

5 Intervention

We must address visual impairment because it forces our clients to give up occupations that are meaningful to them and important for independent living. Vision impairment also causes the client to question their self-efficacy and autonomy—the ability to control and successfully respond to the environment.^{98, 102} Without intervention, the person will experience a decline in their quality of life and an increase in depression and anxiety.

Recovery from brain injury often spans months and years rather than days or weeks. Some vision impairment—notably some forms of oculomotor impairment and visual inattention can improve over time (see sections 5.7.1., 5.9.1).^{161, 171} Other vision conditions like visual field deficit cause a permanent impairment.^{34, 195} Currently, there is little research evidence to support the efficacy of interventions that aim to restore visual function to normal pre-injury levels.^{82, 176, 197, 198, 234} In addition, many proposed restorative interventions require a significant amount of practice and can't feasibly be implemented during the brief time allotted to therapy.^{124, 198, 233, 234} To provide the best client outcome, rather than focusing on restoration of visual processing, OT intervention should concentrate on enabling the client to use their current visual abilities to participate in valued activities and occupations. This approach aligns with the overarching goal of OT intervention, as stated in the practice framework, to promote the client's health and participation despite disability.⁷ It is also consistent with research showing that neuroplasticity within the brain is stimulated when a person attempts to engage in meaningful tasks.⁶³

Intervention should focus on adaptation and empowerment. Adaptation enables the client to use their current vision as effectively as possible to participate in daily occupations. Empowerment evolves from the client's understanding of how the visual condition limits their ability to complete occupations and how they can minimize its negative affect through modification and compensation. This knowledge gives the client control over their condition by promoting an active problem-solving approach that fosters adaptation and mastery instead of avoiding difficult tasks.⁵⁷ Thoroughly understanding their condition also empowers the client to advocate for what they need from eye doctors, physicians, and healthcare providers.

As occupational therapists, we view occupation as an outcome and an intervention.⁷ Using occupations as intervention has several key advantages in improving performance skills like visual search or sustained attention:

1. With few exceptions, occupations require integration of the body sides and body space and thus naturally promote attention and search to both sides. Playing scales on the piano²⁷ and listening to music through headphones⁴² have been shown to improve attention towards the left side in persons with chronic left neglect.
2. Completing a well-practiced and valued occupation enables the client to tap into their expertise. This reduces metabolic demand within the brain and in turn, reduces effort, and fatigue.^{64, 102, 130, 181, 203}

3. Objects used in everyday activities are established as generic memories that can be accessed by a broad range of sensory input.⁹⁰ This increases the likelihood that even clients with severe brain injury may be able to recognize and appropriately use these objects within the context of an everyday activity.

5.1 Key Questions to Guide Setting Goals and Selecting Interventions

There are 2 key questions to answer that ensure your intervention aligns with the practice framework.

1. What does my client **want** and **need** to do?

- Clients will go to great lengths to complete valued occupations.

2. Can I improve my client's ability to **compensate** for their limitations in visual processing?

- If you answer **YES** to this question, focus on improving performance skills like compensatory visual scanning training that will enable the client to compensate for the vision impairment in activities.
- If you answer **NO**, focus on modifying the environment and task to facilitate the client's ability to use their current vision to complete occupations. This includes training the client to use adaptive devices and technology to compensate or substitute for vision. For example, train the client to use voiceover and text to speech apps to eliminate the need to read text.

5.2 Setting Goals

Follow the AOTA Practice Framework⁷ and make participation the goal instead of independence. Letting go of the belief that restoring vision and independence is the *only* path to recovery forces you to be client-centered and focused on the client's priorities. Aiming for participation forces you to be more creative and use modification, adaptive devices, and technology rather than exercises to achieve the goal. A client ultimately won't participate in an activity they don't care about but will go to great lengths to participate in an occupation that is important to them. Make co-occupation the goal instead of independence. Co-occupations require each member to contribute to completing the task.⁷ Examples include participating with a spouse to prepare the evening meal or put a child to bed. Co-occupation enables the client to take an active role in family life and make a useful contribution. Assisting the client and partner to identify co-occupations and figuring out the modifications needed to make it happen helps both adjust to living with brain injury.

5.2.1 Setting the Best Goal

The best goal is one that focuses on an explicit occupational outcome. Some examples include:

1. The client will consistently use strategies to compensate for vision impairment to locate and select items during the weekly grocery shopping trip with her husband.

2. The client will identify home and task modifications that support his ability to compensate for vision loss to complete meal preparation.
3. The client will employ strategies to minimize visual stress and prepare the evening meal.
4. The client will compensate for vision loss to accurately fill her weekly medication pillbox.

5.3 Team Approach is Best

Using a team approach is essential to obtaining an optimal outcome for the client with vision impairment.^{8, 63, 76, 79, 160} This is especially true when the client has unusual, severe, or permanent vision impairment. There are many vision professionals who add valuable insight and intervention to assist the client to achieve their goals.

5.3.1 Collaborating with Eye Doctors

5.3.1.1 Ophthalmologist vs. Optometrist

The best client outcome is achieved when we collaborate with an ophthalmologist or optometrist. These eye doctors increase our understanding of how the client's vision has changed and the prognosis for recovery. They vary in their approach to the client with brain injury based on their educational preparation and professional role.

