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OF OPHTHALMOLOGY®

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Vision Rehabilitation Preferred Practice Pattern®

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VISION REHABILITATION PREFERRED PRACTICE PATTERN® DEVELOPMENT PROCESS AND PARTICIPANTS

The **Vision Rehabilitation Committee** members wrote the Vision Rehabilitation Preferred Practice Pattern guidelines (PPP). The Committee members discussed and reviewed successive drafts of the document by e-mail to develop a consensus over the final version of the document.

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The **Preferred Practice Patterns Committee** members reviewed and discussed the document during a meeting in June 2022. The document was edited in response to the discussion and comments.

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The Vision Rehabilitation PPP was then sent for review to additional internal and external groups and individuals in July 2022. All those returning comments were required to provide disclosure of relevant relationships with industry to have their comments considered (indicated with an asterisk below). Members of the Vision Rehabilitation Committee reviewed and discussed these comments and determined revisions to the document.

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In compliance with the Council of Medical Specialty Societies' Code for Interactions with Companies (available at <https://cmss.org/code-for-interactions-with-companies/>) relevant relationships with industry are listed. The Academy has Relationship with Industry Procedures to comply with the Code (available at www.aaopt.org/about-preferred-practice-patterns). A majority (80%) of the members of the Vision Rehabilitation Committee had no financial relationship to disclose.

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The disclosures of relevant relationships to industry of other reviewers of the document from January to October 2022 are available online at www.aaopt.org/ppp.

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OBJECTIVES OF PREFERRED PRACTICE PATTERN® GUIDELINES

As a service to its members and the public, the American Academy of Ophthalmology has developed a series of Preferred Practice Pattern guidelines that **identify characteristics and components of quality eye care**. Appendix 1 describes the core criteria of quality eye care.

The Preferred Practice Pattern guidelines are based on the best available scientific data as interpreted by panels of knowledgeable health professionals. In some instances, such as when results of carefully conducted clinical trials are available, the data are particularly persuasive and provide clear guidance. In other instances, the panels have to rely on their collective judgment and evaluation of available evidence.

These documents provide guidance for the pattern of practice, not for the care of a particular individual. While they should generally meet the needs of most patients, they cannot possibly best meet the needs of all patients. Adherence to these PPPs will not ensure a successful outcome in every situation. These practice patterns should not be deemed inclusive of all proper methods of care or exclusive of other methods of care reasonably directed at obtaining the best results. It may be necessary to approach different patients' needs in different ways. The physician must make the ultimate judgment about the propriety of the care of a particular patient in light of all of the circumstances presented by that patient. The American Academy of Ophthalmology is available to assist members in resolving ethical dilemmas that arise in the course of ophthalmic practice.

Preferred Practice Pattern guidelines are not medical standards to be adhered to in all individual situations. The Academy specifically disclaims any and all liability for injury or other damages of any kind, from negligence or otherwise, for any and all claims that may arise out of the use of any recommendations or other information contained herein.

References to certain drugs, instruments, and other products are made for illustrative purposes only and are not intended to constitute an endorsement of such. Such material may include information on applications that are not considered community standard, that reflect indications not included in approved U.S. Food and Drug Administration (FDA) labeling, or that are approved for use only in restricted research settings. The FDA has stated that it is the responsibility of the physician to determine the FDA status of each drug or device he or she wishes to use, and to use them with appropriate patient consent in compliance with applicable law.

Innovation in medicine is essential to ensure the future health of the American public, and the Academy encourages the development of new diagnostic and therapeutic methods that will improve eye care. It is essential to recognize that true medical excellence is achieved only when the patients' needs are the foremost consideration.

All Preferred Practice Pattern guidelines are reviewed by their parent panel annually or earlier if developments warrant and updated accordingly. To ensure that all PPPs are current, each is valid for 5 years from the approved by date unless superseded by a revision. Preferred Practice Pattern guidelines are funded by the Academy without commercial support. Authors and reviewers of PPPs are volunteers and do not receive any financial compensation for their contributions to the documents. The PPPs are externally reviewed by experts and stakeholders, including consumer representatives, before publication. The PPPs are developed in compliance with the Council of Medical Specialty Societies' Code for Interactions with Companies. The Academy has Relationship with Industry Procedures (available at www.aaopt.org/about-preferred-practice-patterns) to comply with the Code.

Appendix 2 contains the International Statistical Classification of Diseases and Related Health Problems (ICD) codes for the entities that this PPP covers. The intended users of the Vision Rehabilitation PPP are ophthalmologists.

METHODS AND KEY TO RATINGS

Preferred Practice Pattern guidelines should be clinically relevant and specific enough to provide useful information to practitioners. Where evidence exists to support a recommendation for care, the recommendation should be given an explicit rating that shows the strength of evidence. To accomplish these aims, methods from the Scottish Intercollegiate Guideline Network¹ (SIGN) and the Grading of Recommendations Assessment, Development and Evaluation² (GRADE) group are used. GRADE is a systematic approach to grading the strength of the total body of evidence that is available to support recommendations on a specific clinical management issue. Organizations that have adopted GRADE include SIGN, the World Health Organization, the Agency for Healthcare Research and Policy, and the American College of Physicians.³

- ◆ All studies used to form a recommendation for care are graded for strength of evidence individually, and that grade is listed with the study citation.
- ◆ To rate individual studies, a scale based on SIGN¹ is used. The definitions and levels of evidence to rate individual studies are as follows:

I++	High-quality meta-analyses, systematic reviews of randomized controlled trials (RCTs), or RCTs with a very low risk of bias
I+	Well-conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
I-	Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias
II++	High-quality systematic reviews of case-control or cohort studies High-quality case-control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal
II+	Well-conducted case-control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
II-	Case-control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
III	Nonanalytic studies (e.g., case reports, case series)

- ◆ Recommendations for care are formed based on the body of the evidence. The body of evidence quality ratings are defined by GRADE² as follows:

Good quality	Further research is very unlikely to change our confidence in the estimate of effect
Moderate quality	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate
Insufficient quality	Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate Any estimate of effect is very uncertain

- ◆ Key recommendations for care are defined by GRADE² as follows:

Strong recommendation	Used when the desirable effects of an intervention clearly outweigh the undesirable effects or clearly do not
Discretionary recommendation	Used when the trade-offs are less certain—either because of low-quality evidence or because evidence suggests that desirable and undesirable effects are closely balanced

- ◆ The Highlighted Findings and Recommendations for Care section lists points determined by the PPP Panel to be of particular importance to vision and quality of life outcomes.
- ◆ All recommendations for care in this PPP were rated using the system described above. Ratings are embedded throughout the PPP main text in italics.
- ◆ Literature searches to update the PPP were undertaken in July 2021 in the PubMed and Cochrane databases. Complete details of the literature searches are available in Appendix 7.

HIGHLIGHTED FINDINGS & RECOMMENDATIONS FOR CARE

Ophthalmologists are encouraged to provide information about rehabilitation resources to patients who have vision loss. Vision rehabilitation is not reserved for patients with advanced vision loss or severe loss of visual acuity. Even early or moderate vision loss may result in disability, which can affect visual performance, cause anxiety, interfere with safety and everyday activities, and diminish quality of life.

Ophthalmologists who subspecialize in providing vision rehabilitation should aim to optimize patients' reading, daily living activities, safety, participation in their community, and psychosocial well-being despite vision loss. Vision rehabilitation should not only include device recommendations but also address the broader impact of vision loss on patients' lives.

Keys to successful vision rehabilitation are the ability to empathize, communicate with sensitivity, and convey hope to patients with vision loss.

INTRODUCTION

MULTIDISCIPLINARY VISION REHABILITATION

Vision rehabilitation is part of the continuum of eye care that extends from promotion and prevention to diagnosis, treatment, and rehabilitation.⁴ The primary role of all ophthalmologists in the vision rehabilitation process is to **recognize** patients who are impacted by their vision loss and **respond** by referring patients for vision rehabilitation, a clinical process to help patients achieve their goals and maintain quality of life and safety despite vision loss. The rehabilitative needs of patients vary considerably. There is a wide range of vision rehabilitation interventions and devices available, and these change over time.^{5, 6} An example of rapid change in vision rehabilitation is the recent uptake of cell phones and tablets with accessibility features that are common devices used by individuals with vision loss for a variety of tasks, including using the cell phone camera as a magnifier. The initial evaluation by a vision rehabilitation clinician typically determines the level of care and possible interventions required depending on the patient's goals, visual function, psychosocial status, and personal attributes, not solely on their visual acuity. The rehabilitation of children with vision loss is important and has special considerations. Vision rehabilitation for children is discussed in Appendix 3.

DISEASE DEFINITION

Low vision is the term for vision impairment that cannot be corrected by standard eyeglasses, contact lenses, or by medical or surgical treatment. Low vision may result from many different ocular diseases or from neurological disorders such as cerebral vascular accidents.

The ICD-10 CM definitions of low vision are based on visual acuity and visual field (see Appendix 2), but other aspects of visual function can interfere substantially with day-to-day tasks.⁷⁻⁹ Even moderate vision loss can have an impact on one's life. For example, a minimum visual acuity of 20/50 to 20/70 in the better seeing eye is required for driving in many states,¹⁰ and a patient can be significantly impacted by losing his or her driving license.

Legal blindness is defined by the Social Security Administration (SSA) as visual acuity 20/200 or less with the use of a correcting lens or a visual field diameter 20 degrees or less in the better seeing eye. Automated visual fields and visual acuity charts that measure lower levels of acuity can be used to assess legal blindness status.¹¹ Individuals who cannot identify any letters with either eye on the 20/100 line of a visual acuity chart, such as Baily-Lovie or the Early Treatment Diabetic Retinopathy Study (ETDRS) chart, are considered legally blind.¹¹ The legal blindness designation has been used to determine eligibility for disability benefits in the United States.¹¹ The term *legal blindness* can be confusing because most patients with legal blindness have partial vision. They are candidates for vision rehabilitation to optimize use of their residual vision. Services for individuals with very limited vision are referred to as blind rehabilitation and include sight substitutes such as braille instruction, long-white-cane training, or guide dog assistance.

Terms such as *visual function*, *functional vision*, *functional vision loss*, and *functional blindness* are used in different ways by different authors and, therefore, can be confusing. In this document, we use the term *visual functions* to refer to visual acuity, contrast sensitivity, and visual field and the term *visual performance* to refer to how one uses vision and includes observed tasks such as reading.

PATIENT POPULATION

Adults with vision impairment (for discussion of vision rehabilitation in children, see Appendix 3).

CLINICAL OBJECTIVES

- ◆ For all ophthalmologists: Recognize patients with vision impairment.
- ◆ For all ophthalmologists: Advise patients about options for simple or multidisciplinary vision rehabilitation interventions

- ◆ For ophthalmologists who subspecialize in vision rehabilitation: Support patients to engage in vision rehabilitation that addresses their unique goals, values, and individual resources

PATIENT OUTCOMES

- ◆ Maximized access to information they wish to access, such as news, literature, bills
- ◆ Improved ability to accomplish daily living activities and perform tasks of interest
- ◆ Improved safety
- ◆ Optimized social participation despite vision loss
- ◆ Improved psychosocial status and adjustment to vision loss, and enhanced awareness of options for psychological support
- ◆ Improvement in quality of life and independence

BACKGROUND

PREVALENCE

Systematic review and meta-analysis estimated that in 2020, 295 million people globally had moderate or severe visual impairment, defined by the authors as presenting visual acuity worse than 20/60 to 20/400, and 43.3 million had blindness, defined by the authors as presenting visual acuity worse than 20/400 or less than 10 degrees of visual field around central fixation.¹² It was projected that 474 million people would be living with moderate or severe vision impairment and 61 million with blindness by 2050.¹² The leading causes of blindness identified were cataract, glaucoma, undercorrected refractive error, age-related macular degeneration (AMD), and diabetic retinopathy in those 50 and older.¹³

Based on data from six previous population-based studies of blindness and vision impairment in the United States, it was estimated that 3.22 million individuals in the United States had visual impairment in 2015 (defined as visual acuity less than 20/40 in the better-seeing eye but better than 20/200 best corrected) and that 1.02 million were legally blind.¹⁴ It is estimated that by 2050 there will be a significant increase in the number of individuals living with vision loss in the United States, with an estimated 2.01 million individuals living with legal blindness and 6.95 million living with visual impairment.¹⁴ The highest numbers of individuals living with visual impairment and blindness are predicted to be among non-Hispanic whites, women, and older adults. African Americans are projected to have the highest prevalence of blindness.

Visual impairment disproportionately affects the elderly. Adults over the age of 80 account for almost 70% of individuals with severe vision impairment (visual acuity 20/200 or less in the better eye) yet they represent only 7.7% of the population.¹⁵ The sector of the U.S. population that is 65 and older is rapidly expanding and is estimated to reach 83.7 million by 2050.¹⁶

A leading cause of reduced vision in the United States among those over the age of 65 and of European descent is AMD.¹⁷ In 2004 it was estimated that 1.75 million adults 40 or older had AMD. It is estimated that at least 1 in every 10 individuals over the age of 80 has advanced AMD.¹⁷ From 2000 to 2010, the number of individuals 40 and older in the United States who had diabetic retinopathy rose from 4.06 million to 7.69 million, an estimated 89% increase.¹⁸ The number of Americans with diabetic retinopathy is anticipated to almost double by 2050 to 14.6 million.¹⁸ The number of individuals with glaucoma worldwide is estimated to increase from 76.02 million in 2020 to 111.82 million by 2040.¹⁹ In addition to patients with ocular disease, patients with acquired or progressive disorders of the central nervous system, including trauma, stroke, neurodegenerative diseases, and tumors, often have substantial limitations that result from visual impairment.²⁰⁻²²

RATIONALE FOR TREATMENT

Living with visual impairment is associated with the following:

- ◆ Decreased quality of life²³⁻²⁸

- ◆ Almost twice the risk of falling and four times or more increased risk of sustaining a hip fracture.^{29, 30}
- ◆ Activity restriction due to fear of falling³¹⁻³⁵
- ◆ Increased mortality, identified when controlling for confounding variables³⁶
- ◆ Earlier admission to nursing homes (by 3 years on average)³⁷
- ◆ Increased use of community services³⁸
- ◆ Increased social isolation³⁹
- ◆ Increased depressive and anxiety disorders⁴⁰⁻⁴²
- ◆ Risk of errors in self-administering medications^{43, 44}
- ◆ Likelihood to require assistance managing their medications, which has more than doubled⁴⁵

In patients with early glaucoma, psychosocial function can be negatively affected.⁴⁶ Difficulty with mobility is reported in more than 25% of glaucoma patients who have relatively minor binocular field loss.⁴⁷

Although some patients with low vision successfully minimize the impact of their vision loss without formal rehabilitation, most are unable to read standard print, many are unable to maintain their safety and independence in daily activities, and some require extensive assistance from family members to remain in their own homes or move into extended-care facilities.³⁸ These limitations often lead to decreased participation in routine activities and a lower quality of life.

SYSTEMATIC REVIEWS OF EFFECTIVENESS OF VISION REHABILITATION

A search of recent quantitative systematic reviews (SRs) related to vision rehabilitation was conducted, and the search and results are described in Appendix 4. Given the complexity and large number of vision rehabilitation interventions as well as the many models of rehabilitation, the topics included were broad, including methods for enhancing vision, interventions that affect mental health outcomes, fall prevention interventions, interventions for visual field defects in patients with strokes, and interventions in children with vision impairment. Only six of 10 SRs identified were assessed to have overall low risk of bias using the ROBIS risk of bias assessment tool.⁴⁸ Two broadly inclusive Cochrane reviews, Virgili et al⁴⁹ and van Nispen et al⁵⁰ each had different approaches.

Virgili et al⁴⁹ compared reading performance using different optical and electronic magnifiers. This was a very specific approach using a primary outcome (reading speed) that was often obtained in laboratory conditions during vision rehabilitation sessions and may be only partly relevant to the benefits of low-vision devices in daily use. Moreover, only one or a few small studies were included in each comparison, and the evidence was often low quality and imprecise. Finally, some studies on electronic devices were not recent, which may limit the applicability of their results to current technologies that are evolving rapidly.

The review by van Nispen et al⁵⁰ adopted a much broader approach, first by grouping very different interventions in four large categories of vision rehabilitation and then by adopting quality-of-life questionnaires to measure the outcome, thus offering a higher-level view of current vision rehabilitation. The disadvantage of this review is that very different interventions were grouped together. The interpretation of the findings, including their applicability, must be assessed carefully against the characteristics of the studies included in each meta-analysis.

The review by van Nispen et al⁵⁰ also confirmed that measurable benefits can be obtained in studies comparing experimental interventions with active interventions or usual care. Because participants are unmasked, such comparisons might also limit bias with respect to subjective outcomes such as vision-related quality of life (VRQOL), since both groups received active interventions.

