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SENSORY IMPAIRMENT IN OLDER ADULTS: PART 2: VISION LOSS

While changes in vision are a normal part of aging, regular assessment and the use of assistive devices can keep older adults active and independent.

OVERVIEW: A decline in vision occurs naturally with age; more severe impairment can result from medical conditions such as age-related macular degeneration, cataracts, glaucoma, and diabetic retinopathy. Nurses can pick up signs of visual impairment and suggest certain environmental modifications to prevent injury, such as keeping floors free of clutter and rooms well lit. Although assistive technologies such as optical devices, magnifiers, telescopes, and electronic magnification can help, some forms of impairment, such as that caused by cataracts and uncorrected refractive error, can be corrected.

“**O** loss of sight, of thee I most complain!” wrote the great English poet John Milton, after he became totally blind at the age of 43 in 1651. In subsequent years Milton composed poetry, including *Paradise Lost*, through dictation. In several works Milton documented the terrors and struggles of waning eyesight. But it was also Milton who wrote, “To be blind is not miserable; not to be able to bear blindness, that is miserable.”

Older adults experience a natural decline in vision that occurs with aging; some may also experience serious impairment resulting from disease. Congdon and colleagues found that “blindness or low vision affects approximately one in 28 Americans older than 40

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years.”¹ What are the major causes of visual impairment and how can nurses help those impaired?

DEFINING VISUAL IMPAIRMENT

In this article, the term *visual impairment* is used to describe low vision in all older adults, including those who are legally blind. Visual acuity is generally measured with a Snellen vision chart. According to the *Merck Manual of Diagnosis and Therapy*, 17th edition, the results of the test can be understood as follows: “A Snellen notation of 20/40 indicates that the smallest letter that can be read by someone with normal vision at 40 ft has to be brought to 20 ft before

it is recognized by the patient.”² The following tri-
chotomy is used commonly in the United States³
(assuming correction):