Ophthalmologists are primarily responsible for diagnosing and treating the medical conditions that cause the visual impairment. As physicians (MDs) ophthalmologists are trained to answer the question: "What caused the vision impairment, and will it get better?" Neuro-ophthalmology is a subspecialty of both neurology and ophthalmology. Board-certified neuro-ophthalmologists are the ultimate authority on visual impairment from brain injury, but they are a small subspecialty. In 2020, only eight states in the U.S. had enough neuro-ophthalmologists and 6 states did not have any.²⁶⁶ Because of their limited numbers, neuro-ophthalmologists often only see the most complex cases and are rarely the first eye doctor to evaluate a person with vision impairment from brain injury. Ophthalmologists provide valuable information about how the client's vision has changed and whether it will improve. However, they rarely offer explicit direction to the rehab team on the best interventions to enable the client to use their vision more efficiently.

Optometrists are licensed health care professionals (like OT and PT) who hold a clinical doctorate in optometry (OD). They are not physicians, but they also diagnose and treat medical conditions causing vision loss and provide most of the primary eye care in the United States.²⁶⁵ In addition to answering the question "What caused the vision impairment?" their training prepares them to answer the question "What can be done to improve vision?" They have extensive training in the use of lenses and prism and are often especially adept at treating oculomotor impairment and focusing deficiencies. They are comfortable in the role of providing direction and input to assist the rehab team to enable the client to use vision more efficiently.

Some optometrists specialize in neurorehabilitation and focus on persons with vision impairment from brain injury.²⁶⁵

5.3.1.2 Reasons to Consult Early with Eye Doctors

Early consultation with an eye doctor is important as there are many correctable vision impairments that can significantly improve the client's ability to participate in rehabilitation (see sections 5.3.1.1 and 5.7.1) Undiagnosed vision impairment can lead the rehab team in the wrong direction by creating a false picture of the client's limitations. This often occurs when the client adopts a visual compensatory strategy that limits their ability in another area. For example, a client with bilateral 4th CN palsy may hold their head forward and down to eliminate double vision when viewing objects. While successful in reducing double vision, this visual strategy can interfere with the client's ability to walk and complete tabletop activities. The rehab team, observing these behaviors, may mistakenly believe it is due to poor neck /trunk control instead of oculomotor impairment and attempt to address it through strengthening.

Prompt diagnosis of the vision impairment and early intervention improves the client's ability to fully participate in rehabilitation. Many eye doctors advocate for early consultation beginning with a brief "bedside" exam to rule out vision threatening conditions (orbital fracture, optic nerve or retinal injury) and progressing to a more comprehensive office exam as the client's cognitive and physical function improves.^{79, 160, 213, 249} An ophthalmologist or neurologist will likely complete the initial bedside exam because as MD's they have hospital privileges. However, the optimal medical rehabilitation model is to have an optometrist on the rehabilitation team. The OD evaluates and diagnoses the client's vision impairment and provides the team with information on prognosis and medical/optical management.⁷⁹ Although their numbers are increasing, relatively few optometrists are integrated into rehab teams at this time. Instead, the client must be referred out to the eye doctor's private practice and obtaining an outside referral can be a difficult and time-consuming process. The OT will be expected to provide evidence to the medical director or case manager that a visual impairment may be limiting the client's occupational performance. To advocate for referral, the OT must screen for visual impairment and link it to limitations in occupational performance.

5.3.2 Collaborating with Vestibular Specialists

Brain injury, especially from TBI, can injure the pathways that integrate vision, neck proprioceptors and vestibular centers within the brain. The resulting visual vestibular impairment can reduce gaze stability during head and eye movement causing blurred vision, nystagmus, and oscillopsia (presence of constant motion with the visual field). Vision is generally worse when the client moves the body or the eyes to walk, read and complete daily activities and it can be accompanied by dizziness, vertigo, and nausea. PTs and OTs who have completed a certification course in vestibular rehabilitation provide the therapy. Neuro-optometrists may also provide vision therapy using prism and eye exercises.^{48, 194}

5.3.3 Collaborating with Non-Medical Vision Rehabilitation Professionals

These professionals work outside of the healthcare system. They are not licensed health care providers, and their services are not covered by medical insurance in the U.S. This creates a barrier to referral and collaboration, but their understanding of how vision impairment influences daily living can be very helpful to the OT. It's worth it to seek out these professionals in your community and establish a relationship with them.

5.3.3.1 Certified Orientation Mobility Specialists (COMS)

The COMS instructs persons with vision impairment to use their remaining senses to safely navigate from one place to another. COMS provide services to children and adults in various settings, including school systems and private, state, and VA (Department of Veterans Affairs) programs.²⁶³ Services are usually community-based. The goal of orientation and mobility (O&M) instruction is to develop independent travel skills. To achieve this goal, the COMS focuses on developing cognitive spatial concepts and efficient sensory skills along with optical devices, compensatory techniques, and travel aids to guide movement in space. COMS have either a baccalaureate or a master's degree from an accredited university. In 1990, professionals with baccalaureate or master's degrees in a related field became eligible for O&M certification after completing an approved university program.²⁶³ This rule change allowed occupational therapists to obtain additional credentialing in O&M in the United States.