An example of a rigorous trial is the Low Vision Intervention Trial (LOVIT),⁵¹ which used an intensive and protracted multidisciplinary vision rehabilitation model as an intervention and recorded

the largest benefits with good precision. Although this trial was rigorously conducted, the use of a waiting list as control can overestimate the effect on VRQOL, since controls were aware of not receiving an intensive program of care. Almost 10 years later, LOVIT II⁵² compared the provision of low-vision devices with vision rehabilitation delivered by a therapist versus without. It found smaller benefits than the previous LOVIT trial for most domains of the Veterans Affairs Low Vision Visual Functioning Questionnaire, especially for individuals with better-eye vision from 20/63 to 20/200. This clearly shows that selecting the models being compared is a critical decision in trial design. Measuring cost-effectiveness is informative, given the different intensities of interventions.⁵³

A critical decision to be made by vision rehabilitation trial designers is which comparisons are most important in current research. This inevitably will be different in different settings, and it will be critical to consider the social context and availability of resources, especially in low- and middle-income countries.⁵⁴ The process of establishing priorities in different settings should include patient representatives, policymakers, and public health and health professionals. Such priorities should drive the agenda for vision rehabilitation research.

THREE-LEVEL MODEL OF VISION REHABILITATION

LEVEL 1 – ALL OPHTHALMOLOGISTS

All ophthalmologists should address the following:

- ◆ **Recognize** patients who have the following issues:
 - ◆ Difficulty with visual tasks
 - ◆ Less than 20/40 corrected distance visual acuity in the better eye
 - ◆ Contrast sensitivity loss
 - ◆ Scotoma
 - ◆ Peripheral field loss
 - ◆ Difficulty adjusting to vision changes
- ◆ **Respond** by doing the following:
 - ◆ Advise patients that vision rehabilitation is an option
 - ◆ Encourage patients to begin using simple interventions such as smartphone accessibility options and direct lighting
 - ◆ Assist patients with access to stronger reading adds, if beneficial
 - ◆ Offer patients the Academy’s Vision Rehabilitation Patient Handout (See Appendix 5.)
It is essential that patients understand that although no further medical or surgical treatments may be available, rehabilitation can help improve their ability to continue to perform tasks they value.

Ophthalmologists are not the only providers referring to vision rehabilitation services. Others, including optometrists and physiatrists, also initiate vision rehabilitation referrals.

LEVEL 2 – VISION REHABILITATION SERVICES

Level 2 of vision rehabilitation service is provided by clinicians with interest and expertise in vision rehabilitation who provide assessment of low vision, recommendations for interventions, and referral to other services as indicated. This may suffice for patients with vision loss that affects a specific task but does not broadly limit their function. For those with greater impairment, referral to other services may be indicated.

LEVEL 3 –MULTIDISCIPLINARY VISION REHABILITATION

Level 3 services are typically provided by a multidisciplinary team that may include a clinician (either an ophthalmologist or optometrist), an occupational therapist or other rehabilitation professionals, psychological support staff (e.g., social workers or psychologists), and specialists (e.g., orientation and mobility trainers).

VISION REHABILITATION CARE PROCESS

HISTORY

The initial history includes the following elements:

- ◆ The patient’s understanding of their diagnosis
- ◆ The duration and progression of vision loss
- ◆ The changes in the patient’s life since the onset of vision loss
- ◆ Goals and priorities with rehabilitation.

- ◆ Impairments relevant to rehabilitation (e.g., tremor, decreased hearing, cognitive deficit, restricted mobility, gait instability, balance issues)
- ◆ Current use of magnifying devices and success or lack of success with these
- ◆ Reading difficulties
- ◆ Daily living task difficulties such as:
 - ◆ Using a telephone, cell phone, tablet, or computer
 - ◆ Paying bills, counting money, and managing finances
 - ◆ Shopping and financial management
 - ◆ Preparing and eating meals
 - ◆ Seeing faces
 - ◆ Watching TV, a movie, or a theater performance
 - ◆ Managing personal self-care
 - ◆ Managing glare and lighting
 - ◆ Enjoying leisure activities
- ◆ Safety concerns
 - ◆ Difficulty managing medications
 - ◆ Falls and fear of falling
 - ◆ Difficulty crossing streets, using stairs or ambulating safely
 - ◆ Cuts or burns from kitchen tasks
- ◆ Participation or lack of participation in activities that are valued or enjoyed
 - ◆ Driving status
 - ◆ Barriers to participating
- ◆ Psychosocial well-being
 - ◆ Depressed mood
 - ◆ Anxiety about hallucinations (Charles Bonnet syndrome)
 - ◆ Concerns about prognosis of losing vision
 - ◆ Concerns about independence
- ◆ Social history:
 - ◆ Living situation
 - ◆ Family responsibilities
 - ◆ Family or other supports
 - ◆ Employment

ASSESSMENT

EVALUATION OF VISUAL FUNCTION

A review of relevant clinical notes, previous diagnosis, and previous ancillary testing such as retinal photographs or visual fields is helpful when evaluating visual function.

Visual Acuity and Refraction

Precise measurements, even in the lower ranges of visual acuity, are necessary to appreciate ocular function fully and to recommend devices and interventions. For patients with visual acuity less than 20/100, the measurement range can be extended by using a portable test chart at a closer testing distance than that typically used in an eye clinic, such as the ETDRS chart at 1 meter (3.3 feet), the Colenbrander Chart (Precision Vision, La Salle, IL), or the Berkeley Rudimentary Vision Test (Precision Vision, La Salle, IL). The latter test is conducted using cards that are held at 25 centimeters (10 inches). Portable tests eliminate the use of the “count fingers” notation.

For near visual acuity measurements, the reading add used (if any), letter size, and reading distance should be specified, because an individual’s near visual acuity will vary with the power of the reading add used.

Clinical observations during visual acuity testing can be informative. Head turns, deviated gaze, or searching eye and head movements should be noted and may indicate that a patient has scotomas or is using an eccentric viewing location. Missing letters on the chart in a consistent pattern (e.g., to the right) is also a sign of the location of the scotoma. As patients

shift fixation, measured visual acuity may vary. As patients take more time to view an acuity chart, their fixation may vary and their acuity may also vary, so avoiding rushed testing is useful. Difficulty identifying very large letters, with better performance in the middle-size range, may indicate a small central island of vision surrounded by nonseeing field.

Retinoscopy may be performed with a phoropter or with loose lenses, and the prescription may be confirmed by using a trial frame if necessary. Refraction techniques may be modified for the patient with reduced vision, such as by using a +1.00 diopter (D) cross cylinder, because reduced acuity may obviate a patient's ability to determine any difference between ± 0.25 D steps. A retrospective study suggests that a small proportion of patients (11%) presenting for vision rehabilitation require new distance eyeglasses.⁵⁵ Unless the refraction varies substantially from the current spectacles, a prescription for new distance eyeglasses is often best delayed until completion of occupational therapy training with devices, when the potential benefit and cost of new eyeglasses can be reassessed relative to other devices.

Contrast Sensitivity

Contrast sensitivity measurement provides insight into a patient's performance and helps in planning rehabilitation interventions.^{56, 57} In visual acuity testing, targets are high-contrast dark letters on a white background. The only variable being tested is the size of the letter that can be discerned. The ability of the human visual system to resolve objects, however, depends not only on size but also on the contrast or luminance difference between an object and its surrounding area. In daily visual tasks, many targets do not have high contrast or sharp edges. Recognizing a face or distinguishing between pills of similar color requires sensitivity to low-contrast targets. Patients with poor contrast sensitivity are also at increased risk of missing steps and falling.^{58, 59}

Printed and computer contrast sensitivity tests are available. Printed tests include those that test a single spatial frequency or size of target (e.g., Pelli-Robson) or a range of spatial frequencies (e.g., VISTECH test). Computer tests (e.g., SPARCS Spaeth/Richmond contrast sensitivity test) allow adaptive testing and a range of test stimuli.⁶⁰ Reading tests with varied contrast demonstrate a patient's difficulty with reading low-contrast text. A patient with severe contrast sensitivity loss may require devices that supply illumination or contrast enhancement, such as illuminated magnifiers, video magnifiers, computers, or electronic tablets.

Central Visual Field

Measurement of the central field includes assessment of scotomas (areas that are not seen surrounded by seeing areas of retina) and fixation. Fixation can be foveal or eccentric and stable or not stable. The eccentric area of retina used habitually for fixation is referred to as a preferred retinal locus (PRL).⁶¹ Although research about fixation and the development of PRLs is ongoing, it is apparent that eccentric fixation is a dynamic process; patients use multiple PRLs and eccentric fixation can change if the task, print size, or illumination changes. The fixation can change with a change of fixation target during microperimetry. Assessment of scotomas and fixation is informative for appreciating patients' natural adaptation to their central vision loss and assessing the anticipated challenges for using their central field for tasks such as reading.⁶²

Central field assessment using traditional automated field tests is less accurate in patients with unstable or nonfoveal fixation secondary to macular disease. When the patient has eccentric fixation, the scotoma location may be mapped in the wrong location.⁶³ For example, a scotoma that appears paracentral may be a central scotoma that is displaced by eccentric fixation. In addition, scotomas can be either overestimated or underestimated by poor fixation.

Fundus-related macular microperimetry, or microperimetry, can accurately detect both fixation and scotomas.⁶³ During macular microperimetry, eye-tracking technology detects ocular movements during testing and ensures that stimuli are presented to the correct retinal position. Fixation assessment determines both location and fixation stability.

Commercially available macular microperimetry devices image the retina with either a camera or a scanning laser ophthalmoscope.⁶³ These devices test monocular central field. Macular microperimetry devices also include an option for biofeedback training to develop a new area

of fixation referred to as a trained retinal locus (TRL), although evidence for biofeedback TRL training is limited due to lack of trials with appropriate control groups or sham interventions.⁶⁴

Central scotomas can also be detected by other nonautomated methods. A patient can report scotomas seen on an Amsler grid, however, this is anticipated to detect only about half of central scotomas owing to perceptual completion.⁶⁵ A patient can report scotomas seen when observing an examiner's face, a clock face, single-letter targets mounted on flash cards⁶⁶ or while observing stimuli projected on a paper target with a laser pointer (California Central Visual Field test; Precision Vision). During these tests the examiner observes fixation, but these nonautomated tests cannot accurately determine where the patient is fixing or small changes in fixation during testing. As with traditional field tests, a scotoma that appears paracentral may be a central scotoma displaced by eccentric fixation. The macular microperimeter is a monocular test. A benefit of nonautomated tests is that they can be conducted binocularly so they can offer useful information about the patient's fixation relative to scotoma during binocular viewing.

Clinicians must also be aware that some patients will maintain a sense of straight ahead related to their fovea, whereas others will re-reference their sense of straight ahead to their PRL, again suggesting that fixation is a dynamic process that is influenced by various factors. Hence, directing a patient to look straight ahead can confound assessment of habitual eccentric fixation when testing with microperimetry or other tests of central field.^{61, 67}

Peripheral Visual Field

Peripheral visual field testing with Goldmann or automated perimetry testing is important when patients have a disease that is anticipated to affect peripheral visual field, such as glaucoma, other optic nerve disease, proliferative diabetic retinopathy, other retinal disease such as retinitis pigmentosa, or neurological disease such as a cerebral vascular accident.

Other Visual Functions

Measurement of other visual functions such as glare, color vision, eye dominance, suppression, or motion detection may be considered.

ASSESSMENT OF ABILITY TO PERFORM VISUAL TASKS

As part of the assessment of the ability to perform visual tasks, the patient may be observed doing tasks such as the following:

- ◆ Reading continuous print
 - ◆ The iReST (Precision Vision International Reading Speed Texts) has a paragraph of single-size text and is available in multiple languages.
 - ◆ The MNREAD test (Precision Vision Minnesota Low Vision Reading Test) has sentences in varying text size from larger to smaller and is available as both a print version and as an iPad application.⁶⁸
 - Maximum reading speed and the size of text maximum fluency is achieved can indicate a patient's potential reading speed with an adaptive device and the magnification that the patient will benefit from.
 - Critical print size is the smallest size of text at which reading speed declines significantly.⁶⁹
- ◆ Spot-reading labels, including medication labels
- ◆ Writing
- ◆ Using a cell phone
- ◆ Using a computer or tablet
- ◆ Walking and navigating

Errors made when reading or doing tasks can confer information about central and paracentral fields, for example, missing the last letters in words may indicate a scotoma to the right of fixation. Patterns of errors may be identified when reading a series of number or letters such as on the SKRead test of random letters (Precision Vision).⁷⁰

ASSESSMENT OF OTHER FACTORS

Other factors to consider during the assessment include the following:

- ◆ Mood, anxiety, and adjustment to vision loss
- ◆ Cognitive or memory deficits
- ◆ Motivation, stamina
- ◆ Comorbidities including tremor, weakness, hearing deficit, mobility difficulties, and chronic illnesses
- ◆ Risks for the individual patient such as errors with self-management of medications,⁷¹ label misidentification and product misuse, mismanagement of diabetes and other chronic medical conditions, nutritional compromise, injury from falls, cuts, burns driving accidents or head injuries, or errors in financial management

REHABILITATION INTERVENTIONS

Ophthalmologists who subspecialize in vision rehabilitation use a patient's history and evaluation to guide recommendations for rehabilitation interventions. Vision rehabilitation goes beyond device recommendations and sales to assess and address the broader impact of vision loss on patients' lives. Vision rehabilitation must be individualized to meet each patient's particular goals, limitations, and resources (e.g., age, finances to purchase devices, and responsibilities).

READING INTERVENTIONS

Being able to read is the most common goal that patients identify, and it should be assessed and addressed.^{72, 73} There is evolving research on reading rehabilitation including optimal device selection,⁴⁹ and effective training interventions,^{74, 75} but further research is required to outline a standard rehabilitation program or, more specifically, the right reading intervention for the right patient at the right point during the course of their adaptation to vision loss. Overall, the approaches to rehabilitation of reading include the following:

- ◆ Recommending magnification and devices
- ◆ Training patients to use devices
- ◆ Training visual function
- ◆ Substitution with either audio or braille reading

Magnification and Devices

Magnification allows most patients with reduced visual acuity to see smaller text and read more fluently without additional training,⁷⁶ and it is recommended, given individual patient considerations. (*Level II, Insufficient Quality Evidence, Strong Recommendation*) Cell phone cameras are commonly used to take a photo of text and then magnify. There is increasing use of electronic magnification and accessibility features in devices such as tablets and cell phones. In order to read continuous print of a desired text size without fatigue, a patient usually needs to be able to read two or three lines smaller than the desired text size. A quantitative systematic review⁴⁹ of studies that considered reading speed outcome with reading aids found insufficient evidence to recommend specific devices. The following findings with *moderate certainty* are highlighted from single studies considered in the review:

- ◆ Stand-mounted electronic magnification may improve reading speed.
- ◆ A mouse-based video magnifier improves reading speed and duration.
- ◆ A hand-held video magnifier does not improve reading speed compared with optical devices.
- ◆ Fixation relocation with spectacle prisms does not improve reading speed compared with conventional spectacles.

The Cochrane review by van Nispen et al⁵⁰ considered the impact of the prescription of low-vision devices as a method of enhancing vision that might impact vision-related quality of life outcomes.

There was low-certainty evidence of small benefit due to risk of bias and imprecision. The following findings with low risk of bias can be noted:

- ♦ A randomized trial of prism spectacles versus sham showed low risk of bias and reported no significant benefit of prism spectacles for fixation relocation in patients with macular degeneration.⁵⁰
- ♦ A second randomized trial of a spectacle that combined prisms, 6% magnification, yellow tint, and antireflection coating found no difference on National Eye Institute Visual Function Questionnaire (NEI-VFQ) outcomes, and only small benefit on binocular acuity and contrast sensitivity that was considered not clinically meaningful.⁵⁰

Therefore, considering the two Cochrane reviews^{49, 50} prism spectacles for fixation relocation are not recommended. (*Level 1+*, *Moderate Quality Evidence*, *Strong Recommendation*)

Even with magnification, reading with nonfoveal retinal fixation does not restore normal continuous print reading speed. Many factors may contribute to decreased reading fluency, including visual span (the number of letters that can be recognized), perceptual span (the information that can be gained without moving gaze), oculomotor control for effective saccades, fixation, contrast sensitivity, inadequate illumination, crowding, cognitive processing, and slower visual processing to recognize text seen with the peripheral retina. A limited area of horizontal field is used for left-to-right reading and fixation and scotoma characteristics will determine the horizontal span for reading.^{75, 77} Scotoma patterns that limit the horizontal span for reading may limit both reading fluency and the ability to use magnification. One clinical example of this is patients with macular degeneration who have a scotoma pattern that encircles the fovea, leaving a limited horizontal span for reading or using magnification (foveal-sparing scotoma pattern).⁷⁸

Even when magnifiers do not restore reading speed to normal fluency for continuous print, magnifiers or cell phone cameras will assist with spot reading tasks such as reading a price tag or a medication label. This can be of significant value to patients.