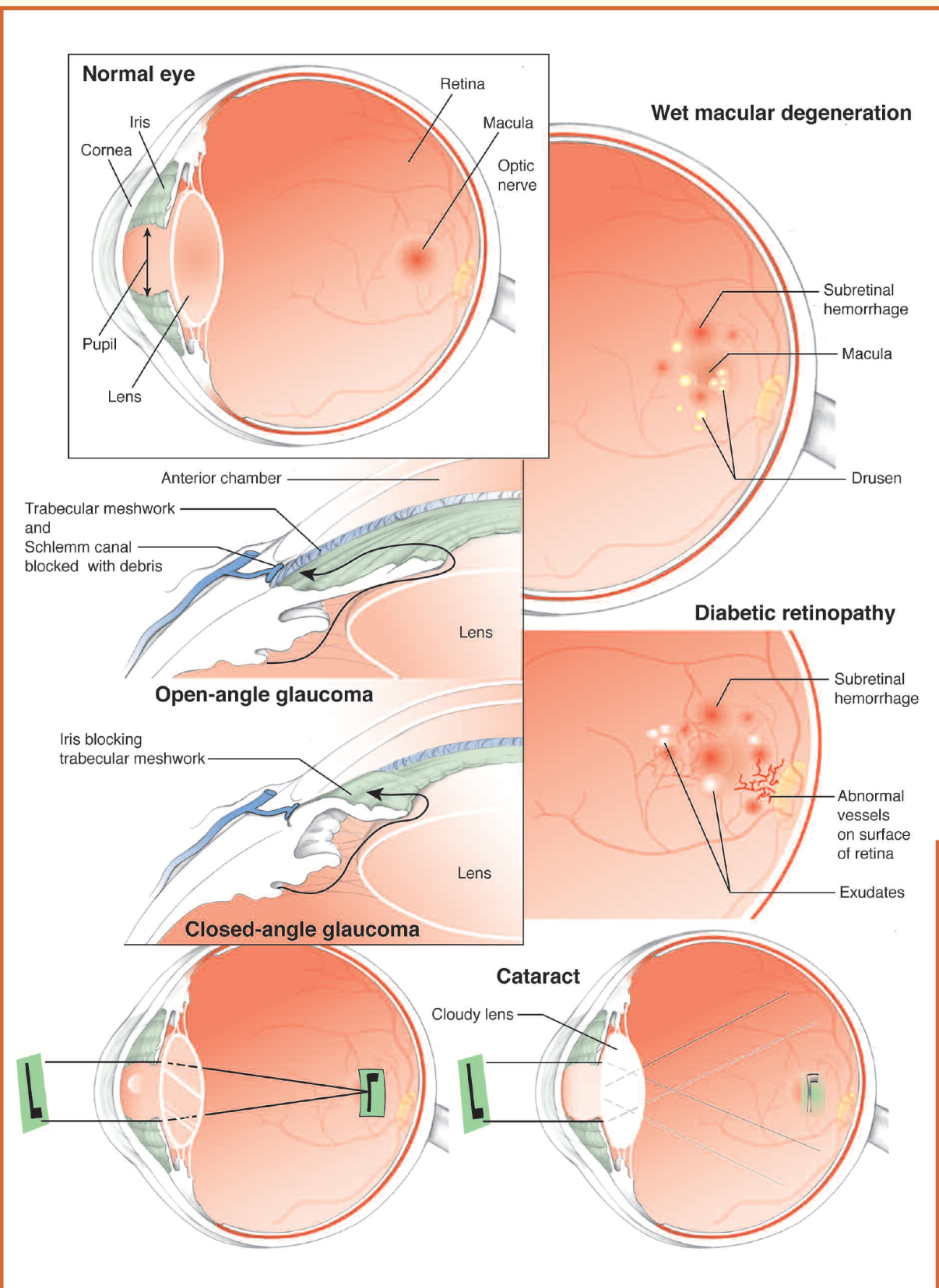
- normal vision: 20/40 or better
- visual impairment (“low vision”): worse than 20/40 but better than 20/200
- legal blindness: equal to or worse than 20/200

Changes in sensitivity to contrast, color, and glare; stereoacuity (otherwise known as binocular depth perception); and peripheral vision can affect visual function as a person ages. For example, a person with a visual field less than or equal to 20 degrees, which is associated with certain eye pathologies, is also con-



Diseases that can result in significant visual impairment in older adults, including macular degeneration and glaucoma, need not be life limiting. Photograph taken from *Aging in America: The Years Ahead*, by photographer Ed Kashi and writer Julie Winokur.

FIGURE 1. AGE-RELATED CHANGES TO THE EYE



Macular degeneration results from the breakdown of cells in the macula of the retina, causing yellow deposits, known as drusen, to form under the retina. The wet form of the condition, in which abnormal blood vessels surrounding the drusen leak, causes subretinal hemorrhage and scarring.

Diabetic retinopathy, a disease of the retinal microvasculature, is characterized by increased vessel permeability. Blood and lipid leakage leads to macular edema and hard exudates (composed of lipids). In advanced disease, new fragile blood vessels form that hemorrhage easily.

Cataract is a clouding of the normally clear ocular lens that's usually caused by a clumping of proteins in the nucleus of the lens. As a result, less light can reach the retina.

Glaucoma results in vision loss because of increased intraocular pressure. In *open-angle glaucoma* the anterior chamber angle is normal, but abnormalities of the trabecular meshwork or the Schlemm canal, as well as in the rate of aqueous fluid production (or a combination of these), lead to the rise in pressure. In *closed-angle glaucoma* the anterior chamber angle itself is obstructed, often by an iris that is thickened or displaced anteriorly by an enlarged lens. Both damage the optic nerve, which leads to blindness.

sidered legally blind.⁴ In a study of 2,520 adults ages 65 to 84 years, Rubin and colleagues found that, like visual acuity, these aspects of vision declined with age and this interfered with participants' ability to perform everyday tasks.³