5.3.3.2 Certified Vision Rehabilitation Therapist (CVRT)

As a sister profession to occupational therapy, CVRTs train persons to use adaptive skills, devices, and technology to compensate for vision loss in completing daily occupations. Originally known as rehabilitation teachers, CVRTs work with children and adults in various settings, including the VA, state vocational rehabilitation programs, private agencies, and special education programs.¹⁷⁵ Their knowledge and skill set is especially important in achieving an optimal outcome for a client with acquired brain injury who is newly blinded and unable to use vision.

5.3.3.3 Certified Low Vision Therapist (CLVT)

This specialty certification was established in 1997 for professionals working specifically with persons with low vision.²⁶¹ The professionals who hold this certification represent a variety of backgrounds, including COMS, CVRTs, optometrists, educators, nurses, and occupational therapists. The CLVT works as part of an interdisciplinary team with a low vision physician. CLVTs provide intervention using optical devices and compensatory techniques that enable the person to use vision more efficiently to read, write, and complete daily activities. The CLVT must be a licensed health care provider to be reimbursed for services provided to Medicare beneficiaries, thus OTs with the CLVT credential can bill Medicare when providing OT services to clients with low vision.

5.3.3.4 Orthoptists

Orthoptists work on an ophthalmology-led eye care team to treat vision disorders, eye misalignments, disorders of binocular function.⁷⁸ These professionals are much more common outside of the United States, but the number of training programs is increasing in the U.S.

5.4 Evaluation is the First Step of Intervention

Addressing vision limitations from brain injury is complex because brain injury doesn't just cause vision loss. The client may also have motor and speech impairment, impaired cognition and difficulty regulating emotions. Each of these impairments influences how the client views and interprets the environment and context for daily occupations. The fact that vision loss is a hidden impairment and visual processing provides a foundation for movement, cognition, and social interaction (see sections 1.3 and 1.4) adds another level of complexity. There are few outward signs that indicate a client has a vision impairment and vision impairment often mimics deficits in movement, cognition, and social interaction. As a result, some vision impairment may not become apparent until other performance areas improve.

We tend to think that the purpose of evaluation is to label the deficit to justify the need for skilled occupational therapy intervention. But evaluation is actually the first step in intervention. The sole reason for evaluating the client is to select the best intervention to obtain an optimal client outcome. A good evaluation enables you to:

1. Identify the client's imitations in occupational performance.
2. Identify the factors that contribute to these limitations.
3. Determine if intervention is needed (because sometimes it isn't).
4. Identify the best intervention to achieve an optimal outcome.
5. Identify what to focus on first during intervention.
6. Determine who needs to be on the rehab team.

Knowing the key client behaviors that indicate vision impairment and the key assessments that describe vision impairment enables you to connect the client's visual limitations to their occupational limitations. Making this connection will help you:

1. Clearly communicate information to the rehab team about the clients' functional limitations so that they can also provide appropriate accommodation and intervention.
2. Justify the need for skilled OT intervention by identifying how the client's vision has changed and how it affects occupational performance.
3. Establish achievable goals by aligning intervention with the client's functional impairment.

5.5 Intervention for All Types of Vision Impairment

5.5.1 The Most Important Tool in the OT Intervention Toolkit

Environmental and task modification is the most important tool in the OT toolbox. Simply put, it is our superpower-the skill that we possess that other rehab professionals do not. There is no question that we are well-trained in using task analysis to achieve an optimal fit between the client and the task and environment. Our practice framework⁷ identifies this as a key intervention for all clients, and it is particularly important for clients with vision impairment.

Our focus on the fit between environment and task is well supported by newer models of neocortical processing (see section 1.2) that suggest the brain uses past experience to create a context in which to evaluate incoming visual information and predict what is going to happen next.^{14, 100, 101} For example, you see your mug of steaming coffee and based on your coffee drinking experience you predict that the cup will feel warm when you pick it up. The brain uses previously learned information to continuously run unconscious stimulations (like the coffee example) to predict what will happen next. These simulations keep you prepared to successfully respond to situations as they arise. The key take-away message is that the ability to make an accurate prediction depends on the ability to *accurately see* the critical environmental features that trigger memory and create the context to unlock prediction. As stated earlier, vision is the primary way we acquire information about our world and as such it dominates the interpretation of environment and context. Vision impairment may reduce the accuracy, quality, and completeness of visual input into the brain causing the person to miss the critical environment/task features needed to define the context and trigger prediction. As a result, the person may not be able to successfully participate in the activity or occupation.

5.5.2 Basic Principles of Environment/Task Modification

Persons with vision impairment regardless of the cause, are strongly influenced by the visual properties of the task and the environment. These properties include contrast, pattern, size, and brightness. A client's success in using their current vision to complete daily occupations depends on the OT's ability to create a visible and explicit environment that facilitates rather than inhibits visual processing. Because increasing visibility is the most important OT intervention for **all types** of vision impairment, the key components of this intervention are described below and mentioned again in the sections on specific visual deficits.