Training

Training interventions to optimize reading, in addition to using magnification, have been studied, including training patients to use devices, training oculomotor function,⁷⁹ offering perceptual training,⁸⁰ providing structured reading practice,⁸¹ and training fixation with a PRL or an alternative-fixation location called a TRL (trained retinal locus).⁷⁵

The van Nispen et al review⁵⁰ included studies that evaluated methods of enhancing vision such as low-vision device training. Meta-analysis suggested a small, but significant effect on vision-related quality of life. However, due to risk of bias this evidence was rated of low certainty.

A large randomized four-arm trial, the EFFECT Trial, comparing two types of eccentric viewing training, was conducted with 200 subjects with age-related macular disease.⁸² One group received three sessions of training to optimize the subjects' spontaneous preferred retinal locus and a second group received three sessions of biofeedback training of a TRL. There was a third group with supervised reading support and a fourth group which was a control group. All groups received standard low-vision rehabilitation assessment and appropriate low-vision aids. Eccentric viewing training did not significantly improve reading, fixation or task ability measured with the Activity Inventory questionnaire (personal communication).

A systematic review of 25 articles and 18 abstracts related to biofeedback training for rehabilitation did not identify high-quality evidence. Only one trial used a randomized control design, and the control group received no treatment.⁶⁴

Overall, limited evidence supports specific training as part of reading rehabilitation in addition to magnification. Therefore, at present, no specific training in addition to magnification can be specified. (*I-*, *Insufficient Quality Evidence*, *Strong Recommendation*). As noted by van Nispen et al,⁵⁰ however, there is a trend of positive effect with heterogeneous types of training. Further study with sound research design, including randomization, clear definitions of training methods, appropriate matched controls with sham interventions that balance the inherent motivation of interventions, adequate sample size, and masked assessment of outcomes, is required to identify effective and optimal interventions.

Substitution

Substitution of visual reading with tactile braille reading or audio reading is the third option for reading rehabilitation. Although braille is used only by those with very limited vision or no vision, audio reading is widely used. Access to digital audio books has expanded a great deal in recent years and can be free, easy to use, and often an acceptable and efficient method for patients to achieve significant fluency in accessing text, particularly if reading for extended periods of time. Patients who have not read entire books for years can begin reading multiple books each month when they are introduced to audio reading, a success that is often not achievable with magnification. Patients may use magnification for some reading tasks and audio for other texts. Audio reading with text converted to speech is also available with computer-screen reading, smart phone applications, or head-worn technologies.

It is important for patients to be aware of the large array of devices for reading rehabilitation, because more than one device may be appropriate for different reading tasks.

The effectiveness, ergonomics, and appropriateness of the following interventions and devices for individual patients should be considered, and the patient's response to each should be noted:

- ◆ Lighting
- ◆ Reading eyeglasses, including readers with base-in prism to reduce convergence demand with higher adds
- ◆ Handheld magnifiers with or without illumination
- ◆ Stand magnifiers with or without illumination
- ◆ Electronic video magnifiers
- ◆ Electronic books/readers
- ◆ Computers or tablets with magnification and accessibility features
- ◆ Text-to-speech devices, audio books, and audio newspapers
- ◆ Large print
- ◆ Telescopic devices for near
- ◆ Braille for individuals with little or no vision

The clinician can guide a patient's optical and non-optical preferences, but each patient will make his or her individual selection. Once the patient can use a device in the clinical setting, it is essential to provide sufficient training to ensure confidence and successful use in the patient's environment.

Cost of devices and lack of insurance coverage for assistive devices may remain a barrier to patients' ability to acquire the necessary equipment. For example, Medicare disallows coverage of these devices based on incorrectly classifying them with standard spectacles for correction of refractive error.

INTERVENTIONS FOR DAILY LIVING ACTIVITIES

Patients have varied goals for rehabilitation for daily living activities, and a range of interventions may be appropriate depending on their set of unique circumstances and interests. In general, objects at near can be enlarged or magnified. Objects at distance can be enlarged by moving closer or by viewing them with a telescopic device. Objects at intermediate distance, such as information on computer monitors, can often be magnified to allow easier viewing or, less often, telescopic devices can be utilized.

Devices can be considered in the following categories:

- ◆ Optical devices
- ◆ Technology, including electronic devices
 - ◆ Computer adaptations using magnification, audio-screen readers, and text-to-speech using optical character recognition
 - ◆ Cell phone accessibility options; cell phone cameras to magnify; and specific cell phone applications that read print aloud, offer directions, and identify colors, objects, and currencies and so on
- ◆ Other non-optical devices
 - ◆ Audio devices (e.g., watches, liquid level indicators)
 - ◆ Large-format items such as large-print bank checks and large-button telephones

- ◆ Alternative strategies such as signature templates and needle threaders
- ◆ Tactile, audio, or braille labeling
- ◆ Alternative strategies and training
 - ◆ Modification of lighting and contrast to increase visibility
 - ◆ Training with new strategies for completing desired daily activities, including personal care, home management, financial management, meal preparation, and shopping

The effectiveness, ergonomics, and appropriateness of the devices listed in the Reading Interventions section above may be considered for daily living activities. Rehabilitation training with devices or strategies is often provided over multiple sessions, often by a Medicare-funded occupational therapist.

New technologies are available and evolving for patients with vision loss. One example is head-worn devices that combine a camera and virtual reality headset to allow electronic magnification, autofocus, contrast enhancement, and other features. More than two dozen head-worn devices are available commercially. Cost, size, weight, and motion sickness discomfort with head movement are variables patients consider. Studies have documented improved distance visual acuity and improved contrast sensitivity, as anticipated with electronic magnification devices.^{83, 84} Improvement in reading speed was not reported based on the review of three trials,⁴⁹ although the findings had low certainty of evidence. Mobility has not been shown to be improved by head-mounted devices with scene enhancement, simplification, and other image enhancements such as edge enhancement (augmented reality). Obstacle detection and collision avoidance benefit was noted.⁸⁵ Currently, the devices are not used as mobility aids. Other technologies such as cell phones, tablets, and computers continue to evolve and offer new options for patients with vision loss. A recent study showed comparable spot reading with either a portable video magnifier or an iPad tablet,⁸⁶ and a study comparing iPad and video magnifier reading found these devices to be comparable.⁸⁷ Technologies for optical character recognition and text-to-speech are also evolving quickly.⁸⁸ For example, free cell phone applications can take a photo of text and read the text aloud. Given how quickly devices change, it is a challenge for published literature to reflect current practice. It is anticipated that future studies will compare different device options and also compare newer technologies to the other options patients currently use to address their goals.

INTERVENTIONS TO ADDRESS PATIENT SAFETY

The visual rehabilitation process should address the following patient safety issues:

- ◆ *Risk of falling* – Three quantitative reviews (see Appendix 4) address various physical activity interventions such as home exercise, yoga or tai chi, and environmental interventions such as for home safety.⁸⁹⁻⁹¹ There is low certainty of effective interventions for fall prevention because of methodological limitations. For example, it is difficult to determine if a reduced rate of falls is due to increased mobility with physical activity interventions or reduced activity and lessened exposure to fall risk. Recommendations for future research include adopting reliable, standard methods to describe falls and physical activity, using both objective and subjective measures of physical activity and describing both visual impairments and interventions in greater detail.⁹¹ There is limited evidence that exploratory saccade training is beneficial for patients with retinitis pigmentosa who have limited visual field.⁹²
- ◆ *Kitchen safety* – Interventions can address identifying expiration dates on food, handling knives to avoid cuts, transporting hot liquids and foods, and safely operating stoves to avoid burns and starting fires.
- ◆ *Medication management* – Devices and training allow patients to accurately identify and self-administer medications, including insulin, over-the-counter medications, and prescribed medications.
- ◆ *Ability to reach emergency assistance* – Patients may be assisted to plan strategies to contact emergency assistance and/or implement an emergency evacuation plan.
- ◆ *Safe ambulation* – Orientation and mobility training and white-cane instruction are available through most state services and some privately funded services for the visually impaired. Guide dog training is reserved for patients with very limited or no vision and is available through several agencies. Many new technologies for obstacle detection are being developed.⁹³ Family members and patients may benefit from instruction in sighted-guide techniques, which outline steps to assist a person with reduced vision to hold the guide's arm if the level of vision loss impairs independent ambulation.

INTERVENTIONS TO ENHANCE PARTICIPATION IN ACTIVITIES

Many issues limit full participation in activities, such as difficulty with individual visual tasks, mood disorders, activity restriction due to fear of falling,³¹ and limited opportunities for employment.⁹⁴ Transportation is a significant barrier to continued participation. Driving is also a key element in maintaining independence.⁹⁵⁻⁹⁷

Driving requires a composite of visual, cognitive, and motor functions. The ophthalmologist has a role in formally assessing visual function in drivers, in discussing findings, offering advice about driving restrictions, driving retirement, or driving alternatives, and in reporting according to state requirements outlined in the American Medical Association's Physician's Guide to Assessing and Counseling Older Drivers.¹⁰ Further evaluation and training with a driver rehabilitation specialist may be appropriate for some patients. Some states allow restricted driving licensing or bioptic telescope driving. Bioptic telescopes are mounted superior to the driver's visual axis. While driving, the bioptic driver views through the carrier lens, which has the driver's distance prescription, and intermittently drops their chin to view through the superiorly placed telescope when they wish to see details on signs or identify traffic lights. Behind-the-wheel driving assessment remains the gold standard for driving competence.⁹⁸ Driving retirement can be associated with depression and social isolation, each of which may require intervention. Recommendations for transportation alternatives are an important intervention to enhance participation in activities despite vision loss.

INTERVENTIONS FOR PSYCHOSOCIAL WELL-BEING

Psychological supports such as peer support groups can alleviate the fear, frustration, loneliness, depression, and/or anger patients with vision loss may experience. The possibility of mood disorders should be considered by vision rehabilitation clinicians, because even early or moderate vision loss causes disability and can generate great anxiety.⁴⁰ Additional comorbidities such as hearing loss may increase the risk of decreased mental health.⁹⁹ A recent investigation of depressive symptoms in subjects age 80 and older found that individuals with poor vision and also hearing loss had the highest levels of depressive symptoms.¹⁰⁰

Van Nispen et al⁵⁰ reviewed 20 studies that examined the impact of varied psychological therapies and group programs on a broad range of outcomes: health-related quality of life, vision-related quality of life outcomes, depression, self-efficacy, adaptation to vision loss, and social aspects of quality of life. The authors reported low-certainty evidence of a benefit of psychological therapies on vision-related quality of life and moderate effect on depression versus usual care. Based on this Cochrane Review, psychological therapies such as support groups should be recommended for patients with vision loss, in consultation with the individual patient. (*II+ Moderate Quality Evidence, Strong Recommendation*) The review also considered the impact of interventions to enhance vision or multidisciplinary interventions on quality of life, including psychological aspects such as depression, self-efficacy, and adaptation to vision loss, noting small-effect sizes and possible relationship with intensity of interventions.

Stepped care, where interventions are added as needed to usual care-vision rehabilitation, has also been shown to lead to significant reduction in incidence of major depressive, dysthymic, and/or anxiety disorder over a 2-year follow-up (absolute difference 17%; 95% confidence interval [CI], 13 – 22).⁴⁰

Professional assessment should be recommended for patients who report severe changes in their mood, mood changes that interfere with everyday life, or suicidal ideation. In addition, although there is limited literature on the topic, vision rehabilitation may minimize caregiver burden and depression.¹⁰¹

Charles Bonnet Syndrome Hallucinations

Patients with any level of vision impairment may experience recurrent hallucinations as part of Charles Bonnet syndrome (CBS), characterized by four findings:

- ◆ Recurrent, vivid visual hallucinations
- ◆ Insight that what is seen is not real
- ◆ No other neurological or medical diagnosis to explain the hallucinations
- ◆ Some degree of vision loss

Experiencing CBS hallucinations can cause anxiety or fear, particularly when the cause of the hallucinations is not known to the patient.¹⁰² Patients who have CBS and their family/caregivers should be educated and reassured that this phantom vision is common in visually impaired people. Discussion often leads to significant relief and decreased anxiety. Hallucinations can occur in patients who have reduced visual acuity, contrast sensitivity, or visual field loss and can occur in patients with monocular vision loss. The hallucinations are attributed to a cortical-release phenomena resulting from a lack of afferent visual information. A possible link between CBS and cognitive dysfunction is a topic of current research.^{103, 104} The reported prevalence of CBS among patients with a range of ophthalmologic disorders varies widely from 15% to 60%, depending on the definition and population studied.¹⁰⁵ Limited evidence from a case series suggests that techniques such as eye movements, changing lighting, or distraction may reduce hallucinations in some patients, and these self-management methods can be recommended for such patients.¹⁰⁶ A recent trial of 16 subjects with CBS reported reduced frequency of hallucinations in subjects receiving inhibitory transcranial direct-current stimulation (tDCS).¹⁰⁷ In addition, both the tDCS and the control group reported reduced impact of hallucinations, suggesting that education and support for patients with CBS is therapeutic.¹⁰⁷ Although a range of pharmacological treatments is reported in case reports, there is currently no significant evidence of efficacy.¹⁰⁵ Atypical features that should raise suspicion of a diagnosis other than CBS include lack of insight into the unreal nature of the images despite an explanation of CBS, images that interact with the patient, or other associated neurological signs or symptoms. Other entities including Parkinson’s disease, dementias (including dementia with Lewy Bodies and Alzheimer’s disease), psychiatric disease, or medication side effects can also cause hallucinations.¹⁰⁵ Patients with atypical features require a medical or neuropsychiatric evaluation for accurate diagnosis.

CONCLUSION AND SUMMARY OF REHABILITATION PLANS

The vision rehabilitation consultation concludes with a comprehensive discussion of planned interventions, patients’ questions, and other concerns.¹⁰⁸ Discussion may address why conventional eyeglasses will not correct low vision that is a result of ocular disease, patient concerns about fear of blindness, the definition of legal blindness, and concessions available to patients in their jurisdiction. (See Table 1.)

TABLE 1. EXAMPLES OF HOW A RANGE OF INTERVENTIONS AND DEVICES MIGHT BE USED TO ADDRESS PATIENTS’ GOALS

Patient Goals	Technology	Optical Devices	Non-optical Devices and Alternative Strategies
Reading	Audio books played on a smart phone	Hand magnifier for spot reading	Large-print books
Daily living tasks	Smartphone Seeing AI app to read prices aloud	Pocket magnifier to read labels	Large-format playing cards
Safety	Audio medication labels	High-plus readers leaving hands free to check insulin dosage	Fall prevention
Participation	Smart phone GPS to independently navigate	Telescope to see bus numbers	Alternative transportation
Well-being	Attending support groups virtually		In-person peer-support groups

COMMUNICATING BAD NEWS

The vision rehabilitation clinician often has a role in communicating information to patients that the patient perceives as bad news, such as informing the patient that he or she cannot continue driving or that vision cannot be improved to normal with eyeglasses or standard treatment. Conveying bad news effectively is a skill set that requires training.¹⁰⁹ Elements of effective communication skills include attending to body language, asking patients about their understanding of their situation,

acknowledging the patient's emotions and the connection of their emotions to the bad news, and slowing the pace of information delivery or even allowing silence in the encounter.¹¹⁰⁻¹¹² Physicians develop individual styles that incorporate honest explanations balanced with optimism and hope. Both the interest and the skills to communicate with sensitivity and convey empathy and hope to patients with vision loss are important keys to successful clinical vision rehabilitation.

REHABILITATION FOR VISION LOSS DUE TO ACQUIRED BRAIN INJURY

Visual deficits are common with acquired brain injury and may be accompanied by motor, language, and cognitive deficits that combine to create a complex disability picture that requires a multidisciplinary approach to rehabilitation, including occupational therapy. Neurological deficits may determine capacity for rehabilitation. (For discussion about occupational therapy, see Appendix 6.) Vision impairment, such as hemianopia, can impact reading, daily living activities, safety, participation, and mobility. Three approaches to hemianopia field-loss rehabilitation are described and reviewed in the 2019 Cochrane review:²⁰ compensatory training such as scanning training, visual restitution that restores visual field, and substitution such as peripheral sector prism eyeglasses with, overall, low to very low evidence of effectiveness of interventions, primarily due to methodological deficiencies in the studies and insufficient evidence. Overall, the Cochrane review cited low-quality evidence that quality of life is positively impacted by compensatory scanning training compared with placebo or control. Scanning training to compensate for visual field loss is recommended with consideration of individual patient characteristics (*I- Moderate Quality Evidence, Discretionary Recommendation*). In addition, there was also low-quality evidence that sector prisms for hemianopia causes minor, frequent adverse events, and there was insufficient evidence to reach any generalized conclusions about the effect of restitutive interventions or substitutive interventions (prisms) compared with placebo, control, or no treatment. A recent randomized trial of the efficacy of motion discrimination training did not show a difference between treatment and control training.¹¹³

Patients with either right or left homonymous hemianopsias can experience difficulty reading. Right hemianopia causes difficulty seeing the end of longer words and impairs the ability to see subsequent words, thus disrupting the reading saccade pattern.¹¹⁴ Left hemianopia causes difficulty identifying the beginning of the next line of text. Patients experience decreased accuracy and reading speed.¹¹⁵ Practical strategies such as marking the left margin of text or tilting text vertically can assist. In addition, there is limited evidence that practice reading laterally scrolling text improves reading for patients with hemianopia.^{116, 117}

Given the intensity of rehabilitation post-stroke, posing both health care costs and costs to patients who may find attending treatment challenging, cost-effectiveness of these interventions should also be assessed in future research.

