preferential looking test in use, Good-Lite

Fig. 12. Optokinetic (OKN) drums, Richmond Products

Fig. 13. LEA Single Symbol book, Good-Lite

Fig. 14. LEA Puzzle, Good-Lite

Fig. 15. LEA Numbers low vision book, Richmond Products

Fig. 16. Continuous text chart, Optelec

Fig. 17. HOTV Near and Distance Charts, Good-Lite

Fig. 18A. LEA Flicher Wand, Good-Lite

Fig. 18B. LEA Flicker Wand in use, Good-Lite

Fig. 19. Color vision screening and testing, Good-Lite and Richmond Products

Fig. 20A. Hiding Heidi contrast sensitivity test, Good-Lite

Fig. 20B. Hiding Heidi contrast sensitivity test, in use, Good-Lite

Fig. 21. PowerDome dome magnifier, Optelec

Fig. 22. North Star Vision Group, LLC's Low Vision Exam Flow Chart, North Star Vision Group

Fig. 23. Pediatric LV examination tools, Good-Lite

Fig. 24. Types of low vision spectacles in different frames, Optelec

Fig. 25. Spectacle mounted and headborne loupes, Optelec

Fig. 26. Non-illuminated and pocket hand magnifiers, Schweizer

Fig. 27. Dome, bar and illuminated stand magnifiers, Schweizer

Fig. 28. Hand-held and spectacle mounted telescopes, Optelec

Fig. 29. Filters for adults and children, Optelec

Fig. 30. Portable and desktop videomagnifiers, Optelec

Fig. 31. Portable mini videomagnifier, Optelec

Fig. 32. Non-optical adaptive devices, Optelec

Fig. 33. North Star Vision Group, LLC's Low Vision Devices Chart™, North Star Vision Group

Fig. 34A. Low vision examination room, North Star Vision Group

Fig. 34B Low vision examination room, North Star Vision Group

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