Use Contrast to Identify Key Components of the Task and Environment. Key components are those features of a task or environment that guide completion of the desired occupation. Add contrast by changing background color so it differs from the object/feature to help the client see it. Adding contrast can be as simple as using a black cup for milk and a white cup for coffee. When background color cannot be changed add color to highlight critical features. For example, on carpeted stairs apply a line of bright orange duct tape to the carpet on the edge of each step to distinguish between them. Contrast also enables the client to locate a desired item more quickly as illustrated in Figure 5.1.^{52, 68}

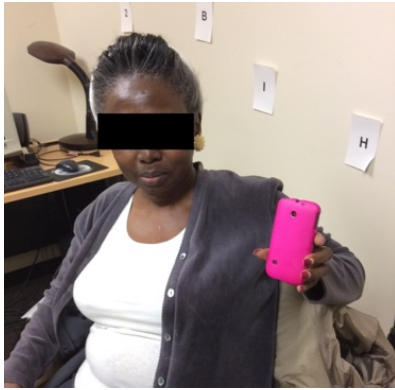


Figure 5.1: Example of using contrast to increase visibility.

After we discussed adding contrast to make it easier to locate objects, my client with hemianopia replaced her gray smartphone cover with a bright pink one. She excitedly showed me the modification during her next session and told me that she hadn't lost the phone since.

Reduce/Eliminate Background Pattern in Environments and Objects. Persons with visual processing deficits perform best in simple environments that contain only the objects needed for daily occupations.⁶⁸ Patterned backgrounds have the effect of camouflaging visual details. Using solid colors on background surfaces (bedspreads, place mats, dishes, countertops, rugs, towels, furniture coverings) increases the visibility of objects placed on them. Clutter also creates background pattern in an environment, making it more difficult to locate needed items. Cluttered environments with haphazardly placed objects are challenging even for persons with normal visual processing. If possible, reduce the number of objects in a setting and arrange needed objects in an orderly fashion. Place items that are used daily on accessible shelves in single rows. Store rarely used items on upper and lower shelves or remove them. Use commercially available organizing systems to store items together to create workstations. For example, place all items used for grooming in a basket on a tray (see Figure 5.2). Reducing clutter and adding structure creates an **explicit and predictable** environment that places less demand on visual attention. Once the environment is organized and simplified, educate the client and family on the importance of maintaining the structure. Developing the habit of putting items back where they belong reduces frustration and facilitates independence.

Enlarge Critical Features of Objects and Environments. Increasing the size of a feature or object makes it more visible. Enlarge the print on instructions, medications, calendars, and other items. The last line of print that the client can easily read on the reading acuity test card wearing their eyeglasses provides a starting place for enlarging print—generally persons prefer to read 3-5 points greater than their minimum acuity (see Appendix G).¹³⁶ Increase contrast along with size—as it does little good to enlarge text if the print is faint. Black on white or white on black print is more visible than any other color combination. Modify the accessibility settings of digital devices to adjust the brightness and background color of the screen; enhance the size, color, and boldness of text, icons, and cursors. Many commonly used items are available in larger print, including calculators, clocks, watches, telephones; health devices like glucose monitors, blood pressure cuffs and scales; leisure items like playing cards, games, and puzzles. These items can be purchased through specialty catalogs that carry low-vision products and are also increasingly available from large box retailers like Target and Walmart.

Eliminate Vision-Dependent Steps in Tasks. If it is not possible increase the visibility of a task component, consider eliminating the vision-dependent step from the occupation. For example, apply toothpaste directly onto the tongue rather than the toothbrush and purchase pre-chopped vegetables. Train the client to use internet-connected virtual assistants like Siri and Alexa to perform tasks such as dialing numbers, turning on lights, setting a timer, telling the time, temperature, and weather forecast and ordering items.

Add Adequate, Good Quality Lighting. Increasing the intensity, amount and quality of available light enables the client to see objects and environmental features more readily. For example, it is easier to identify facial features when a person's face is fully illuminated. Strategically place task lighting to provide full, even illumination of the task without areas of surface shadow. The light should be positioned as close to the task surface as possible to obtain optimal brightness and illumination of the task.⁵¹



Figure 5.2: Visible workstation for medication management.

The tray keeps the medication management items in one place. The black/white surface (made from craft foam sheets) provides a high contrast pattern free surface that enables the client to accurately identify the shape and size of pills. The medication bottles are labeled in large print. The gooseneck lamp has a bright non glaring LED bulb. The light is positioned close to the tray surface to provide bright illumination without shadow.

Many persons with acquired brain injury experience photophobia (see section 2.1.2.2) defined as an abnormal sensitivity to light that is uncomfortable and often painful.^{32, 62, 272} Light sensitivity is common in persons with stroke, TBI, neurodegenerative diseases (PD and MS), and age-related eye disease.^{62, 272} For these persons, light is often friend and foe. They need more illumination to see the details in environment while at the same time lighting often causes visual stress and its uncomfortable side effects including excessive blinking, tearing, eye pain, and headache. The visual stress may cause a client to avoid or limit participation in settings where lighting cannot be controlled including virtually all community environments. The light sensitive person may also take extreme measures to reduce light by wearing dark sunglasses and wide brimmed hats indoors or using thick drapes on windows and turning off all of the lights within a room.