NORMAL VISUAL CHANGES

Normally, vision changes occur slowly with aging. For example, beginning at about age 40, the eye's crystalline lens gradually becomes less flexible; as a result, the lens is less able to change shape (accommodate) to focus on near objects. This condition, called *presbyopia*, is considered a "universal age-related change."⁵ The amount of light that reaches the retina also becomes reduced substantially with age. In part, this is because pupil size diminishes, but it is also because the crystalline lens absorbs progressively more light because of the formation of

CHANGES IN SENSITIVITY TO CONTRAST, COLOR, AND GLARE; STEREOACUITY (OTHERWISE KNOWN AS BINOCULAR DEPTH PERCEPTION); AND PERIPHERAL VISION CAN AFFECT VISUAL FUNCTION AS AN INDIVIDUAL AGES.

a cataract, an opacity of the crystalline lens that also occurs inevitably with age. The reduction in the amount of light that reaches the retina in the older adult is substantial; the retina of a typical 60-year-old receives only about one-third of the light that the retina of a typical 20-year-old receives.⁶ One might assume that cataracts absorbing so much light would limit vision significantly; however, in the typical healthy 60-year-old, cataracts may be only mild and often will not cause visual impairment.

Aging also causes a reduction in the eye's ability to adapt to sudden changes in illumination. This is due in part to the pupil losing the ability to adjust its size, the development of cataracts, and neural changes within the retina.⁶ As a result, when older adults go from a very bright environment (such as a sunny day) to a darker one (such as inside a clinic), their eyes will require a longer time to adjust than those of a younger person. Finally, age-related changes in the lens and opacities in the cornea increase the older adult's sensitivity to glare. While everyone experiences debilitating glare when confronted with high levels of illumination, such as high-beam headlights from oncoming cars, older adults can find it debilitating simply to look at a brightly illuminated, shiny floor. This increased sensitivity to glare can have a blinding effect that decreases visual acuity. Although these normal, age-related changes do influence function, they typically don't result in significant impairment of vision in a healthy older adult.

MAJOR CAUSES OF VISION IMPAIRMENT

There are a number of conditions whose presence does cause a marked loss of vision in older adults. The major causes of significant visual impairment are the following:

Age-related macular degeneration (AMD) is a progressive disease in which light-sensing cells are damaged in the macula, the part of the retina

TABLE 1. AGE-RELATED CAUSES OF VISUAL IMPAIRMENT

Condition	Common Clinical Presentation	Implications for Rehabilitation
Macular degeneration	• Reduced visual acuity • Loss of central visual field and contrast sensitivity	Difficulty with tasks requiring visual detail such as reading, inability to recognize faces, distortion or disappearance of the visual field straight ahead, loss of color and contrast perception, mobility difficulties related to loss of depth and contrast cues.
Diabetic retinopathy	• Reduced visual acuity • Scattered central scotomas • Peripheral and midperipheral scotomas • Macular edema	Difficulty with tasks requiring visual detail such as reading, distorted central vision, fluctuating vision, loss of color perception, mobility problems resulting from loss of depth and contrast cues.
Cataract	• Reduced visual acuity • Light scatter • Sensitivity to glare • Altered color perception • Loss of contrast sensitivity • Image distortion • Possible myopia	Usually remedied by lens extraction and implantation, except in extreme cases. If not managed by replacement, difficulty with detail, bright and changing light, color perception, contrast perception; some mobility problems caused by loss of perception of depth and distance, sensitivity to glare, loss of contrast.
Glaucoma	• Degeneration of optic disc • Loss of peripheral visual fields	Mobility and reading problems caused by restricted visual fields, people suddenly appearing in the visual field seen as "jack-in-the-box."