There can be confusion between vision rehabilitation terminology and terms describing other services such as those addressing reading difficulties of normally sighted children or symptoms following brain injury. The terms *vision therapy*, *visual training*, *visual therapy*, or *vision training* are used to refer to other services, but they are not the same as the interventions used in vision rehabilitation. The American Association for Pediatric Ophthalmology and Strabismus has developed useful information for patients about vision therapy (<https://aapos.org/glossary/vision-therapy>). In addition, recent reviews have been published of components of vision therapy such as oculomotor training, yoked prisms, occlusion, and filters following mild traumatic brain injury. They outline a lack of substantive evidence for these interventions at this time.^{118, 119}

REHABILITATION OUTCOMES

Many factors influence the success of rehabilitation. Patients who are searching for a cure for their disease and a restoration of vision to "the way it was" may perceive rehabilitation to be an intense disappointment, and this may present a difficult challenge to the clinician. Cultural factors may influence goals and expectations. Mood disorders, anxiety, or discouragement may limit motivation. Some patients have limited financial resources to obtain devices. Although most rehabilitation services are covered by the Center for Medicare and Medicaid Services, devices currently are not.¹²⁰ Many patients have other physical impairments that influence the rehabilitation process or increase dependency. Hearing loss can lead to difficulty communicating and a higher risk of depression.¹²¹ Limitations in manual dexterity may require specialized adaptations to enable the patient to use optical devices. Patients with low endurance, cognitive impairments, or limited energy may progress

more slowly through the rehabilitation process. It is important to realize that although these factors challenge vision rehabilitation professionals, some aspects of vision rehabilitation can still be provided to the patient. A small pre-post trial of 10 hours of vision rehabilitation with an occupational therapist for 12 patients with mild cognitive deficits reported improvement on both subjective measures (National Eye Institute Vision Function Questionnaire-25 and reported progress towards goals) and timed performance outcome measures (writing a grocery list and filling in a crossword puzzle answer).¹²² Homes of patients who suffer from cognitive limitations can be made safer, and their caregivers can be trained to make accommodations for vision loss for these patients.

PROVIDERS

The rehabilitation team may include clinicians (typically an ophthalmologist or optometrist), ophthalmic technicians who assess visual function, therapists (e.g., an occupational therapist or vision rehabilitation therapist) who evaluate patient function and train patients to use devices or alternate strategies, assistive technology trainers, orientation and mobility specialists who offer specific skill training (e.g., how to use a white cane), teachers of the visually impaired, opticians, social workers, psychologists, or vocational counselors. Low-vision and blind rehabilitation services are provided by the Veteran's Administration. Services provided by state agencies vary. The Center for Medicare and Medicaid Services reimburses for vision rehabilitation services provided by occupational therapists, just as services are provided following a cerebral vascular accident or orthopedic procedures. More than 50% of patients with vision loss have other morbidities that contribute to difficulties with daily living tasks,¹²³ and occupational therapists are trained to consider and address such comorbidities (Appendix 6).¹²⁴ Treatment provided by certified low-vision therapists, certified vision rehabilitation therapists, and certified orientation and mobility specialists, who all have nonmedical certifications, is not reimbursable within the medical system. The primary care physician can also provide a key role in supporting patients with vision loss. Communication that vision loss is irreversible and about plans for rehabilitation is encouraged between the vision rehabilitation physician and other involved physicians.

VISION REHABILITATION RESEARCH AGENDA

Well-designed trials with masking and controls, consensus about relevant outcome measures, and studies of cost-effectiveness are required to guide vision rehabilitation clinicians in providing effective and efficient interventions for patients with vision loss. It is encouraging that recent research has addressed important clinical questions with randomized controlled trials. Three different examples of this include whether eccentric-viewing training offers benefit compared with controls matched for contact,⁸² whether sector prisms offer benefit compared with scanning training in patients with hemianopia,¹²⁵ and whether prisms to relocate fixation offer benefit compared with sham spectacles.¹²⁶ The inclusion of sham controls balances patient expectation that interventions will have benefit. Motivation is a key element in rehabilitation, and sham control groups have also shown the significant placebo effect of vision rehabilitation, highlighting the need for appropriate control groups in studies of vision rehabilitation interventions. These studies also demonstrate that masking of outcome assessment and including sham controls are feasible and can be part of well-designed vision rehabilitation trials. Reporting of adverse events has not been common in past research but has been very informative in a recent Rowe et al trial.¹²⁵ Overall, it is encouraging that large reviews such as the Cochrane review by van Nispen et al⁵⁰ show a consistent trend towards positive benefit of a range of vision rehabilitation interventions on quality of life. Future consensus about outcomes of vision rehabilitation interventions is important to allow for meaningful meta-analysis. Increased clarity and detailed description of interventions will allow appreciation that different researchers are, in fact, offering similar or different interventions. Studies of both cost-effectiveness of interventions and patient burden of interventions (e.g., time burden of many clinic visits, financial burden due to cost of devices, and cognitive burden due to difficulty using or learning to use devices) are important and valuable. Research that contrasts rehabilitation for patients with different pathologies, such as macular degeneration versus glaucoma, and also different life stages such as working age versus the oldest-old, will create evidence that directs the clinician to provide optimal interventions for each patient.

APPENDIX 1. QUALITY OF OPHTHALMIC CARE CORE CRITERIA

*Providing quality care
is the physician's foremost ethical obligation, and is
the basis of public trust in physicians.
AMA Board of Trustees, 1986*

Quality ophthalmic care is provided in a manner and with the skill that is consistent with the best interests of the patient. The discussion that follows characterizes the core elements of such care.

The ophthalmologist is first and foremost a physician. As such, the ophthalmologist demonstrates compassion and concern for the individual, and utilizes the science and art of medicine to help alleviate patient fear and suffering. The ophthalmologist strives to develop and maintain clinical skills at the highest feasible level, consistent with the needs of patients, through training and continuing education. The ophthalmologist evaluates those skills and medical knowledge in relation to the needs of the patient and responds accordingly. The ophthalmologist also ensures that needy patients receive necessary care directly or through referral to appropriate persons and facilities that will provide such care, and he or she supports activities that promote health and prevent disease and disability.

The ophthalmologist recognizes that disease places patients in a disadvantaged, dependent state. The ophthalmologist respects the dignity and integrity of his or her patients and does not exploit their vulnerability.

Quality ophthalmic care has the following optimal attributes, among others.

- ◆ The essence of quality care is a meaningful partnership relationship between patient and physician. The ophthalmologist strives to communicate effectively with his or her patients, listening carefully to their needs and concerns. In turn, the ophthalmologist educates his or her patients about the nature and prognosis of their condition and about proper and appropriate therapeutic modalities. This is to ensure their meaningful participation (appropriate to their unique physical, intellectual and emotional state) in decisions affecting their management and care, to improve their motivation and compliance with the agreed plan of treatment, and to help alleviate their fears and concerns.
- ◆ The ophthalmologist uses his or her best judgment in choosing and timing appropriate diagnostic and therapeutic modalities as well as the frequency of evaluation and follow-up, with due regard to the urgency and nature of the patient's condition and unique needs and desires.
- ◆ The ophthalmologist carries out only those procedures for which he or she is adequately trained, experienced and competent, or, when necessary, is assisted by someone who is, depending on the urgency of the problem and availability and accessibility of alternative providers.
- ◆ Patients are assured access to, and continuity of, needed and appropriate ophthalmic care, which can be described as follows.
 - The ophthalmologist treats patients with due regard to timeliness, appropriateness, and his or her own ability to provide such care.
 - The operating ophthalmologist makes adequate provision for appropriate pre- and postoperative patient care.
 - When the ophthalmologist is unavailable for his or her patient, he or she provides appropriate alternative ophthalmic care, with adequate mechanisms for informing patients of the existence of such care and procedures for obtaining it.
 - The ophthalmologist refers patients to other ophthalmologists and eye care providers based on the timeliness and appropriateness of such referral, the patient's needs, the competence and qualifications of the person to whom the referral is made, and access and availability.
 - The ophthalmologist seeks appropriate consultation with due regard to the nature of the ocular or other medical or surgical problem. Consultants are suggested for their skill, competence, and accessibility. They receive as complete and accurate an accounting of the problem as necessary to provide efficient and effective advice or intervention, and in turn respond in an adequate and timely manner.
 - The ophthalmologist maintains complete and accurate medical records.
 - On appropriate request, the ophthalmologist provides a full and accurate rendering of the patient's records in his or her possession.

- ◆ The ophthalmologist reviews the results of consultations and laboratory tests in a timely and effective manner and takes appropriate actions.
- ◆ The ophthalmologist and those who assist in providing care identify themselves and their profession.
- ◆ For patients whose conditions fail to respond to treatment and for whom further treatment is unavailable, the ophthalmologist provides proper professional support, counseling, rehabilitative and social services, and referral as appropriate and accessible.
- ◆ Prior to therapeutic or invasive diagnostic procedures, the ophthalmologist becomes appropriately conversant with the patient's condition by collecting pertinent historical information and performing relevant preoperative examinations. Additionally, he or she enables the patient to reach a fully informed decision by providing an accurate and truthful explanation of the diagnosis; the nature, purpose, risks, benefits, and probability of success of the proposed treatment and of alternative treatment; and the risks and benefits of no treatment.
- ◆ The ophthalmologist adopts new technology (e.g., drugs, devices, surgical techniques) in judicious fashion, appropriate to the cost and potential benefit relative to existing alternatives and to its demonstrated safety and efficacy.
- ◆ The ophthalmologist enhances the quality of care he or she provides by periodically reviewing and assessing his or her personal performance in relation to established standards, and by revising or altering his or her practices and techniques appropriately.
- ◆ The ophthalmologist improves ophthalmic care by communicating to colleagues, through appropriate professional channels, knowledge gained through clinical research and practice. This includes alerting colleagues of instances of unusual or unexpected rates of complications and problems related to new drugs, devices or procedures.
- ◆ The ophthalmologist provides care in suitably staffed and equipped facilities adequate to deal with potential ocular and systemic complications requiring immediate attention.
- ◆ The ophthalmologist also provides ophthalmic care in a manner that is cost-effective without unacceptably compromising accepted standards of quality.

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APPENDIX 2. INTERNATIONAL STATISTICAL CLASSIFICATION OF DISEASES AND RELATED HEALTH PROBLEMS (ICD) CODES

Visual acuity impairment: ICD-10 categories are based on the 6-level WHO Study Group Classification from normal to no light perception. These are indicated on the row and column labels in the chart below. Relevant ICD codes indicated take into account both the right and left eye.

	Right Eye	0	1	2	3	4	5
		Normal	Moderate VI	Severe VI	Blindness	Blindness	Blindness
Left Eye		20/60 or better	20/61 to 20/200	20.201 to 20/400	20/401 to 20/1200	20/1201 to LP	NLP
0 Normal	20/60 or better		(H54.511A)	(H54.512A)	(H54.413A)	(H54.414A)	(H54.415A)
1 Moderate VI	20/61 to 20/200	(H54.52 A1)	H54.2X11	H54.2X21	H54.1131	H54.1141	H54.1151
2 Severe VI	20.201 to 20/400	(H54.52 A2)	H54.2X12	H54.2X22	H54.1132	H54.1142	H54.1152
3 Blindness	20/401 to 20/1200	(H54.42 A3)	H54.1213	H54.1223	H54.0X33	H54.0X43	H54.0X53
4 Blindness	20/1201 to LP	(H54.42 A4)	H54.1214	H54.1224	H54.0X34	H54.0X44	H54.0X54
5 Blindness	NLP	(H54.42 A5)	H54.1215	H54.1225	H54.0X35	H54.0X45	H54.0X55

LP = light perception; NLP = no light perception.

Visual field impairment can also be used to determine ICD codes.

Category 3 - A field no greater than 10 degrees but greater than 5 around central fixation.

Category 4 – A field no greater than 5 degrees around central fixation.

Visual field impairment is assessed based on a Goldmann III size target for Goldman fields. For Humphrey field testing, a point seen with a 10db or higher stimulus is a point that would be seen with a 4e stimulus.

ICD-10 CM	
<i>Code any associated underlying cause of the blindness first.</i>	
Scotoma involving the central area (within 10 degrees of fixation)	Central scotoma H53.411 Scotoma involving central area right eye H53.412 Scotoma involving central area left eye H53.413 Scotoma involving central area bilateral H53.419 Scotoma involving central area unspecified eye
Homonymous bilateral field defects (blind spots in the right or left halves of the visual fields of both eyes: hemianopsia, quadrantanopia, altitudinal)	Homonymous hemianop(s)ia Quadrant anop(s)ia H53.461 Homonymous bilateral field defects right eye H53.462 Homonymous bilateral field defects left eye H53.469 Homonymous bilateral field defects unspecified side
Heteronymous bilateral field defects (blind spots in opposite halves of the visual fields of both eyes: binasal, bitemporal)	H53.47 Heteronymous bilateral field defects Heteronymous hemianop(s)ia
Generalized contraction or constriction	H53.481 Generalized contraction of visual field right eye H53.482 Generalized contraction of visual field left eye H53.483 Generalized contraction of visual field bilateral H53.489 Generalized contraction of visual field unspecified eye

CM = Clinical Modification used in the United States; ICD = International Classification of Diseases

The following definitions apply to the ICD-10 categories:

- ◆ Moderate visual impairment: best-corrected visual acuity is less than 20/60 (including 20/70) to 20/160
- ◆ Severe visual impairment: best-corrected visual acuity is less than 20/160 (including 20/200) to 20/400, or the visual field diameter is 20 degrees or less (largest field diameter for Goldmann isopter III4e, 3/100 white test object, or equivalent)
- ◆ Profound visual impairment: best-corrected visual acuity is less than 20/400 (including 20/500) to 20/1000, or the visual field diameter is 10 degrees or less (largest field diameter for Goldmann isopter III4e, 3/100 white test object, or equivalent)
- ◆ Near-total vision loss: best-corrected visual acuity is less than 20/1000
- ◆ Total blindness is no light perception

The table below gives a classification of severity of visual impairment recommended by a WHO Study Group on the Prevention of Blindness, Geneva, 6–10 November 1972.

Category of Visual Impairment	Visual Acuity with Best Possible Correction	
	Maximum less than:	Minimum equal to or better than:
1	6/18 3/10 (0.30) 20/70	6/60 1/10 (0.10) 20/200
2	6/60 1/10 (0.10) 20/200	3/60 1/20 (0.50) 20/400
3	3/60 1/20 (0.05) 20/400	1/60 (central fixation at 1 meter) 1/50 (0.02) 5/300 (20/1200)
4	1/60 (central fixation at 1 meter) 1/50 (0.02) 5/300	Light perception
5	No light perception	
9	Undetermined/unspecified	

The term *low vision* in category H54 comprises categories 1 and 2 of the table; the term *blindness* comprises categories 3, 4, and 5; and the term *unqualified visual loss* comprises category 9.

If the extent of the visual field is taken into account, patients with a field no greater than 10 degrees but greater than 5 around central fixation should be placed in category 3; patients with a field no greater than 5 around central fixation should be placed in category 4, even if the central acuity is not impaired.