The challenge is to find lighting sources that provide adequate illumination without discomfort. Fluorescent lighting, commonly used because of its energy efficiency, is actually the least tolerated light source. Fluorescent lighting emits a short wavelength 50-60 HZ flicker that can

be quite noxious to persons with light sensitivity.^{6, 62, 272} Halogen and LED lighting provide a well-tolerated bright illumination that works well for most light sensitive clients. However, consider all types of lighting including fluorescent as clients vary widely in their lighting preferences.

Other techniques/strategies for light sensitive clients include:

- Change the background on computer screens and smartphones from white to a darker color to alleviate eyestrain.
- Use blinds to deflect incoming light upward and filter light from windows.
- Cover glossy surfaces such as countertops and floors with rugs, or mats to reduce reflected light.⁵²
- Use tinted eyeglass lenses or fit over shields (combined with a wide brimmed hat outdoors) to reduce glare and ease discomfort in when lighting cannot be controlled (such as in community environments).^{15, 62, 72, 79}

The OT must also help the client establish performance patterns that support occupational performance. Establishing routines such as shopping at off hours to avoid a crowded grocery store reduces both cognitive and visual stress. Establishing a habit of leaving the house keys in a bowl by the door reduces the need for visual search; cleaning eyeglasses daily ensures a brighter image.

5.6 Intervention for Reduced Acuity

5.6.1 Reduced Acuity = Reduced Participation

Persons who don't see well miss or misinterpret details in tasks and environments. They may not accurately recognize the context of a setting which will diminish their ability to predict and therefore direct actions. They will make mistakes (that we may interpret as cognitive impairment) and those mistakes will cause them to feel stress, anxiety, and fear about participating in occupations and environments. They may slow down, shut down and avoid participation leaving a void in their occupational performance.

Reduced acuity limits the ability to see small or distant visual details and will make it difficult for the client to complete some daily living tasks. The more the daily task relies on vision, the greater the visual stress and limitations the client will experience. Eating (other than food identification) usually is not affected, nor is dressing once clothing is identified. But any activity that requires reading will be affected. The list includes meal preparation, medication management, financial management, telling time, setting thermostats and appliance dials, using a smart phone, reading overhead signs and traffic lights.

5.6.2 Address Correctable Vision Loss

5.6.2.1 Determine Whether Vision can be Improved

Reduced acuity can often be corrected with eyewear or surgery. Seek referral to an eye doctor if the client has less than 20/25 acuity wearing their eyeglasses on the LeaNumbers Intermediate Acuity Chart or the Warren Text Card, or if it has been more than 2 years since an older client's eyeglasses were updated.

5.6.2.2 Evaluate the Client's Eyewear

Make sure client is wearing glasses and the glasses are clean and in good repair. Research shows that persons are frequently admitted to rehabilitation floors without their prescription eyewear. Lotery et al.¹⁴⁰ studied patients admitted to a stroke rehab floor and reported that over a quarter who wore prescription glasses did not have their glasses with them and among those who did, nearly a quarter of the eyeglasses were dirty, scratched or needed repair. Roche et al.¹⁸⁷ also found that a quarter of patients admitted onto an orthopedic floor did not have their glasses with them and for those with glasses, 85% of the spectacles were dirty or in poor repair. Lotery et al.¹⁴⁰ also found that approximately half of their participants needed stronger glasses.

5.6.3 Inform the Rehab Team

Make sure the team knows about the client's vision loss and how to assist the client to compensate. We *are* the experts in using vision for functional activities and must claim the role of vision expert. As the vision expert we must ALWAYS screen the client's vision and share our findings with our colleagues. We must also provide suggestions to our colleagues on the most effective accommodations to enable the client to participate in their interventions.

5.6.4 Advocate for the Client

Visual acuity is the most important of the three foundation visual functions within the visual perceptual hierarchy (see section 1.4) because it strongly influences the ability to safely navigate, read, and complete ADLS. Reduced visual acuity must be addressed as early as possible in recovery to obtain an optimal client outcome. It is easy to document the client's limitations and pass the buck to others to obtain services. But if your team doesn't have access to an eye doctor, it is your role to advocate for the client. Work with social services to locate funding for new eyeglasses when needed; work with the case manager and the physician to get the client referred to an eye doctor.

5.6.5 Ensure the Client Receives Accessible Handouts

It is the OT's role to ensure that the team (including nursing) knows how to create a visible environment and task for the client who doesn't see well (see section 5.5.2). This includes creating visually accessible handouts to ensure that the client can accurately read printed materials like handouts, labels, and home programs. The two critical components of accessible reading materials are visibility and readability.²⁵ Visibility is print size and contrast; readability is formatting, word use, and sentence construction. Appendix G provides information on how to create visible documents for the client using information gained from their performance on the Warren Test Card. The Appendix also includes information on how to make the text easier to read (readability). A client with reduced acuity must allocate more attentional resources to decoding words. This extra effort may cause the client to experience stress and fatigue which can reduce comprehension. Modifying how information on handouts is written and formatted can reduce this stress and increase the readability of the materials. Share the Appendix information with the rehab team to ensure that their handouts are also visible and readable.