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responsible for central vision. The leading cause of blindness among white Americans, AMD accounted for 54% of all blindness in a recent study.¹

Risk factors include advancing age; being white; and having a family history of AMD, cardiovascular disease, smoking, or hypertension.⁷

Cataracts can increase in density gradually and eventually may require surgery. In their early stages, cataracts are largely asymptomatic. According to a recent study, cataracts are a leading cause of vision impairment in the United States¹; a lack of treatment is attributable to poor access to medical care and disparities in health literacy. How fast a cataract progresses depends on numerous variables.

Risk factors include age, certain diseases (such as diabetes), smoking and alcohol consumption, and prolonged exposure to sunlight (specifically ultraviolet B radiation).⁸

Glaucoma, another leading cause of blindness, is associated with loss of peripheral vision, often the

- For information about state and federal benefits for the visually impaired, see *If You Are Blind Or Have Low Vision—How We Can Help*, available at www.ssa.gov/pubs/10052.html.
- For those in need of financial aid to assess or treat an eye problem, the National Eye Institute supplies contact information for several organizations that provide free eye care. Go to www.nei.nih.gov/health/financialaid.asp.

result of increased intraocular pressure that damages the optic nerve.¹

Risk factors include age, family history, and race: Mexican Americans older than 60 years of age and African Americans older than 40 years of age are especially susceptible.⁹

Diabetic retinopathy damages retinal blood vessels, causing them to leak, grow abnormally, and form scar tissue. According to the American Diabetes Association, “diabetic retinopathy is the most frequent cause of new cases of blindness among adults aged 20 [to] 74 years.”¹⁰

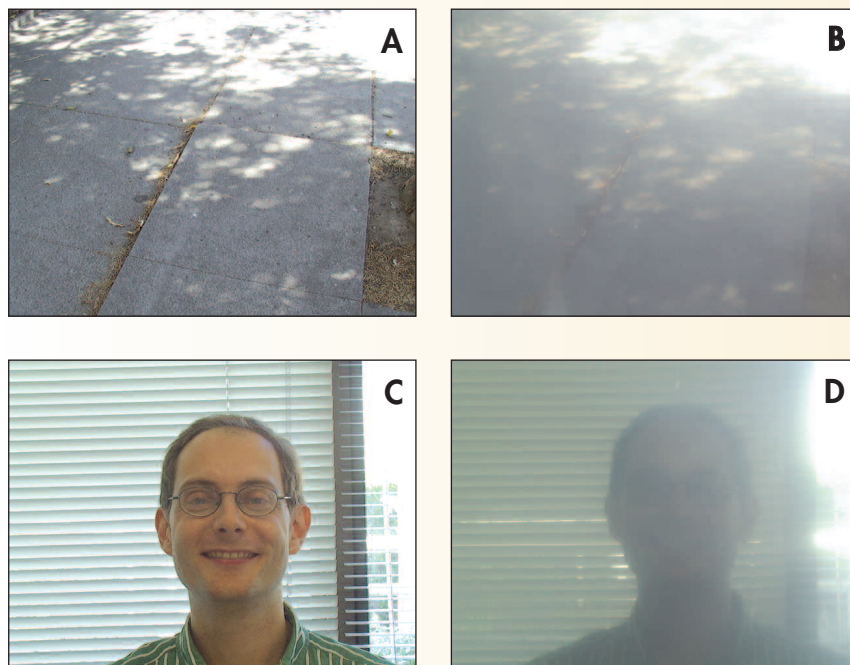
Risk factors include long duration of disease, poor control of blood sugar levels, and elevated blood pressure and cholesterol levels.¹¹