APPENDIX 3. VISION REHABILITATION FOR CHILDREN

INTRODUCTION

Vision rehabilitation for children with low vision and their families is an essential component of ophthalmic care. It represents a collaborative effort of a multidisciplinary team that may include ophthalmologists, pediatric ophthalmologists, vision rehabilitation clinicians, occupational therapists, orientation and mobility instructors, teachers of the visually impaired and others working with the child and family. The developmental needs of children, their vulnerability to poor outcome without supports and advocates, their often comorbid disabilities, and the future lifetime potential of such children necessitates an emphasis on providing excellent rehabilitation at both the earliest point of intervention and on an ongoing basis to ensure a healthy childhood and a future young adult who can fully participate in society. A recent review of interventions to improve quality of life, participation, and function of children with vision loss outlines the need for well-designed, quality research to guide rehabilitation interventions for children.¹²⁷

EARLY IDENTIFICATION

Causes of visual impairment in children include congenital structural abnormalities that are sometimes associated with other systemic disorders (e.g., optic nerve hypoplasia, optic nerve and chorioretinal colobomas involving the maculae); genetic disorders (e.g., Leber congenital amaurosis, achromatopsia, cone or cone-rod dystrophies, congenital stationary night blindness, albinism, aniridia); acquired abnormalities (e.g., uncontrolled glaucoma, severe residua of retinopathy of prematurity, ocular and/or cerebral trauma, and uveitis); and neurologic visual impairment, also called cortical or cerebral visual impairment (CVI). In children with congenital or early onset vision loss (usually less than 3 years of age) involving the anterior visual pathway, parents and caregivers may note nystagmus. In CVI, damage involves primarily the posterior visual pathway (posterior to the lateral geniculate nucleus), and nystagmus may be variably present. With both types of vision loss, other symptoms of vision loss might include lack of eye contact, light sensitivity, difficulty seeing under conditions of decreased illumination, or failure to master color identification. The child may have problems navigating steps or curbs, or he or she may trip over objects on the floor. Parents might notice that their child has difficulty identifying familiar people across a room, particularly in a crowd of people. Some children may seem to have reduced visual function in a visually crowded environment such as a shopping mall. Parents of children with severe visual impairment (e.g., Leber congenital amaurosis) will often volunteer that their child pushes on his or her eyes with fingers (i.e., oculodigital sign), which is a risk factor for keratoconus and periorbital fat atrophy causing enophthalmos. Some diseases, such as Stargardt disease, may involve very subtle fundus changes initially resulting in a delayed diagnosis. Significant time may elapse, and the child may undergo neurological and even psychiatric evaluation before the true diagnosis is made.

EVALUATION

When measuring visual acuity in the child with visual impairment, it is important to not only assess monocular distance acuity but also to measure binocular distance visual acuity and binocular near acuity at both 40 centimeters and at the child's preferred reading distance. In children with nystagmus, binocular acuity is especially important, because it allows the child to use a compensatory head posture to dampen the nystagmus. Also, monocular occlusion can increase the amplitude of latent components of nystagmus, further reducing measured visual acuity. For best monocular measurement, a high-plus sphere can be used as an occluder. The preferred method of visual acuity testing for all children involves linear or crowded optotypes.¹²⁸ Dynamic retinoscopy can be used to assess for accommodation and determine if an additional prescription is needed for clear near vision. Cycloplegic retinoscopy is necessary to reveal significant refractive errors that may improve visual acuity. If eyeglasses are prescribed, vision should be checked with and without the correction to determine whether there has been a measurable improvement.

DISCUSSION

The cause of visual impairment should be explained in an unhurried manner. A written explanation and referral to support organizations may be offered to parents. Understandably, parents can be upset and often grieve for the loss of vision in their child. They may require increased support during office visits. Parents frequently ask about prognosis and usefulness of procedures that lack evidence of efficacy. The ophthalmologist can provide guidance in these areas. Parents should be reassured that it does not hurt the eyes when children sit close to the television or hold visual targets close to the eyes as they use their innate ability to accommodate to see smaller print at a closer focal distance.

REHABILITATION

It is the ophthalmologist's role to provide prompt referral for low-vision rehabilitation services for infants, preschoolers, and school-aged children. The low-vision evaluation may overlap with the evaluation by the pediatric or comprehensive ophthalmologist and the ongoing management of ocular co-morbidities such as strabismus. Assessments of accommodation, eye movements, stereopsis, color perception, contrast sensitivity threshold, dark adaptation, and visual field that are age and ability appropriate are critical for diagnosis and for a complete picture of the child's functional vision. Age-appropriate evaluation of visual function should be conducted. With school-aged or older children, the assessment is similar to the evaluation for adults and can include visual field testing, fundus-related macular perimetry or microperimetry, dark adaptometry, and measures of literacy (e.g., reading speed, fluency, comprehension, and stamina). Regardless of the child's age, offering family support, connections with support organizations, referrals to early-vision intervention, and rehabilitation promptly at the time of initial diagnosis is key.

Newborn to Three-Year-Old

When a young child is diagnosed with bilateral visual impairment, the family should be referred for enrollment in an early-intervention program (Part C of the Individuals with Disabilities Education Act [IDEA]). An Individual Family Service Plan (IFSP) will be designed to address the needs of the child and the family. These programs offer important interventions and support for both the child and family as well as provide insight into options for effective habilitation. These programs can also facilitate development of an Individualized Educational Plan (IEP) when the child transitions to preschool. A Teacher of Students with Visual Impairment (TSVI) can provide services within the early intervention program.

Preschool Child

When a preschool-age child is diagnosed with bilateral visual impairment, consideration should also be given to enrollment in an early-intervention program (Part B under IDEA). These programs may be community based or available through local school coops, nonprofits, or schools for the blind. Such a program can be supportive for the family, and it can offer important stimulation for the child and provide insight into options for effective rehabilitation. A TSVI and a Certified Orientation and Mobility specialist may be involved. Early-intervention programs can also facilitate development of an IEP when the child transitions to elementary school. In preschool, preferential seating close to instruction, introduction to simple optical magnification (e.g., low-power monocular telescopes and dome magnifiers), or using a second copy of a book that the teacher may read to the class, allows the child visual access to instruction, which is essential for success. Children who have extremely poor vision or a disorder that causes progressive vision loss can be introduced to tactile methods for training that can be a prelude to learning braille. Orientation and mobility instruction may be offered to help with safe travel in school and outdoors. The ophthalmologist can recommend that an orientation and mobility assessment be performed. Children with CVI may benefit from a specialized functional vision assessment since their visual characteristics may differ from children with ocular causes of visual impairment. These children often have other comorbidities (e.g., cerebral palsy) and require other specialized services.

School-aged Child

Education can pose challenges for a child with vision impairment. A bright child with a moderate visual disability might not be recognized as having special needs and might be

overlooked, thus failing to receive supportive services.¹²⁹ The vision rehabilitation clinical team and the vision resource teacher (TSVI) in the child's school may collaborate to provide an assessment of visual performance and recommendations for devices, training, and accommodations. In the early grades, print size may be sufficient for the child to see, although the child will adopt a closer focal distance than normal. Children wearing a high myopic refractive correction may prefer to look over the top of their glasses or remove their glasses to read small print. As children progress to higher grades, visual access to teaching materials and print may require additional devices and strategies. Access to distance viewing in the classroom can be accomplished with a video magnifier. An interactive electronic smartboard, which allows digital entry and projection on a white board, combined with a tablet or laptop computer at the child's desk, can be used successfully by many children with visual impairment to view and interact with presentations. For distance spotting, a monocular telescope can be used, particularly if it is small enough to be used inconspicuously. Children may be reluctant to use some low-vision devices that draw attention from their peers yet embrace the use of technology that may be less stigmatizing, such as an iPad to view the blackboard rather than a monocular telescope. Print can be accessed with magnification or optical character recognition programs that will read text aloud.

It can be a challenge for children with vision impairment to learn to write. Video magnification will allow them to view their handwriting in real time. Using a dark felt-tip pen and paper with bold, high-contrast lines can also help. When children lean over the desk to read or write, a slant board can raise books and papers to improve posture. Early keyboarding should be encouraged to optimize computer accessibility options. Computer keyboards that are available in large-print display are preferred by some children with visual impairment. Electronic readers, tablet and laptop computers, and video magnifiers are important tools in a classroom or home setting for the child with low vision. Students with severe vision loss learn braille to enhance literacy. Refreshable braille, an electronic-mechanical device that physically displays output braille by means of rounded pins, can be useful on computer keyboards.

In general, children with low vision should receive preferential seating close to instruction in the classroom. If a significant head turn is noted, the teacher should generally be positioned opposite the direction of the head turn (e.g., a child with a marked left head turn should have the teacher or paraprofessional to the child's right side). Moreover, if a child has a visual field defect, she should be seated on the side of the classroom ipsilateral to the defect so that classroom materials may be viewed with the intact field. The child with photophobia should be seated with his or her back to the window and may benefit from tinted eyeglasses.

The needs of individual children differ, and an IEP is recommended to facilitate an educational environment appropriate for each child's visual needs. The IDEA (Part B) mandates that schools provide education in the "least restrictive environment" for the child. The ophthalmologist, the vision rehabilitation clinician, and the parents all need to advocate for the child to receive educational adaptations to facilitate learning, healthy peer relationships, and opportunities to engage in physical activity for social and emotional growth and development.

Teenager and Young Adult

Students in higher grades may become very self-conscious about using devices and large print. Technology options such as smartphones, tablet and laptop computers, and audio reading are often more acceptable.¹³⁰ In these grades, teachers should ensure that answer sheets for standardized tests are available in the preferred format (e.g., uploaded into tablet or computer, enlarged print, audio, or braille). When teenagers reach driving age, the ophthalmologist should address such additional issues as to whether the patient meets the state's requirements for a driving license, driving with a bioptic (eyeglass-mounted) telescope, what the local resources are for driving assessment and training for the visually impaired, and completing forms for a limited license. During the teenage years, children increasingly become their own advocate. Testing for colleges and universities may be modified for students with visual impairments, and most colleges and universities provide support for students with low vision or blindness.

GENERAL RECOMMENDATIONS

At any age, referrals to support networks specific to the child's diagnosis can be useful. Letters requesting referral for early-vision intervention or to qualify the child for vision services through the school are important and should include enough detail for service providers to have a complete picture of the child's visual impairment. Learning media assessment should be requested through the school to determine whether print or braille is the better approach for literacy.

In some cases of severe visual impairment, children learn best with braille, and in other cases a combination of print, audio, and braille learning may be used. These decisions are made by the educational team. Texts can be made available in an e-textbook format with text-enlarging and optical character recognition capability or in audio format. Test taking may require additional time, and the IEP can specify that tests be given in a separate room.

Protective eyeglasses are recommended; they may include correction of significant refractive errors and photochromic lenses or tinted lenses. Tinted contact lenses may be indicated for photophobia. Reversing the polarity (white print on black background) on a computer or a video magnifier can be helpful for the child who is photophobic or has poor contrast sensitivity. Use of a cap or visor pulled down low on the forehead or a brimmed hat can reduce photosensitivity. Sports and school physical education can be modified to ensure safety and participation. Children with vision impairment need strategies to learn to advocate for themselves in the educational arena. They should let the teacher know when they cannot see the visual target. In many situations, letting the other children know about their visual disability can reduce socially inappropriate comments.

SUMMARY

Visual rehabilitation of the child depends on age, the nature and degree of visual impairment, and other comorbid disabilities. Children with visual impairment have individual needs that typically require multiple adaptations in the classroom environment. The ophthalmologist can provide written documentation on the level and nature of visual impairment, the cause of reduced vision, and whether the condition is likely to progress. Documentation of a child as visually impaired is imperative, as the U.S. educational system is legally obligated to provide vision services. The combined efforts of the ophthalmologist, vision rehabilitation clinician, and the specialized vision teacher (TSVI) can all contribute to the modification of the school environment to facilitate learning. At planned follow-up visits the ophthalmologist can address subsequent needs at each developmental stage, ensure that eyeglass correction is accurate, provide new information about the cause and management of the child's specific visual impairment, make recommended changes to an IFSP or IEP, allow new technologies to be introduced, encourage the child to be a self-advocate, and continue to support the family.

To promote the evaluation and education of a child with visual impairment, children are considered to have low vision if their visual acuity cannot be corrected to 20/40 at both near and at distance, or have significant scotoma, visual field constriction, hemianopia, nyctalopia, color vision impairment, or other conditions (e.g., CVI) that interfere with vision. These children should have a clinical low-vision evaluation by a qualified ophthalmologist or optometrist trained and active in low-vision rehabilitation, receive prescribed optical devices and/or electronic video magnifiers (assistive technology), and be given educational instruction in the use of any prescribed devices. Assessments for determining a child's reading medium or media allow for the use of these devices. Learning media assessment should be undertaken to determine whether braille or print reading is most effective for the student.¹³¹ There should be emphasis on literacy, incidental learning by being able to visually access the environment, and computer competency.¹³² This will promote inclusion of these students into the general education curriculum and will maximize their ability to integrate into society and gain employment. There may be children with multiple disabilities and with deaf-blindness that requires special media and curricula, and the general curriculum may not be accessible.

INFORMATION RESOURCES

- ◆ American Association for Pediatric Ophthalmology and Strabismus (AAPOS) Low Vision Patient and Family Resource Information Sheet, <https://aapos.org/education/education-resources/pediatric-low-vision-education>
- ◆ Center for Patient Information and Resources, <http://www.parentcenterhub.org/>

- ◆ National Eye Institute; NEI for Kids, <https://nei.nih.gov/kids>; and eye health information, www.nei.nih.gov/health

APPENDIX 4. SYSTEMATIC REVIEWS OF EFFECTIVENESS OF VISION REHABILITATION

Guidelines increasingly rely on evidence syntheses to produce recommendations. Methodological innovation in this field has been largely guided by the GRADE Working Group, which, over the years, has developed a platform including software and methods to summarize the results of systematic reviews and grade the quality, or certainty, of the evidence.² The use of Summary of Findings tables to succinctly present effect estimates and the quality of the evidence supporting them has been endorsed by the Cochrane.¹³³

The World Health Organization (WHO) supports including data on functioning as a third health indicator in health information systems in addition to typical morbidity and mortality outcomes.¹³⁴ The WHO has undertaken work to enhance access to rehabilitation, particularly in low- and middle-income countries.¹³⁵ Despite the WHO prioritizing rehabilitation, evidence-based guidelines are still difficult to produce in the field of rehabilitation, and guideline panels and researchers struggle with both the complexity of rehabilitation interventions, and the limited number of randomized controlled trials in this field. Such trials are difficult to design and fund. Nonetheless, syntheses of the best available evidence should be generated by guideline developers.

Although it is acknowledged that this updated version of the PPP for vision rehabilitation cannot only be based on selected high-quality evidence, the aim is to summarize the findings of systematic reviews (SRs) that have dealt with vision rehabilitation interventions and have been published in the last 5 years.

Searches for SRs

We searched for SRs published from 2017–2021 using two approaches:

- 1) The Database of SRs maintained by the U.S. Satellite of Cochrane Eyes and Vision (CEV@US) was searched. It includes 4,786 SRs that had been previously selected as relevant to eyes and vision science and practice. These were first searched using the database label *vision rehabilitation* or any of the search terms in this appendix. A total of 964 SR titles were selected and those that were published in the period 2017–2020 were manually searched.
- 2) The American Academy of Ophthalmology conducted an updated search of literature using the strategy used to prepare the previous version of this PPP; review was limited to most-relevant searches and these identified 5,265 titles.

Titles were retrieved as full texts if they were relevant to vision rehabilitation interventions.

Systematic reviews were further assessed using the following nested questions:

- 1) Does the review summarise the *efficacy* of vision rehabilitation interventions? (All SRs fulfilling this criterion were included.)
- 2) Is the type of evidence of interest *qualitative* (e.g., description of organization and delivery of care) or *quantitative* (i.e., effects of interventions were investigated)?
- 3) Did the *quantitative synthesis* of the evidence have at least one estimate of effect, such as a difference or a ratio comparing the effects of two interventions, plus its uncertainty as 95%, or at minimum as a *P* value?
- 4) Was a *meta-analysis of effects* presented? (SRs fulfilling at least criterion 1 and 3 were reported in full, including quantitative estimates and, if available, the certainty of evidence for each statement.)

The methodological quality of included SRs reporting quantitative estimates (criteria 3 and 4) was assessed using the ROBIS tool.⁴⁸ All searches and assessments were conducted by one author and checked by another. Risk of bias was not assessed by authors of this appendix who were also authors of an included SR. The ROBIS domains and the supporting signalling questions are presented in Table A4-1 and the synthesis of the assessments is shown in Table A4-2.

Table A4-1. Signalling Questions Supporting Judgment in the ROBIS Bias Assessment Tool

Domain 1: Study Eligibility Criteria	
1.1	Did the review adhere to pre-defined objectives and eligibility criteria?
1.2	Were the eligibility criteria appropriate for the review question?
1.3	Were eligibility criteria unambiguous?
1.4	Were all restrictions in eligibility criteria based on study characteristics appropriate (e.g., date, sample size, study quality, outcomes measured)?
1.5	Were any restrictions in eligibility criteria based on sources of information appropriate (e.g., publication status or format, language, availability of data)?
Domain 2: Identification and Selection of Studies	
2.1	Did the search include an appropriate range of databases/electronic sources for published and unpublished reports?
2.2	Were methods in addition to database searching used to identify relevant reports?
2.3	Were the terms and structure of the search strategy likely to retrieve as many eligible studies as possible?
2.4	Were restrictions based on date, publication format, or language appropriate?
2.5	Were efforts made to minimize error in selection of studies?
Domain 3: Data Collection and Study Appraisal	
3.1	Were efforts made to minimize error in data collection?
3.2	Were sufficient study characteristics available for both review authors and readers to be able to interpret the results?
3.3	Were all relevant study results collected for use in the synthesis?
3.4	Was the risk of bias (or methodological quality) formally assessed using appropriate criteria?
3.5	Were efforts made to minimize error in risk of bias assessment?
Domain 4: Synthesis and Findings	
4.1	Did the synthesis include all studies that it should?
4.2	Were all predefined analyses reported or departures explained?
4.3	Was the synthesis appropriate given the nature and similarity in the research questions, study designs, and outcomes across included studies?
4.4	Was between-study variation (heterogeneity) minimal or addressed in the synthesis?
4.5	Were the findings robust (e.g., as demonstrated through funnel plot or sensitivity analyses?)
4.6	Were biases in primary studies minimal or addressed in the synthesis?