The third column on the right side of the Warren text Card-*metric diopters needed*-provides the *approximate* minimum number of diopters of magnification required in eyeglasses or a magnifier to read standard 1M print. Non-prescribed reading glasses are sold in pharmacies and on Amazon in strengths that range from 1-6 diopters. Clients whose acuity falls in the normal to near normal reading acuity range (20/20-20/60) may be able to read print using a pair of these stronger "store bought" glasses. It is OK to have non-prescribed reading glasses available in various diopter strengths to try out with your client. **But this is not a long-term solution.** Common refractive errors like myopia (near-sightedness), hyperopia (far-sightedness) and astigmatism significantly influence acuity and can only be corrected with prescription lenses (see Appendix J illustration 2 and section 2.1.3). Referral to the eye doctor for refraction and prescription of eyeglasses is critical to achieve the clearest vision. Clients with acuities less than 20/60, must use hand-held, stand magnifiers, or video magnifiers to read. Unless a member of the rehab team has experience in low vision and an understanding of optics, this client should be referred to a low vision optometrist or a low vision rehabilitation program to determine their magnifier needs.

5.6.6 If Your Client has Reduced Low Contrast

Clients with reduced contrast sensitivity experience an increased falls risk, difficulty reading, and difficulty completing ADLs with low contrast features. You must modify the client's environment and tasks to increase the visibility of key features. Use the interventions described in section 5.5.2 to increase contrast, reduce pattern, enlarge features, provide good quality and even illumination.

5.6.7 If Your Client has Low Vision

Low vision permanently impairs a person's ability to clearly see objects, details and color and is caused by eye conditions that cannot be corrected by medical procedures or eyeglasses. Unlike

blindness, persons with low vision usually retain some useable vision. The person can see but does not see well and especially has difficulty seeing small details and low contrast forms. Low vision can occur from acquired, congenital, or hereditary conditions and diseases but age-related eye disease (ARED) is the leading cause of low vision in developed countries like the United States (see section 2.1.2.2).²⁵¹ Three age-related eye diseases cause most of the low vision in older Americans: age-related macular degeneration (AMD), open-angle glaucoma (OAG) and diabetic retinopathy (DR). These are chronic and progressing diseases that have no cure; vision loss cannot be reversed and typically increases the longer one has the disease. The severity and permanence of the vision loss requires intervention from specialists in optometry, occupational therapy, and orientation and mobility to enable the client to continue a live a productive life. OTs without low vision training and certification can provide modifications to increase the visibility of tasks and environments, but referral to a low vision program provides the best outcome for the client.

5.6.8 Connect the Client with Free Resources

Most countries provide free resources to assist persons who have poor acuity from low vision or brain injury. Easily accessed resources in the U.S. include:

- The National Library Service for the Blind and Physically Handicapped offers free recorded books, magazines, and music through its Talking Books lending library program. (<http://www.loc.gov/nls/>) Each state has at least one talking book library.
- Many states offer free radio-reading services in conjunction with a university-sponsored public radio station. Radio-reader services provide a variety of special programming for persons with disabilities, which often includes reading local newspapers.
- Pharmacies will provide large-print medication labels; many restaurants will provide large-print menus, and most businesses will provide statements and bills in large print.

5.7 Intervention for Oculomotor Impairment

Oculomotor impairment generally does not prevent the client from independently completing an occupation, but it does affect participation in daily activities and quality of life.^{32, 37, 232} The client may have trouble coordinating eye movements for reading¹⁸³ and other activities. Images may double and blur; the client may be unable to sustain focus on near objects or quickly switch between near and far focal distances. These difficulties, especially when combined with light sensitivity, can cause the client to experience significant visual stress, that may trigger the onset of headache, eye strain, neck strain, and fatigue.^{6, 37, 79, 106} The client may begin to avoid participating in activities that trigger visual stress. The most stressful activities often require reading or take place in community environments that require the person to adjust to bright and changing lighting such as driving. Computer work and viewing television may also cause significant stress due to sustained focus, light sensitivity, and screen glare.⁷⁹

5.7.1 Ophthalmology/Optometry Role

Ophthalmologists and optometrists offer interventions to reestablish fusion and binocularity.⁹⁸ The intervention selected for a client depends on the prognosis for recovery, the client's ability to participate in therapy, financial resources, and the eye doctor providing the consultation. Both eye doctors use occlusion, prism, and lenses to improve vision, but they differ in their use of eye exercises.^{48, 63, 137, 174, 198, 202, 203, 233, 234} Most oculomotor dysfunction resolves without intervention within six months following the brain injury.¹⁷¹ During this recovery period, ophthalmologists generally only prescribe prism, lenses, or occlusion whereas optometrists may also prescribe vision therapy exercises to improve accommodation and binocular use of the eyes.⁴⁸

5.7.1.1 Lenses

The eye doctors may prescribe lenses to reduce blurred vision in clients with accommodative (focusing) impairment. The lenses help the client achieve and maintain focus, reducing the amount of effort the client must put into reading and other near distance tasks. This often increases concentration, improves reading, and reduces headache and eye pain due to eye strain.