ASSESSMENT

For nurses in clinical settings, the most common way to assess vision is by a wall-mounted Snellen letter chart or with a near visual acuity card. For hearing impaired or confused older adults, however, the use of a Snellen letter test can be difficult. In considering the applicability of another option for frail, older adults, Johansen and colleagues compared results from the Snellen letter chart with those from the Cardiff Acuity Test in a cohort of 73 patients, 47 to 99 years of age.¹² The Cardiff Acuity Test involves a series of cards, “ordered ‘A’ to ‘K’ with increasingly faint targets.”¹² The test provider observes the eye movements of participants to assess when they stop acknowledging the printing on the card. (The “G” card was considered a threshold for significant impairment.) The researchers found the Cardiff Acuity Test to be a reliable option, one that was “highly acceptable to elderly patients.”¹² Finally, it is important to note that the visual impairment indicated by poor performance on an acuity test may simply be due to an uncorrected refractive error. Indeed, in a study of Americans 12 years of age and older, Vitale and colleagues found that “more than 11 million [people] could achieve good visual acuity with refractive correction.”¹³

Observation can also provide insight into assessing vision. How well does the older adult navigate the clinical environment? Does he appear to feel his way with his hands or feet? Does he assume mistakenly that an abrupt change in the color of the floor tiles (from light to dark) is asso-

FIGURE 2. THE AGING EYE AND THE LOSS OF CONTRAST SENSITIVITY



The images show contrast sensitivity that occurs with aging, simulated by placing a plastic bag over the camera lens. **Top:** The median contrast sensitivity of an 80-year-old is simulated in this street scene, photographed without (A) and with (B) the plastic bag over the camera. **Bottom:** The loss of contrast sensitivity that occurs with aging is simulated in a face by a window, photographed without (C) and with (D) the plastic bag over the camera.

Haegerstrom-Portnoy G. *Optom Vis Sci* 2005;82(2):87-93. Reprinted with permission.

ciated with a change in depth, testing the darker region with his foot before stepping forward? Does he have difficulty finding the examination chair or table or recognizing familiar faces? Each of these can signal an undiagnosed visual impairment. For example, it has been shown that while facial recognition declines with age, this disability is exacerbated by visual impairment.¹⁴ Suspicions generated by observation require further testing, since they call into question many aspects of visual function—not just visual acuity. For example, in a study of 1,504 adults ages 72 to 92 years, Patel and colleagues compared participants’ performance in walking a straight distance and one that was mined with obstacles.¹⁵ They found an association between performance and visual fields, but none between performance and visual acuity or contrast sensitivity.

TIPS FOR NURSES BY HEALTH CARE SETTING

All Settings

Simple interventions, such as annual eye examinations, can ensure that the older adult has the proper lens prescription and determine whether visual impairment can be corrected by cataract surgery. More frequent examinations may be needed, depending on the specific pathology.

Hospital

Provide typed directions in large print—at least twice as big (24 point) as normal-size print. Print can be enlarged by a photocopier. You can also write with a black felt-tip marker and use white paper. Review written directions verbally with the patient.

Nursing Home

Provide bright, indirect lighting and avoid sources that cause glare, such as reading lights or spotlights. Use bright colors and high contrast to help older adults locate their rooms—for example, by having big, bright, colored labels with the patients' names written in large, black print outside their rooms. Storing assistive devices in brightly colored containers can help older patients locate the containers in a drawer.

Ambulatory Care

Discuss strategies with receptionists and medical technicians. Provide patient directions or appointment reminders in large, high contrast print. Visually impaired patients are sometimes unable to read prescription labels, which are typically in very small print. Write the medication name and dosage in large, high-contrast print and affix it to the bottle with tape or a rubber band. Communicate dosages by taping large dot stickers on the bottles to indicate the regimen (for example two dots can represent "twice daily").

Home Care

Good lighting throughout the home is important. Loose throw rugs, electrical cords, and clutter on the floor may not be easily visible and can contribute to falls. Reduce the number of obstacles in the home by keeping cabinet doors completely closed or open, pushing in chairs, and keeping drawers closed. Make stairs more visible by lining the edge of each step with strips of brightly