Note:

These signalling questions support the judgment made for each ROBIS domain. The worse level across domains is usually used to assign the concern for each domain.

TABLE A4-2. ROBIS Risk of Bias Assessment of Included Reviews

Review	Domain				Overall Risk of Bias of the Review
	#1: Study Eligibility Criteria	#2: Identification and Selection of Studies	#3: Data Collection and Study Appraisal	#4: Synthesis and Findings	
Van Nispen et al 2020 ⁵⁰	Low	Low	Low	Low	Low
Virgili et al 2018 ⁴⁹	Low	Low	Low	Low	Low
Elsman et al 2019 ¹²⁷	Low	Low	Low	Unclear	Unclear
Dillon et al 2018 ⁸⁹	Low	Low	High	High	High

Review	Domain				Overall Risk of Bias of the Review
	#1: Study Eligibility Criteria	#2: Identification and Selection of Studies	#3: Data Collection and Study Appraisal	#4: Synthesis and Findings	
Sweeting et al 2020 ⁹⁰	Low	Low	Low	Low	Low
E et al 2020 ⁹¹	Low	Low	Low	Low	Low
Silvestri et al 2021 ⁶⁴	Unclear	High	High	High	High
Liu et al 2019 ¹³⁶	High	Unclear	High	Low	High
Pollock et al 2019 ²⁰	Low	Low	Low	Low	Low
Health Quality Ontario 2017 ¹³⁷	Low	Low	Low	Low	Low

Results

We screened 425 titles of SRs on vision rehabilitation that were available in the CEV@US database and were published in the period 2017–2020. We also searched 5,265 titles (any study design) that were included in the updated Academy searches to select those SRs dealing with vision rehabilitation. We obtained 57 SRs in full text, of which 20 were vision rehabilitation intervention reviews aiming to assess effectiveness with a qualitative and/or quantitative synthesis. Eleven reviews were excluded because they only made qualitative summaries of the evidence; however, information from these reviews was included in the PPP narrative if relevant.

Finally, 10 intervention reviews that reported quantitative estimates of effects of interventions (listed in List A4-1) were included in the summary and are presented as follows.

List A4-1. Included Reviews with Quantitative Findings

Van Nispen et al 2020

van Nispen RM, Virgili G, Hoeben M, Langelaan M, Klevering J, Keunen JE, van Rens GH. Low vision rehabilitation for better quality of life in visually impaired adults. *Cochrane Database Syst Rev.* 2020 Jan 27;1(1):CD006543.

Virgili et al 2018

Virgili G, Acosta R, Bentley SA, Giacomelli G, Allcock C, Evans JR. Reading aids for adults with low vision. *Cochrane Database Syst Rev.* 2018 Apr 17;4(4):CD003303.

Elsman et al 2019

Elsman EBM, Al Baaj M, van Rens GHMB, Sijbrandi W, van den Broek EGC, van der Aa HPA, Schakel W, Heymans MW, de Vries R, Vervloed MPJ, Steenbergen B, van Nispen RMA. Interventions to improve functioning, participation, and quality of life in children with visual impairment: a systematic review. *Surv Ophthalmol.* 2019 Jul-Aug;64(4):512-557.

Dillon et al 2018

Dillon L, Clemson L, Ramulu P, Sherrington C, Keay L. A systematic review and meta-analysis of exercise-based falls prevention strategies in adults aged 50+ years with visual impairment. *Ophthalmic Physiol Opt.* 2018 Jul;38(4):456-467.

E et al 2020

E J-Y, Li T, McInally L, Thomson K, Shahani U, Gray L, Howe TE, Skelton DA. Environmental and behavioural interventions for reducing physical activity limitation and preventing falls in older people with visual impairment. *Cochrane Database of Systematic Reviews* 2020, Issue 9. Art. No.: CD009233.

Silvestri et al 2021

Silvestri V, Turco S, Piscopo P, Guidobaldi M, Perna F, Sulfaro M, Amore F. Biofeedback stimulation in the visually impaired: a systematic review of literature. *Ophthalmic Physiol Opt.* 2021 Mar;41(2):342-364.

Sweeting et al 2020

Sweeting J, Merom D, Astuti PAS, Antoun M, Edwards K, Ding D. Physical activity interventions for adults who are visually impaired: a systematic review and meta-analysis. *BMJ Open.* 2020 Feb 12;10(2):e034036.

Liu et al 2019

Liu KPY, Hanly J, Fahey P, Fong SSM, Bye R. A Systematic Review and Meta-Analysis of Rehabilitative Interventions for Unilateral Spatial Neglect and Hemianopia Poststroke From 2006 Through 2016. *Arch Phys Med Rehabil.* 2019 May;100(5):956-979.

Pollock et al 2019

Pollock A, Hazelton C, Rowe FJ, Jonuscheit S, Kernohan A, Angilley J, Henderson CA, Langhorne P, Campbell P. Interventions for visual field defects in people with stroke. *Cochrane Database Syst Rev.* 2019 May 23;5(5):CD008388.

Health Quality Ontario 2017

Health Quality Ontario. Retinal Prosthesis System for Advanced Retinitis Pigmentosa: A Health Technology Assessment Update. *Ont Health Technol Assess Ser.* 2017 Nov 6;17(13):1-62. PMID: 2920126

Risk of Bias of the included Reviews

The ROBIS tool was used to assess the risk of bias of included reviews listed in Table A4-2.

The van Nispen et al⁵⁰ and Virgili et al⁴⁹ Cochrane reviews were found to have low risk of bias for all ROBIS domains: 1) They adhered to predefined and adequate eligibility criteria with no restrictions; 2) The methods used to search the studies were broad and inclusive, with independent duplications; 3) Standard methods and independent duplications were used for data extraction and risk of bias assessment; 4) Appropriate meta-analysis methods were used and heterogeneity was accounted for (e.g., with sensitivity analyses, biases in primary studies were numerous, but they were incorporated in the result presentation and conclusions).

Elsman et al¹²⁷ used a review protocol and predefined methods for conducting the review, and we rated the first three ROBIS domains as low risk of bias (eligibility criteria, study selection, data collection and appraisal). This review extensively assessed risk of bias using the Cochrane risk of bias tool (first version) for randomized controlled trials and ROBINS-I for nonrandomized comparative studies. A very large number of comparisons with effect sizes were presented, but only approximate statistical significance (yes or no) was available, which made the risk of bias of syntheses and findings unclear due to insufficient reporting.

Dillon et al⁸⁹ assessed the effect of exercise-based interventions on physical outcomes and falls in individuals with vision impairment. This review updated the searches of a previous SR, thus methods were prespecified, which were also appropriate regarding the first two ROBIS domains. The review used the PEDro scale for risk of bias assessment, which we considered suboptimal since a sum score is produced. This scale has advantages since it was developed for physiotherapy, for a common rehabilitation modality, but it has only moderate agreement with the Cochrane risk of bias tool. Moreover, risk of bias was not incorporated in the description of the results and the conclusions.

Sweeting et al⁹⁰ also assessed the effect of physical activity interventions on physical outcomes, mental health, and falls in individuals with vision impairment. This SR used a study protocol and well-defined inclusion criteria and outcome measures, with no adequate study selection methods, no restrictions, and appropriate bias assessment. Meta-analyses and inference were also appropriate and all domains were rated as low risk of bias.

E et al⁹¹ investigated environmental and behavioural interventions to improve physical activity and reduce the risk of falls in older individuals with vision impairment. All four ROBIS domains were rated as low risk (eligibility criteria, study selection, data collection and appraisal, methods of analysis).

Silvestri et al⁶⁴ used appropriate inclusion criteria, but no review protocol was available, and the first two ROBIS domains were assessed as unclear. A customized risk of bias tool was used with no mention of its validation, hence, study appraisal was scored as high risk. No meta-analysis could be conducted. Risk of bias was not incorporated in the description of the results and the conclusions.

A review protocol was not available for Liu et al.¹³⁶ The authors acknowledged that a limitation of their review could be that it was restricted to studies published in English and because it used the PEDro scale for risk of bias assessment, which they suggested should be replaced with the Cochrane risk of bias tool.¹³⁸ In this review, risk of bias was correctly incorporated in the description of the results and the conclusions.

Pollock et al²⁰ used standard Cochrane methods and, although a meta-analysis was not possible, considerations on bias were incorporated in the results and conclusions, with low overall risk of bias.

Health Quality Ontario¹³⁷ used appropriate review methods for updating a previous technology assessment.

Reviews Assessing Methods for Enhancing Vision in Adults with Vision Impairment

Van Nispen et al⁵⁰ included 44 studies assessing several quality-of-life outcomes in adults with vision impairment, measured using validated questionnaires; health-related quality of life (HRQOL) or vision-related quality of life (VRQOL) were the primary outcomes. Interventions were grouped in four broad categories: 1) psychological therapies and group programs; 2) methods for enhancing vision; 3) multidisciplinary vision rehabilitation; 4) other programs.

Virgili et al⁴⁹ included 12 studies (11 of which used a within-person design) on the comparison of different reading aids in adults with vision impairment, with a primary focus on reading performance.

These two Cochrane reviews were rated as low risk of bias using the ROBIS tool.

Review comparing vision rehabilitation with no care/waiting list in adults: health-related and vision-related quality-of-life outcomes

The SR conducted by van Nispen et al⁵⁰ used the standardized mean difference (standardized mean difference [SMD], 95% CI presented as follows) in a way that negative differences favor the experimental vision rehabilitation arm. Using a rule-of-thumb, SMDs were interpreted as (Cohen's) effect sizes, where 0.2 represents a small effect, 0.5 represents a moderate effect, and 0.8 represents a large effect.

The authors found 5 studies (262 participants) comparing methods for enhancing vision with no care or waiting list. Interventions differed across studies and included vision rehabilitation such as immediate low-vision assessment, provision of magnifying aids and training, low-vision outpatient service, and customized prism glasses for fixation relocation (compared with placebo prism glasses). There was very low-quality evidence from these trials on vision rehabilitation benefits on VRQOL, with large imprecision (SMD, -0.19; 95% CI, -0.54 to 0.15).

There was very low-certainty evidence that multidisciplinary vision rehabilitation (2 trials with 183 participants) did not improve HRQOL (SMD, -0.08 SD, -0.37 to 0.21).

Two discordant trials (193 participants) were found on the effect of multidisciplinary vision rehabilitation on VRQOL. Both studies were beneficial, but a large effect in a trial delivering intensive rehabilitation (51 LOVIT trial) SMD, -1.64; 95% CI, -2.05 to -1.24) and less benefit in the other (SMD, -0.42; 95% CI: -0.90 to 0.07), $P = 0.0001$ for inconsistency).

Reviews comparing vision rehabilitation with usual care in adults: health-related and vision-related quality-of-life outcomes

In van Nispen et al,⁵⁰ very different vision rehabilitation services were compared with active controls or usual practice (Table A4-3).

Table A4-3. Summary of Results from the van Nispen et al Cochrane Review⁵⁰

Intervention	Comparator	Outcomes	No. of Participants (studies)	SMD with Low-Vision Rehabilitation	Certainty of the Evidence (GRADE)
Low-vision rehabilitation such as immediate low-vision assessment, provision of magnifying aids and training, low-vision outpatient service, and as appropriate customised prism glasses	Passive control group such as a waiting list, delayed low-vision assessment, low-vision examination and no intervention, and, when appropriate, placebo prisms	Vision-related quality of life measured with questionnaires: NEI-VFQ-25, VA-LV-VFQ48, Activity Inventory, IVI	262 (5 studies)	SMD -0.19 SDs (better) (-0.54 better to 0.15 worse)	⊕⊖⊖⊖ VERY LOW Downgraded for risk of bias and serious imprecision
Low-vision rehabilitation such as video magnifier (CCTV) training sessions from a low-vision therapist, home-based low-vision rehabilitation, low-vision devices with instruction, usual comprehensive vision rehab and access to desk top video magnifier, video magnifier and training, low-vision support service, nonportable and portable electronic devices	Active control group such as video magnifier instructions from supplier, clinic-based low-vision rehabilitation, low-vision devices without instruction, usual comprehensive vision rehab without access to desk top video magnifier, eccentric viewing training, placebo support by a nurse, nonportable devices only	Health-related quality of life measured with EQ-5D, SF-36	443 (2 studies) Short-term maintenance effect	SMD -0.09 SD (better) (-0.28 to 0.09)	⊕⊖⊖⊖ VERY LOW Downgraded for risk of bias and serious imprecision
		Vision-related quality of life measured with questionnaires: VISQOL, LVQOL subscales, VA-LV-VFQ-48, VFQ-25, Activity Inventory, IVI	660 (7 studies) Short-term direct or maintenance effect	SMD -0.24 SD (better) (-0.40 to -0.08)	⊕⊕⊕⊖ MODERATE Downgraded for risk of bias
Multidisciplinary low-vision rehabilitation such as multidisciplinary low-vision programme plus home visit	Passive control group such as a waiting list	Vision-related quality of life measured with questionnaires: VA-LV-VFQ48	Two studies (193 patients) beneficial: large effect in a large trial delivering intensive rehabilitation (Stelmack 2008 ⁵¹ : SMD, -1.64; 95% CI, -2.05 to -1.24) and less benefit in the other (Acton 2016 ¹³⁹ : SMD, -0.42; 95% CI, -0.90 to 0.07), <i>P</i> = 0.0001 for inconsistency		⊕⊖⊖⊖ VERY LOW Downgraded for risk of bias, serious imprecision, and inconsistency between trials
		Health-related quality of life measured with EQ-5D, SF-36	183 (2 studies)	SMD -0.08 SD (better) (-0.37 to 0.21) Short-term direct or maintenance effect	⊕⊖⊖⊖ VERY LOW Downgraded for risk of bias and serious imprecision

Intervention	Comparator	Outcomes	Nº of participants (studies)	SMD with low-vision rehabilitation	Certainty of the evidence (GRADE)
Multidisciplinary low-vision rehabilitation such as pooled community with center- and community-based low-vision service delivery, family rehabilitation intervention where family is present at all stages, enhanced low-vision rehabilitation including home visits	Active control group such as community placebo home visits, individual rehabilitation intervention with no family present, conventional low-vision rehabilitation and control home visits from a community worker with no rehabilitation, conventional clinic-based low-vision rehabilitation including placebo home visits	Health-related quality of life measured with WHO-QOL, SF-36	375 (2 studies)	SMD -0.10 SD (better) (-0.31 to 0.12)	⊕⊖⊖⊖ VERY LOW Downgraded for risk of bias and serious imprecision
		Vision-related quality of life measured with IVI, FAQ, VCM1	464 (3 studies)	SMD 0.01 SD (same) (-0.18 to 0.20)	⊕⊕⊖⊖ LOW Downgraded for risk of bias and imprecision

Adapted from van Nispen RMA, Virgili G, Hoeben M, Langelaan M, Klevering J, Keunen JEE, van Rens GHMB. Low vision rehabilitation for better quality of life in visually impaired adults. Cochrane Database of Systematic Reviews 2020, Issue 1. Art. No.: CD006543.

CCTV = closed-circuit TV; FAQ = functional assessment questionnaire; IVI = impact of visual impairment profile; SMD = standardized mean difference; VISQOL = vision-related quality of life; LVQOL = low vision quality of life questionnaire; VCM1 = vision-related quality of life Core Measure -1; WHO-QOL = World Health Organization-Quality of Life

Comparisons of methods for enhancing vision were as follows:

- Vision rehabilitation with video magnifier CCTV training sessions from a low-vision therapist versus video magnifier CCTV instructions from supplier
- Home-based vision rehabilitation versus clinic-based vision rehabilitation
- Low-vision devices with instruction versus low-vision devices without instruction
- Usual comprehensive vision rehabilitation with versus without access to desktop video magnifier CCTV and training
- Low-vision support service versus placebo support by a nurse
- Low-vision devices with a rehabilitation therapist providing instruction and homework on the use of low-vision devices, eccentric viewing, and environmental modification versus receiving low-vision devices with no therapist instruction
- Portable electronic video magnifier device in addition to (nonelectronic) optical devices versus optical devices only

There was very low certainty evidence (2 trials with 443 participants) that methods for enhancing vision did not improve HRQOL compared with usual care (SMD, -0.09 SD; 0.28 to 0.09).

There was moderate certainty evidence (7 trials with 660 participants) that methods for enhancing vision slightly improved VRQOL compared with usual care (SMD, -0.24 SD; -0.40 to -0.08).