5.7.1.2 Prism

Both eye doctors use prism to reestablish single vision in the primary directions of gaze in persons with paralytic strabismic (see illustration 9 in Appendix J).^{48, 98, 137, 173} The eye doctor places the prism on the lens of the strabismic eye to shift the image until it overlaps the image from the other eye and creates single vision.^{202, 203} The client wears the prism only as long as needed to maintain fusion. If recovery is expected, the eye doctor usually applies temporary plastic Fresnel press-on prisms and gradually reduces the diopter strength of the prism as the muscle weakness resolves. If recovery isn't expected or does not occur, the eye doctor may have the prism permanently ground into the client's eyeglass lens to provide the clearest vision.

5.7.1.3 Occlusion

Diplopia causes images to double and blur; the resulting distortion creates confusion for the client and limits participation in daily activities. Occlusion is often used during the recovery period to eliminate the diplopia and visual stress. Both eye doctors prescribe occlusion reduce diplopia, but optometrists also use it therapeutically to improve binocular use of the eyes.⁴⁸ If you do not have access to an eye doctor in your setting, you can-in collaboration with the rehab team-apply occlusion to restore single vision to the client (see Appendix H). As an OT intervention, you can ONLY use occlusion to eliminate visual stress from the diplopia so that the client can fully participate in activities and therapy during the recovery period. This intervention has no therapeutic purpose other than to eliminate the double image. Consult your medical director when applying occlusion following the same protocol you use to apply a splint or sling.

Two types of occlusion are used to eliminate the second image.^{79, 173, 174, 202, 203} **Full occlusion** eliminates all of the vision in one eye using a “pirate” patch, a clip-on occluder, or opaque tape to cover the eye glass lens. Pirate patches are often used because they are inexpensive and readily available. However, the client often has difficulty tolerating the patch. The patch eliminates peripheral vision in the covered eye, disrupting normal mechanisms for control of balance and orientation to space. This may cause the client to feel off balance and disoriented when navigating environments. In addition, most clients cannot tolerate long periods of using one eye alone; the working eye becomes fatigued and the person experiences eye strain and headache. To avoid eye strain, the client is usually placed on a schedule to alternate the patch between the eyes. While this reduces fatigue and eye strain, clients often don’t adhere to the patching schedule because they don’t like covering their dominant eye even for short periods of time. **Partial occlusion** covers only a portion of the visual field in one eye-occluding just enough vision to eliminate the diplopia and still allow the client to use the eyes together to complete activities^{173, 174, 202, 203} Appendix H describes two forms of partial occlusion that the OT can apply. Partial occlusion provides a kinder, gentler way to achieve single vision without disrupting balance or orientation. The client is often more comfortable and more willing to engage in activities. The main disadvantage of partial occlusion is that the occlusion tape must be applied to a pair of eyeglasses-either the client’s prescription lenses or a pair of frames with non-refractive (plano) lenses. “Harry Potter” glasses are an example of inexpensive plastic plano lenses available from Amazon or other retailers.

Regardless of the intervention-occlusion, lenses, or prism-it is important that the OT work with the client and eye doctor to find the best way to manage diplopia and focusing issues so that the client will participate in daily occupations. For example, the OT may advocate for partial occlusion instead of total occlusion for a client who must navigate community environments; or advocate for a prism if the client needs to complete a significant amount of reading.

5.7.1.4 Eye Exercises

Evidence for the efficacy of using eye exercises to restore binocular function and improve oculomotor control following adult acquired brain injury is still limited and inconclusive.^{18, 198} However recent carefully planned research studies have shown evidence for the effectiveness of precise exercise protocols to improve vergence and accommodation in persons with chronic mild head trauma.^{208, 209, 233, 234} The evidence of effectiveness has only been demonstrated for specific exercise protocols carried out in the OD’s practice (e.g., not a generic home program or set of exercises swiped from the internet). As an optometric intervention, eye exercises are not within the OT scope of practice and should only be completed by the optometrist. Read my justification for making this statement *in Opinion: Why You Should Reconsider using Therapy Time to Provide Eye Exercises to Clients with Oculomotor Impairment from Acquired Brain Injury* in Appendix I.

5.7.1.5 Surgery

An ophthalmologist specially trained in strabismus surgery completes this intervention. Surgery is recommended when the degree of strabismus is too large to be reduced with prism or fusional effort, or when a significant strabismic condition does not resolve in 12 to 18 months.¹⁷³ The eye surgeon cuts and reattaches the tendons of specific extraocular muscles to physically alter the position of the eye so it aligns with the other eye to create a single image.