Self-report. Asking an older adult how he is doing in day-to-day activities that require good vision (for example, reading the newspaper or reading street signs while driving) may provide clues to possible visual impairment. For example, people with uncorrected refractive error, cataracts, age-related macular degeneration, or diabetic retinopathy will often have trouble seeing well both up close and at distance. People with advanced cataracts will often complain of excessive glare, especially when driving at dusk or after dark. Validated questionnaires have been shown to be an accurate method of obtaining this information. In a recent study of 1,807 adults 75 years and older, Owen and colleagues compared visual acuity scores with results of the 25-item National Eye Institute Visual Function Questionnaire.¹⁶ The authors concluded that the "questions regarding the quality of general vision, social functioning, visual dependency, near vision and colour vision are strongly and independently associated with an objective measure of visual impairment in an elderly population."¹⁶

WORKING WITH VISUALLY IMPAIRED OLDER ADULTS

When meeting a patient with visual impairment, introduce yourself upon entering a room and alert the patient when you are leaving. Watson suggests avoiding directional cues that may be unclear, such as pointing.¹⁷ "For example, instead of saying 'Take that chair over there,' say 'Take the red chair against the white wall to your immediate right.'"¹⁷ It's also important to recognize that although diseases of the eye affect different functions, the symptoms may overlap and that, therefore, the steps one takes to improve vision may be the same regardless of the etiology of the impairment.

Increase contrast. Contrast sensitivity, which decreases with aging, is often markedly reduced in those with visual impairment because of cataracts, age-related macular degeneration, diabetic retinopathy, or advanced glaucoma. Thus, although older adults may be able to read high-contrast, black-on-white Snellen letter charts, those with visual impairment may experience great difficulty in reading letters of the same size on a lower-contrast, grey-on-white chart.¹⁴ This becomes important in how the older adult is able to function, because much of the world consists of low-contrast objects—faces, sidewalk curbs, speed bumps, escalators, and sometimes even newsprint. By recognizing this fact, caregivers can make modifications when providing written directions. For example, printed text is easier to read than cursive, and a black felt-tip marker (not a pen or a pencil) on white paper (not colored) will help the older adult to read what is written.

Increase “good” light. For older adults, “good light” comes from a source that illuminates the room from the ceiling or light that is angled to illuminate an object without shining into their eyes or causing excessive reflection (which causes glare, similar to the effects of oncoming headlights). Remind visually impaired older adults and their families that reading performance may be improved simply by installing a higher wattage light bulb, adding an extra reading light, or angling lamps to minimize glare. Furthermore, wearing dark sunglasses and wide-brimmed hats in very bright conditions and removing them immediately upon entering a darker environment will decrease the eyes’ need to adapt to extremes. For more information on improving lighting conditions for older adults, see *Lighting the Way: A Key to Independence*, available at www.lrc.rpi.edu/programs/lightHealth/AARP/index.asp.

Environmental modifications. In a review of the literature, Evan and Rowlands concluded that “those with low vision are about two times more likely to have falls than fully sighted people.”¹⁸ To reduce this risk, floors should be kept free of clutter, rooms should be kept well lit, and a night light or a motion sensor light should be used.

Watson recommends improving contrast throughout the visually impaired person’s home.¹⁷ For example, a television remote control should be kept on a light-colored surface, and “marking the edge of stairs with contrasting color tape [which] makes each step more visible.” Doors should always be either completely open or closed and chairs should be placed under the table after use to eliminate clutter. Finally, color coding can alleviate the need to decipher printed words to carry out everyday activities—for example, by using colored bands on soup cans to differentiate the types of soup.

Assistive technologies. Clinicians may use optical, nonoptical, or video devices as assistive technologies. Selection of appropriate devices will depend on the patient’s goals and abilities. For devices relying on magnification, there are four main categories.

Optical devices, such as glasses, may include a strong prescription for reading. For example, a prescription may need to be so strong that it makes objects appear in focus only when held very close to the eyes. Thus, glasses for people with visual impairment often require a close working distance when reading. In addition, if older adults wear these devices while walking, it can lead to difficulty with mobility. Lord found that people who wear multifocal lenses “performed significantly worse in both distant depth perception and distant edge contrast

sensitivity tests,” thus possibly leading to a higher risk of falls.¹⁹ In order to decrease this risk, the author recommends replacing multifocal lenses with single-lens glasses for distance when negotiating public spaces and in high risk areas, such as stairs.