Multidisciplinary vision rehabilitation was adopted in 3 studies with the following comparisons:

- Vision rehabilitation delivered as center- and community-based low-vision service delivery versus community placebo home visits
- Family rehabilitation intervention where family is present at all stages versus individual rehabilitation intervention with no family present
- Enhanced vision rehabilitation including home visits versus conventional vision rehabilitation and control home visits from a community worker with no rehabilitation or conventional clinic-based vision rehabilitation including placebo home visits

There was very low or low-certainty evidence (two trials, 375 participants) that multidisciplinary vision rehabilitation, including methods for enhancing vision, did not improve HRQOL (SMD, -0.10; SD, -0.31 to 0.12) or VRQOL (3 trials, 464 participants) (SMD, 0.01; SD, -0.18 to 0.20).

Reviews comparing different methods for enhancing vision in adults: reading performance outcomes

The evidence summarized in Virgili et al⁴⁹ mostly came from a single small study for each comparison. In short, the following findings were reported:

- 1) Low-certainty evidence with large imprecision was found in one study (70 participants, published 2003) that a stand-mounted video magnifier CCTV was not better than an optical device in terms of reading speed (46 wpm more, -26 to 65 wpm), but moderate certainty evidence was found that the video magnifier improved reading duration (14 minutes, 8 to 20 minutes).
- 2) In the same study (70 participants), a mouse-based video magnifier device with a 14-inch monitor improved reading speed (41 wpm, 24 to 57 wpm) and duration (13, 9 to 16 min) with moderate certainty evidence.
- 3) In one study (100 participants, published 2017), a hand-held video magnifier electronic device did not improve reading speed compared with an optical device (1.7 wpm, -7.24 to 3.8 wpm), with moderate certainty evidence.
- 4) In one study (37 participants, published 2017), low-certainty evidence was found that a stand-mounted video magnifier CCTV added to vision rehabilitation may improve reading speed (34 wpm, 4 to 63 wpm).
- 5) Three trials (93 participants, published 1999 to 2003) compared a stand-mounted video magnifier with a head-mounted electronic device and found low-certainty evidence of no difference in reading speed (3 wpm, -4 to 10 wpm).

- 6) Two trials (92 participants, published 2001 to 2003) compared a stand-mounted with a hand-held, mouse-based electronic video magnifier device and found low-certainty evidence of no difference in reading speed (10 wpm, -0.3 to 20 wpm). Only one study (22 participants) measured reading duration and found no significant increase (1 min, -4 to 6 min).
- 7) One trial (100 participants) compared a tablet (iPad Air; 9.7" display, version 2013) with a stand-based video magnifier CCTV and found low-certainty evidence of no difference, with large imprecision (2.8 wpm, -53.1 to 58.7).
- 8) Finally, in one trial on 150 participants with age-related macular degeneration (2005), custom prisms for fixation relocation did not improve reading speed compared with conventional spectacles (-6 wpm, -25 to 13 wpm).

A limitation of this evidence is that several of the electronic devices were produced many years ago, and this technology has been modified and improved in recent years.

Reviews assessing various interventions in adults: effects on mental health outcomes

Two reviews reported on the effects of various interventions on mental health outcomes in adults with vision impairment. As reported above, van Nispen et al⁵⁰ collected data on the effect of psychological therapies, methods for enhancing vision, multidisciplinary vision rehabilitation, and other interventions using questionnaires targeted at HRQOL, VRQOL, and other outcomes such as activities of daily living, depression, self-esteem, and adaptation to vision loss.

In reporting mental health data, the focus is on depression, which is recognized to be a major comorbidity in older adults and is twice as common in those with vision impairment;¹⁴⁰ only van Nispen et al⁵⁰ is summarized here since it is more recent and good quality.

Van Nispen et al⁵⁰ found moderate certainty evidence of a large but imprecise effect of psychological therapies and/or group programs versus waiting list or no care in 5 trials (456 participants): -1.23 [-2.18, -0.28]. This effect was smaller but significant after the exclusion of one outlying study. Interventions ranged from group-based cognitive behavioural therapy to self-management programs. Methods for enhancing vision (including reading self-training or provision of magnifying aids versus no care) also improved depression in two small trials (44 participants; -0.86, -1.50, -0.23, very low-certainty evidence). Multidisciplinary VR (vs. no care) had no effect on depression in two trials (193 participants; -0.16, -0.44 to 0.13, very low-certainty evidence).

A small but consistent effect on depression, with moderate certainty evidence, was also found in 9 trials (1334 participants) comparing several psychological interventions, ranging from self-management programs to Problem-Solving Therapy, with active control or usual care (-0.14, -0.25 to -0.04). No evidence of an effect, with large imprecision and very low certainty, was found for methods for enhancing vision (video magnifier CCTV training program vs. supplier's training, eccentric viewing training in addition to home training with video magnifier CCTV, or video magnifier CCTV provision in addition to optical aids; three trials, 162 participants: -0.22, -0.59 to 0.15).

Reviews of Vision Rehabilitation in Children with Vision Impairment

Elsman et al¹²⁷ summarized the evidence on interventions to improve functioning, participation, and quality of life in children with visual impairment. They reported results of a large number of different interventions from individual studies, including randomized controlled trials and nonrandomized controlled trials. Summarising these results is difficult because of the vast number of outcomes presented and also because significance is reported descriptively (yes/no) without presenting 95% CIs or at least *P* values. This review was rated as unclear risk of bias using the ROBIS tool.

This SR included 28 randomized controlled trials, 18 nonrandomized controlled trials, and 20 before-after comparisons. The authors conclude that “the results suggest that sports camps, prescription and training in the use of low-vision devices, and oral hygiene programs might be effective in improving functioning and elements of participation and quality of life in children with visual impairment, whereas other interventions showed mixed or negative results.” They observed that heterogeneity of results and the use of over 50 different outcome measures prevented a meta-analysis and suggested

that results should be interpreted with caution because of moderate to high risk of bias and insufficient reporting.

Reviews Assessing Prevention of Falls in Adults with Vision Impairment

Dillon et al⁸⁹ assessed the effect of exercise-based interventions on physical outcomes and falls in individuals with vision impairment.

Dillon et al⁸⁹ found seven RCTs, of which six had good methodological quality and that assessed the effect of various exercise programs such as the Otago program, the Alexander technique, Tai Chi, Ashtanga-based yoga, and multimodal exercise. They found consistent evidence for improvement in physical function in three studies using very different physical outcomes, which are difficult to summarize here. They also found no effect on the risk of falls in three trials (RR: 1.05, 0.73 to 1.50). A description of these trials is beyond the scope of this summary.

This review was rated as high risk of bias with the ROBIS tool (Table A4-2).

Sweeting et al⁹⁰ also assessed the effect of physical activity interventions on physical outcomes, mental health, and falls in individuals with vision impairment. They also found evidence, with estimates not reaching significance, that physical outcomes were improved using three indicators of performance; two of three studies were low risk of bias in these analyses. No meta-analysis was possible for other outcomes.

E et al⁹¹ investigated the effects of environmental (home safety modification by occupational therapists) and behavioural interventions (exercise) on physical outcomes and falls on older adults with VI and included six RCTs (686 participants). They did not carry out meta-analyses because interventions and outcomes were considered too different. They found two studies providing low-certainty evidence that changes to the home may make little to no difference to physical activity, fear of falling, or quality of life, at 6 months, but may slightly reduce risk of falling after one year. Six studies comparing exercise versus usual activities or home visits suggested that exercise may make little to no difference to physical activity, risk of falling, fear of falling, or quality of life after six months, with low-certainty evidence.

The differences in the results among these reviews may be due to partly overlapping included studies, different inclusion criteria and year of searches, different decisions on similarity of the interventions and meta-analyses, and different interpretations of the evidence. Overall, they suggest that no high-quality evidence is available on strategies to reduce falls and increase physical activity in older individuals with VI.

Review of the Effect of Biofeedback in Patients with Vision Impairment

Silvestri et al⁶⁴ included 25 full-text studies and 18 conference proceeding abstracts that addressed the efficacy of biofeedback in adults with vision impairment. They reported that visual acuity improved in 15 (60%) studies, reading acuity in four (16%) and reading speed in 15 (60%), only two of which were controlled studies, one of which was a randomized controlled trial with inactive controls, whereas the others were before/after studies. Both of these two studies recorded an improvement with large imprecision, reaching borderline significance in one. No meta-analysis was conducted. The quality of these two studies was found to be high, but a nonvalidated customized quality instrument was used. Benefits were also recorded on fixation stability and other outcomes not considered in this review.

This review was rated as high risk of bias with the ROBIS tool.

Reviews Assessing Interventions for Vision Defects in Stroke Patients

Pollock et al²⁰ and Liu et al¹³⁶ investigated vision rehabilitation in patients with visual defects due to stroke. The results of these reviews were inconsistent.

Liu et al¹³⁶ included 20 randomized controlled trials for unilateral spatial neglect (USN) and five for hemianopia, involving 594 and 206 stroke participants, respectively. Encouraging results were found in relation to activity-based interventions for visual scanning training and compensatory training for hemianopia (mean difference 5.11, 0.83 to 9.4) on visual outcomes, and optokinetic stimulation and smooth pursuit training for USN (0.49, 0.01-0.97) on functional performance in activities of daily living (0.96, 0.09 to 1.82) on neglect. This review was rated as high risk of bias with the ROBIS tool.

Pollock et al²⁰ also included 20 RCTs (involving 547 stroke participants) but found that only two studies presented data on effects on stroke survivors' abilities in activities of daily living. They concluded that there was insufficient evidence to draw any conclusions about the effectiveness of the rehabilitation interventions compared with control. They found low-quality or very low-quality evidence that scanning training may help improve quality of life, with no effect on other outcomes (including adverse events). There was low-quality or very low-quality evidence that sector prisms may have an effect on ability to look for objects but could cause minor, but frequent, adverse events (e.g., headache) with effect on other outcomes. This review was rated as low risk of bias with the ROBIS tool.

Reviews Assessing Retinal Prosthesis in Individuals with Very Severe Vision Impairment

Health Quality Ontario¹³⁷ published a health technology assessment on cost-effectiveness of the Argus II implant in patients with retinitis pigmentosa. Based on four studies assessing visual function (direction of motion, object localization, grating visual acuity) with the implant on versus off, they reported the percentage of patients who performed significantly better for the tasks. They observed that no patient could reach vision of 2.9 logMAR or better with the system on. Based on evidence of moderate quality, they concluded that the Argus II retinal prosthesis system significantly improved visual function, real-life functional outcomes, and quality of life in patients with profound vision loss from advanced retinitis pigmentosa. The fact that Argus II is no longer commercially available is a limitation of this evidence.

APPENDIX 5. THE ACADEMY'S VISION REHABILITATION PATIENT HANDOUT

American Academy of Ophthalmology Vision Rehabilitation Patient Handout

To locate services in your area, contact the
 APH Directory of Services: aphcareerconnect.org/directory/results

MAKING THE MOST OF REMAINING VISION

If you are having difficulty with things such as reading, using your cell phone, or doing daily tasks, this Patient Handout can help with tips and resources. There are many new technologies that are of great assistance to people with low vision. Cell phone cameras can magnify, you can send texts by voice, smart speakers can tell you the time, and smartphone applications can read aloud for you or help you identify objects and colors. Losing vision does not mean giving up your activities, but it may mean learning new ways to do them.

Patterns of Vision and Vision Loss

- ◆ **Central vision** is the detailed vision we have when looking directly at an object. Macular degeneration affects central vision.
- ◆ **Peripheral vision** is the less detailed vision we have for everything we are not looking directly at. Glaucoma and retinitis pigmentosa typically affect peripheral vision first. Strokes can affect one side of peripheral vision. Diabetic retinopathy can affect central or peripheral vision.
- ◆ **Contrast sensitivity** is the ability to see shades of gray or items that are similar in color. Reduced contrast sensitivity can make it difficult to see steps or read newsprint.

The Experience of Vision Loss

It is important to acknowledge the anxiety, frustration, or sadness you may feel upon learning that your vision loss is irreversible. You can live well with low vision but you cannot live well with depression. Counseling and a peer support group can help you recognize that your value to yourself and others does not depend on your vision and that you are worth the effort it takes to learn to make the most of the vision you have.

The Phantom Vision of Charles Bonnet Syndrome

More than 20% of people with vision loss see repeated lifelike images that they know are not real. This is called Charles Bonnet syndrome. See <https://www.aao.org/eye-health/diseases/what-is-charles-bonnet-syndrome>

Making the Most of Remaining Vision

Using Your "Next-Best Spot"

If there is a blind spot (scotoma) in the center of your vision, you will use the vision outside the center to see objects (the preferred retinal locus). You will require magnification, and vision rehabilitation can assist you to use your remaining vision optimally.

Make Things Brighter

- ◆ **Improve lighting.** Use a task lamp and carry a pocket flashlight.
- ◆ **Reduce glare.** While indoors, cover shiny counters. Try yellow, amber, or plum tinted eyeglasses or clip-ons. Visors are useful.
- ◆ **Increase contrast.** Use a black felt-tipped pen, not a ballpoint. Draw a dark line where you need to sign. Use a white cup for coffee and a dark cup for milk.

Make Things Bigger

- ◆ **Move closer.** Sit close to the TV and up front at performances.
- ◆ **Enlarge.** Large-print checks, playing cards, bingo cards, crosswords, calendars, and books are available. Use larger-format phones, TV remotes, and keyboards.
- ◆ **Magnify.** Get an e-reader or electronic tablet for books. Use a lighted handheld magnifier for price tags and menus, and a stand magnifier or video magnifier for reading printed text. The camera on your cell phone can magnify.

Organize

- ◆ Designate a spot for everything. Minimize clutter.

Label

- ◆ Mark dials with tactile fabric paint or raised dots. Label medications with markers or rubber bands. Safety-pin the labels of similar-colored clothing.

Substitute: Let's Hear It for Ears!

Get books and magazines in audio format. Get a talking watch, calculator, glucometer, or audio labels. Audio screen readers allow you to listen to your computer or your cell phone and free cell phone applications can read text aloud. (See the Resources section of this appendix.)

Participate

Don't isolate yourself. Keep your social group, volunteer job, golf, or bowling. You might need large print, a magnifier, a ride, or someone to spot your ball, so ask for the help you need. If you have difficulty recognizing others, you can wait until they get closer, or tell them that you can't see them. Staying home to avoid asking for help is not independence. Friends are honored to be asked.

Driving and Alternative Transportation

If driving, pick your times and routes carefully or use GPS. If driving is difficult, cars appear unexpectedly, drivers honk at you, or you are having fender-benders, consider transportation alternatives. Sell your car and with the money you are saving by not paying car insurance take a taxi or car-sharing services, buy gas for a friend who drives, or hire a part-time driver. Try a 3-wheel bike or electric scooter. Walk when you can.

For Family and Friends

To keep up their spirits, your loved ones need to be empowered to do as much as possible independently. Recognize the challenge of vision loss and offer help, but don't take over their tasks. Instead, help them make the adaptations necessary to accomplish them on their own.

RESOURCES

Audio books, magazines, news, and textbooks:

- ◆ American Printing House for the Blind: 1-800-223-1839, www.aph.org
- ◆ Audio Bibles for the Blind (search "audio bibles" on the internet)
- ◆ Choice Magazines (bimonthly articles, unabridged): 1-888-724-6423, www.choicemagazinelistening.org
- ◆ National Federation of the Blind, NFB-NEWSLINE news by phone: 866-504-7300, www.nfb.org
- ◆ Talking Books Program of the National Library Service: 1-800-424-8567, www.loc.gov/nls
- ◆ Public libraries in Canada (celalibrary.ca) and the United States

Large-print and braille books:

- ◆ Read larger text on your e-reader, tablet, or computer
- ◆ Large print books are available in public libraries
- ◆ Large print or braille faith-based texts are available (e.g., braille Bible, braille Qu'ran, www.islambytouch.com)

Other large-print materials – checks, calendars, address books, crosswords, playing cards, bingo cards, phones, keyboards:

- ◆ American Printing House for the Blind, Inc.: 1-800-223-1839, www.aph.org
- ◆ Deluxe Check Printers, Inc.: 1-800-342-1500, large print bank checks
- ◆ Independent Living Aids: 1-800-537-2118, www.independentliving.com
- ◆ Learning Sight & Sound (LS&S): 1-800-468-4789, <https://lssproducts.com/>
- ◆ MaxiAids: 1-800-522-6294, www.maxiaids.com

Technology – computers:

Both Windows and Apple computers have many features built into the operating systems to assist patients with low vision to use their computer.