IF AN OPTICAL DEVICE ISN’T BEING USED
ANY LONGER, IT MAY MEAN THAT THE
PATIENT’S VISION HAS FURTHER DECLINED
AND REEVALUATION MAY BE NECESSARY.

Magnifiers enlarge objects held at a normal distance; they can be handheld or attached to a stand. With a stand magnifier, the height of the stand determines how close it is placed in relation to the object of interest. Magnifiers also may require bifocals for visual accommodation.¹⁷ While the advantages of hand-held magnifiers are that they can be used at a greater distance from the eye, their disadvantages are that they require good hand control and one hand is always in use.

Telescopes can be handheld or mounted onto a pair of glasses, and they can be monocular or binocular. While telescopes can be used to view both near and distant objects, one disadvantage is that stronger telescopes allow only a small field of view, which can lead to the older adult getting “lost” trying to find the object of interest. Telescopes are also less acceptable cosmetically.

Electronic magnification can be achieved through closed circuit television or computer software in which images are enlarged and contrast enhanced. Although these technologies provide very high magnification, they are expensive and not very portable.

Additional issues. Because it takes time to learn to use magnification devices, many professionals strongly encourage older adults with progressive visual losses to learn to use assistive devices before becoming severely impaired. Another issue is that sometimes a person can experience symptoms of motion sickness, such as nausea and dizziness, when using the device while moving. Proper instruction can alleviate this problem. For example, telescopes should not be used continuously while walking but rather intermittently. In addition, for a patient with

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tremor or poor hand dexterity, mounting the telescope on a spectacle frame that the patient wears can reduce symptoms of motion sickness.

Medicare may pay for most evaluations by an eye specialist, but it typically does not cover the cost of assistive devices for the visually impaired. Because of the expense of high-powered devices, many patients may be hesitant to buy them. This is exacerbated by the fact that many patients have already purchased, and been disappointed by, over-the-counter magnifiers and reading glasses—which usually are not strong enough for those with significant visual impairment. In some cases the cost of assistive devices may be covered by state resources or the patient's insurance plan, and there are also community organizations that may help low-income patients to obtain optical devices.

In addition, most visually impaired older adults are unable to inspect their own optical devices. This can result in difficulty using the device when the lenses become dirty or batteries have to be replaced. Therefore, it's important to remind family members and caregivers to inspect devices regularly and to clean them and replace batteries as necessary. In addition, people should realize that if an optical device isn't being used any longer, it may mean that the patient's vision has further declined and reevaluation may be necessary.

Other resources. Many publications (for example, *Readers Digest* and the *New York Times*) are available in a large-print format, and many states have free audio libraries for the visually impaired. Also available are telephones with large, high-contrast numbered buttons, watches and clocks with large-print numbers or an auditory message of the time, and even special syringes for people with diabetes that make a noise for each unit of insulin withdrawn from the vial. For more information on visual rehabilitation services, education, research, prevention, and advocacy, go to www.lighthouse.org.

EXAMINATION

It's interesting to note that many older adults are not getting their regular yearly eye examinations after age 61, as is recommended by the American Optometric Association. Orr and colleagues found that among those ages 65 to 84 years, only 69% of whites and 50% of blacks visited any type of eye care professional over a one-year period.²⁰ More frequent examinations (ranging from every few weeks to every six to nine months) are suggested for those who are at higher risk because of a personal or family history of diabetes mellitus, age-related macular degeneration, cataracts, or glaucoma. The evaluation performed by an eye-care specialist typically includes an assessment of refractive error, intraocular pressure, and visual field tests, as well as funduscopy and slit-lamp biomicroscopy (during which the front and the inside of the eye are examined by microscope). Results of these tests allow for appropriate diagnosis and treatment of some changes that occur with age. ▼

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