- ◆ Apple Accessibility: 1-877-204-3930, www.apple.com/accessibility, www.applevis.com
- ◆ [Apple accessibility courses: http://hadley.edu](http://hadley.edu)
- ◆ Computers for the Blind (CFTB): www.computersfortheblind.net
- ◆ Magnification computer software: Zoomtext, <https://www.freedomscientific.com/products/lowvision/>
- ◆ Microsoft Accessibility support: 1-800-936-5900, www.microsoft.com/en-us/accessibility
- ◆ Dictation with speech-to-text: available for computers

Technology – cell phones:

Both Android and iPhones have many accessibility features, including magnification and audio accessibility options

- ◆ Use voice assistance (e.g. SIRI for iPhones) to dial a phone number, dictate a text, or search the internet
- ◆ Use your cell phone or iPad camera to photograph and enlarge images, such as menus in restaurants or prices
- ◆ Use applications that convert text-to-speech (e.g., Seeing AI [free]), KNFB Reader [fee]) www.knfbreader.com

Technology – other:

- ◆ Smart speakers (e.g., Google Home or Alexa) offer voice assistance for many tasks such as dialing calls or internet information

Technology information:

- ◆ American Foundation for the Blind *AccessWorld*® Magazine: www.afb.org/aw
- ◆ YouTube – *The Blind Life* (video), <https://www.youtube.com/c/theblindlife>
- ◆ Ophthalmicedge.org, <https://ophthalmicedge.org/>
- ◆ List of video magnifier products and descriptions, <https://www.afb.org/blindness-and-low-vision/using-technology/assistive-technology-products/video-magnifiers>

National organizations for support, information, and research updates:

- ◆ American Diabetes Association: www.diabetes.org
- ◆ American Foundation for the Blind: 1-800-AFB-LINE (1-800-232-5463), www.afb.org
- ◆ American Macular Degeneration Foundation: www.macular.org
- ◆ Centers for Disease Control and Prevention (CDC): Fall prevention brochure, www.cdc.gov/HomeandRecreationalSafety/pubs/English/brochure_Eng_desktop-a.pdf
- ◆ Clinical trials: <http://clinicaltrials.gov>
- ◆ Glaucoma Research Foundation: 1-800-826-6693, www.glaucoma.org
- ◆ Hadley School for the Blind online courses: 1-800-323-4238, www.hadley.edu
- ◆ Macular Degeneration Foundation 1-888-633-3937: www.eyesight.org/
- ◆ MD Support: Support group list and video (*Learning to Live with Low Vision*), 1-816-761-7080 (toll call), www.mdsupport.org
- ◆ National Eye Health Education Program (English and Spanish): www.nei.nih.gov/nehep
- ◆ Vision Aware: www.visionaware.org

Pediatric and youth resources:

- ◆ American Association for Pediatric Ophthalmology and Strabismus (AAPOS)
Low Vision Patient and Family Resource Information Sheet:
<https://aapos.org/education/education-resources/pediatric-low-vision-education>

To locate vision rehabilitation services in your area:

- ◆ APH Directory of Services: <https://aphcareerconnect.org/directory/results>
Ask if services include a vision rehabilitation consultation with a medical doctor or optometrist; device recommendations; devices for loan; rehabilitation training for reading, writing, shopping, cooking, lighting, glare control; home assessment; mobility training; support groups.
Ask about cost: Is it free, billed to insurance, or other? Medicare covers most services but not devices.
- ◆ Eligible Veterans: Contact U.S. Department of Veterans Affairs, 1-877-222-8387, www.va.gov/blindrehab

To view this handout in larger print, visit the Academy's Initiative in Vision Rehabilitation page, www.aao.org/low-vision-and-vision-rehab

APPENDIX 6. OCCUPATIONAL THERAPY FOR PATIENTS WITH VISION LOSS*

INTRODUCTION

Occupational therapy focuses on enabling persons with impairments to participate in their desired daily “roles, habits, and routines in the home, school, workplace, community and other settings.”¹⁴¹ For individuals with vision impairment, the occupational therapist helps them to develop skills and strategies to use remaining vision as effectively as possible to complete their daily occupations. Occupational therapists typically provide medically based rehabilitation services that are reimbursed by Medicare and other medical insurance.

OCCUPATIONAL THERAPY EVALUATION

The rehabilitation process begins with evaluation. The primary purpose of the occupational therapy evaluation is to develop an intervention plan that will lead to optimal patient outcomes. The therapist determines the patient’s current ability to complete desired and necessary activities of daily living and identifies the multiple factors that may influence the patient’s performance, including visual, physical, cognitive, psychosocial, and environmental. The therapist uses assessments to identify the client’s strengths and weaknesses in completing daily occupations. This information is then used to set explicit achievable goals in collaboration with the patient and develop a tailored intervention plan that will enable the patient to participate fully in desired activities.

OCCUPATIONAL THERAPY INTERVENTION

Intervention incorporates any or all of the following:

- ◆ Modification of the environment and task to enhance safety and enable the patient to complete desired and needed daily activities. Modifications include enhancing lighting, contrast and organization; minimizing pattern and glare; and removing potential hazards to reduce risk of falls or injury.
- ◆ Modifications to enable independence that allows patients to manage themselves and occupations in their home such as self-care, cooking, cleaning, financial management, and yard and home maintenance
- ◆ Modifications to enable participation in valued leisure and social activities to decrease risk for depression and isolation
- ◆ Modifications to enable engagement in activities that promote health and well-being, including physical activity (e.g., walking, swimming, yoga) and exercise
- ◆ Training in strategies and modifications to enable safe and accurate medication management and devices used to monitor medical conditions (e.g., glucose level, blood pressure, diet, weight)
- ◆ Visual-skills training to enhance the ability to compensate for vision loss and use remaining vision more effectively for daily activities. Training includes the ability to use the preferred retinal location for reading and visual scanning to compensate for peripheral field loss.
- ◆ Training in strategies to improve reading accuracy and fluency as well as handwriting legibility
- ◆ Training to use optical devices and assistive technology (e.g., electronic readers) to complete specific daily tasks
- ◆ Training to use non-optical devices to complete specific daily tasks
- ◆ Modifications of smartphone and computer settings to facilitate access to these devices; training to use applications, software, and hardware applications to enable the patient to use digital media to complete daily occupations
- ◆ Guidance on safe functional mobility within the home and for undertaking activities of daily living in the community, such as shopping or attending social functions. Occupational therapists do not address street crossing or outdoor mobility; this requires the skill set of an orientation mobility specialist. (Orientation and mobility training is not reimbursed by Medicare.)
- ◆ Driver evaluation and training, when appropriate, or assistance in transitioning to driving retirement. (Driver training is not reimbursed by Medicare.)

- ◆ Access to community resources, such as audio books, radio reader services, and transportation services
- ◆ Assessment and modification of the workplace
- ◆ Education for the caregiver to enable the patient and caregiver to work together to maximize independence and participation
- ◆ Referral to additional services as indicated in consultation with the ophthalmologist and rehabilitation team. These include state services for the blind and visually impaired, Veteran's Administration services, orientation and mobility services, physical therapy, hearing rehabilitation services, psychology or psychiatric services, and support groups or aging community service agencies.

VISION REHABILITATION AND OCCUPATIONAL THERAPY FOR PATIENTS WITH HEMIANOPIA OR OTHER NEUROLOGICAL DISEASES

Homonymous hemianopia is a commonly occurring visual deficit associated with central nervous system pathology such as stroke or traumatic brain injury. Affected individuals may or may not be aware of their deficit(s). It can significantly limit reading performance and visual search and scanning of the environment, which subsequently impairs safe mobility and the person's ability to complete many daily occupations.¹⁴² Occupational therapists address the limitations in daily activities that the patient experiences because of the field loss or neglect. Reading limitations may be addressed using assistive technology and/or training to improve the person's adaptation to the shortened reading perceptual span created by the field deficit. Occupational therapists also train the patient to use compensatory scanning strategies combined with environmental and task modification to complete occupations that require interaction with a broad visual field as needed in driving, shopping, and other community activities.²⁰

Occupational therapists also provide intervention to patients experiencing limitations in daily occupations due to vision impairment from neurodegenerative diseases, such as Parkinson's disease, multiple sclerosis, and visual impairment occurring with concussion. The occupational therapist will help the patient to adjust to light sensitivity, reduced accommodation, decreased contrast sensitivity, and other visual limitations caused by these conditions. In all cases, the occupational therapy intervention includes modifying both task and environment to enhance the person's ability to complete daily activities.

* With acknowledgement to Anne Riddering PhD, OTR/L, CLVT, COMS, representing the American Occupational Therapy Association, who contributed information to this appendix.

APPENDIX 7. LITERATURE SEARCHES

Literature searches of the PubMed database were conducted in July 2021; the search strategies were as follows. The searches had added filters for clinical trials and comparative studies. A comprehensive search produced 8391 studies of which 33 were included in the PPP.

((("vision disorders"[MeSH Terms]) OR ("vision, low"[MeSH Terms])) AND ("rehabilitation"[MeSH Terms] OR rehabilitation[tiab]) OR ((("vision disorders"[MeSH Terms]) OR ("vision, low"[MeSH Terms])) AND ("occupational therapy"[MeSH Terms]) OR ("visually impaired persons"[MeSH Terms]) AND ("rehabilitation"[MeSH Terms]) OR ("vision, low/psychology"[MAJR]) OR ("vision, low/rehabilitation"[MAJR]) OR ("visually impaired persons/rehabilitation"[MeSH Terms]) OR ("visually impaired persons/psychology"[MeSH Terms]))

Driving: ("automobile driving"[MeSH Terms]) OR ((automobile[tiab] OR vehicle[tiab] OR car[tiab]) AND (driving[tiab] OR drive[tiab] OR operate[tiab] OR operating[tiab]))
"vision loss"[tiab] OR "low vision"[tiab] OR "vision rehabilitation"[tiab] OR "vision disorders"[mh] OR "vision, low"[mh] OR vision, low/rehabilitation[mh] OR "visually impaired persons"[mh] OR visually impaired persons/rehabilitation[mh] OR vision disorders[mh] OR vision disorders/rehabilitation[mh]

Falls: "accidental falls"[mh] OR falls[tiab]
"vision"[tiab] OR "vision loss"[tiab] OR "low vision"[tiab] OR "vision rehabilitation"[tiab] OR "vision disorders"[mh] OR "vision, low"[mh] OR vision, low/rehabilitation[mh] OR "visually impaired persons"[mh] OR visually impaired persons/rehabilitation[mh] OR vision disorders[mh] OR vision disorders/rehabilitation[mh]

Hallucinations: Hallucinations[mh] OR hallucinations[tiab]
"vision"[tiab] OR "vision loss"[tiab] OR "low vision"[tiab] OR "vision rehabilitation"[tiab] OR "vision disorders"[mh] OR "vision, low"[mh] OR vision, low/rehabilitation[mh] OR "visually impaired persons"[mh] OR visually impaired persons/rehabilitation[mh] OR vision disorders[mh] OR vision disorders/rehabilitation[mh]

Reading: Reading[mh] OR "reading"[tiab]
"vision"[tiab] OR "vision loss"[tiab] OR "low vision"[tiab] OR "vision rehabilitation"[tiab] OR "vision disorders"[mh] OR "vision, low"[mh] OR vision, low/rehabilitation[mh] OR "visually impaired persons"[mh] OR visually impaired persons/rehabilitation[mh] OR vision disorders[mh] OR vision disorders/rehabilitation[mh]

Vision/Optical Devices: "vision devices"[tiab] OR optical devices[mh] OR sensory aids[mh]
"vision"[tiab] OR "vision loss"[tiab] OR "low vision"[tiab] OR "vision rehabilitation"[tiab] OR "vision disorders"[mh] OR "vision, low"[mh] OR vision, low/rehabilitation[mh] OR "visually impaired persons"[mh] OR visually impaired persons/rehabilitation[mh] OR vision disorders[mh] OR vision disorders/rehabilitation[mh]

Contrast Sensitivity: contrast sensitivity[mh] OR (contrast[tiab] AND sensitivity[tiab])
"vision"[tiab] OR "vision loss"[tiab] OR "low vision"[tiab] OR "vision rehabilitation"[tiab] OR "vision disorders"[mh] OR "vision, low"[mh] OR vision, low/rehabilitation[mh] OR "visually impaired persons"[mh] OR visually impaired persons/rehabilitation[mh] OR vision disorders[mh] OR vision disorders/rehabilitation[mh]

Microperimetry: ("micro perimetry"[tiab]) OR "microperimetry"[tiab]
"vision"[tiab] OR "vision loss"[tiab] OR "low vision"[tiab] OR "vision rehabilitation"[tiab] OR "vision disorders"[mh] OR "vision, low"[mh] OR vision, low/rehabilitation[mh] OR "visually impaired persons"[mh] OR visually impaired persons/rehabilitation[mh] OR vision disorders[mh] OR vision disorders/rehabilitation[mh]

Macular perimetry: Macular perimetry[tiab] OR (macular AND visual field tests[mh])
 “vision”[tiab] OR "vision loss"[tiab] OR "low vision"[tiab] OR "vision rehabilitation"[tiab] OR “vision disorders”[mh] OR "vision, low"[mh] OR vision, low/rehabilitation[mh] OR "visually impaired persons"[mh] OR visually impaired persons/rehabilitation[mh] OR vision disorders[mh] OR vision disorders/rehabilitation[mh]

Brain injury: Brain injuries[mh] OR “brain injury”[tiab] OR (brain[tiab] AND injur*)
 “vision”[tiab] OR "vision loss"[tiab] OR "low vision"[tiab] OR "vision rehabilitation"[tiab] OR “vision disorders”[mh] OR "vision, low"[mh] OR vision, low/rehabilitation[mh] OR "visually impaired persons"[mh] OR visually impaired persons/rehabilitation[mh] OR vision disorders[mh] OR vision disorders/rehabilitation[mh]

Balance: Postural balance[mh] OR balance[tiab] OR posture[mh]
 “vision”[tiab] OR "vision loss"[tiab] OR "low vision"[tiab] OR "vision rehabilitation"[tiab] OR “vision disorders”[mh] OR "vision, low"[mh] OR vision, low/rehabilitation[mh] OR "visually impaired persons"[mh] OR visually impaired persons/rehabilitation[mh] OR vision disorders[mh] OR vision disorders/rehabilitation[mh]

Quality of life: Quality of life[mh] OR (quality[tiab] AND life[tiab]) OR “quality of life”[tiab]
 “vision”[tiab] OR "vision loss"[tiab] OR "low vision"[tiab] OR "vision rehabilitation"[tiab] OR “vision disorders”[mh] OR "vision, low"[mh] OR vision, low/rehabilitation[mh] OR "visually impaired persons"[mh] OR visually impaired persons/rehabilitation[mh] OR vision disorders[mh] OR vision disorders/rehabilitation[mh]

Mobility: Mobility[tiab] OR mobility limitation[mh] OR Range of Motion, Articular[mh]
 "vision loss"[tiab] OR "low vision"[tiab] OR "vision rehabilitation"[tiab] OR “vision disorders”[mh] OR "vision, low"[mh] OR vision, low/rehabilitation[mh] OR "visually impaired persons"[mh] OR visually impaired persons/rehabilitation[mh] OR vision disorders[mh] OR vision disorders/rehabilitation[mh]

Cochrane Searches - Search terms used to search the Cochrane Eyes and Vision database of reviews.

Single words:

Reading, driving, rehabilitation, falls, video-magnifier, braille, prisms, hemianopia, fixation, cell phone, audiobook, biofeedback, microperimetry, depression, anxiety, dementia, balance, mobility, magnification

Composite terms:

Scanning training, quality of life, contrast sensitivity, orientation and mobility, eccentric viewing, preferred retinal loci, assistive technology, mental health, psychosocial, low vision, occupational therapy, Charles-Bonnet hallucinations

SUGGESTED READING

- ◆ American Academy of Ophthalmology. Clinical Optics and Vision Rehabilitation. Section 3, Basic and Clinical Science Course. 2022. Chapter 10 Vision Rehabilitation
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RELATED ACADEMY MATERIALS

Basic and Clinical Science Course

Clinical Optics and Vision Rehabilitation Section 3, Chapter 10 Vision Rehabilitation (2022)

Patient Education Downloadable Handout

Low Vision Brochure (2016)

Waiting Room Video for the Ophthalmic Practice, Volume 3 (2015)

EyeSmart®

What is Low Vision? - <https://www.aao.org/eye-health/diseases/low-vision>

Learning Plan - Identifying and Managing Vision Rehabilitation Patients

<https://www.aao.org/learning-plan-detail/identifying-and-managing-vision-rehabilitation-patients>

Smartsight™

Materials for Patients - free download available at

<https://www.aao.org/low-vision-and-vision-rehab>

Clinical Statement: Recommendations on Assistive Technology for Patients with Low Vision

<https://www.aao.org/clinical-statement/recommendations-on-assistive-technology-patients-w>

Preferred Practice Pattern® Guidelines - Free download available at www.aao.org/ppp.

Comprehensive Adult Medical Eye Evaluation (2020)

To order any of these products, except for the free materials, please contact the Academy's Customer Service at 866.561.8558 (U.S. only) or 415.561.8540 or www.aao.org/store.

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