5.7.2 OT Role

The OT focuses on enabling the client to participate in necessary and desired daily occupations despite the challenges and discomfort of oculomotor impairment. Persons with oculomotor impairment can independently complete daily occupations but they will avoid participating in activities that cause them to experience considerable visual stress. The conditions that occur with oculomotor impairment including light sensitivity, headache, and blurred vision can persist months to years even in cases of mild TBI and concussion.^{37, 146, 216} These co-impairments when combined with visually stressful environmental features like poor or harsh lighting, low contrast, too much clutter and pattern, may cause the client to limit or eliminate participation in enjoyable and meaningful activities. The more stress provoking features the environment contains, the more likely the client will avoid it. The client may stop attending church, lunching with friends, reading books, watching TV, and surfing the internet. Relinquishing important and valued occupations can cause the client to feel depressed and less motivated to engage in daily activities. Ultimately, some clients may experience a debilitating and self-perpetuating vicious cycle often observed in persons with vision impairment wherein depression causes activity limitations and activity limitations cause depression.¹¹⁸

5.7.2.1 Education

Oculomotor impairment is short term for most clients-lasting a few weeks to a few months. The typical client can expect to eventually reestablish normal binocular function using prescription eyeglasses if needed. Because it is relatively short-term, eye doctors and members of the rehab team may feel that educating the client about their vision impairment is not important. But oculomotor impairment and co-impairments do persist (see section 5.7.2). For these clients, education on how their vision changed and especially about common co-impairments is very important to prevent the client from avoiding and dropping out occupations. Helping the client understand the cause of their visual stress enables them to take control of it and problem solve ways to reduce stress by modifying the environment and how they complete occupations.

5.7.2.2 Environment and Task Modification

The OT disrupts the cycle of depression (refer back to section 5.7.2) and promotes participation by assisting the client to modify environment/tasks and devise strategies to reduce or eliminate visual stress during activities. Intervention begins by observing how the environment and/or demands of the activity causes or aggravates the client's visual stress. For example, poor quality

or glaring light in the kitchen may trigger a headache in the light sensitive client attempting to prepare a meal for the family; glare from this client's computer screen may also cause the client to experience eye watering, eye strain and headache when paying bills or completing correspondence.

The following practical interventions teach the client how to manage their visual stress and improve their self-efficacy and belief that they can control rather than be controlled by their symptoms.

- Work with the client to add contrast, increase size, reduce pattern, and find sources of comfortable lighting to create a visually explicit environment.
- Remove vision dependent steps in tasks to lessen the client's need to constantly use vision to complete activities.
- Add structure to create a consistent environment to reduce searching.
- Work with the client to establish habits and routines that minimize and reduce stress. For example, a client who experiences headache triggered by visual stress when grocery shopping might try shopping for just a few items at a time to reduce the amount of time spent in this stress-provoking environment. Alternatively, the client may prevent headaches by shopping in the early morning when the client is well-rested, and the grocery store is less crowded.
- Recommend that light sensitive clients wear fit-over filters and wide brimmed hats to reduce the amount of light entering the eye when participating in community environments (see section 5.5.2).
- Teach the client to use voiceover and speech-to-text apps on their phone and computer to reduce reading and screen time.

5.8 Intervention for Hemianopia and Visual Field Deficits

Persons with hemianopia generally have trouble completing activities that require either mobility or reading. These two performance skills underpin a significant number of I-ADLS. Slow and inaccurate search of the blind side can cause the client to have trouble navigating safely and engaging in daily occupations in dynamic environments, such as driving, shopping, and participating in community events. The client's challenges in reading result from inability to adapt their habitual eye movement strategy to the shortened width of the new perceptual span. The client experiences reduced reading accuracy and speed that limits participation in occupations like financial management, meal preparation and medication management.

5.8.1 Education

Increasing the client's awareness of the location and extent of the field deficit is a critical aspect of intervention. Most visual field deficits cause at least some permanent vision loss which is why hemianopia is considered a low vision condition. The client must learn to compensate for the vision loss in their daily activities and compensation is rooted in understanding how vision has changed. Unfortunately, perceptual completion (see section 2.4.3) makes it difficult for the

client to realize the presence, extent, and boundaries of their field deficit. To successfully compensate, the client must firmly believe that the deficit exists and that the visual input from the blind side cannot be trusted. This level of insight is critical to the client's ability to resume driving and participate in activities outside of the home. Education helps the client develop this awareness and successfully apply compensatory strategies.

5.8.2 Environment and Task Modification

Persons with hemianopia function best in a structured and predictable environment because it reduces the need for constant scanning and lessens stress and fatigue. Examples of beneficial environment/ task modifications for persons with hemianopia include

- Adding color and contrast to the key structures within the environment required for safe navigation and orientation (e.g., door frames and furniture) to ensure the client sees these structures more quickly.
- Using black felt-tip pens and bold line paper to increase the contrast in writing materials, and help client more accurately monitor the pen tip in handwriting.
- Adding a high-quality non glaring task light to make print more visible when reading.
- Adding high-quality, non-glaring ambient lighting in the home and other environments to improve mobility and navigation.
- Reducing pattern in the environment by eliminating clutter and using solid-colored objects enhances the client's ability to locate items more quickly.

Consider recommending these environmental modifications to increase the visibility of the other environments that your client wants to participate in including your clinic, the client's church, office, etc.

5.8.3 Compensatory Visual Scanning Training (C-VST)

Clients with hemianopia have difficulty navigating environments because they do not turn the head far enough, fast enough, or often enough towards the blind field to take in the information needed to stay oriented and avoid collisions. When the inferior visual field is affected, as occurs with a hemianopia, the client may also have trouble monitoring the support surface on the deficit side. This can cause the client to walk slowly and hesitantly, keeping the head down and the eyes fixed on the floor directly in front of them. This strategy prevents the client from colliding with objects, but also limits their ability to monitor the surrounding environment increasing disorientation during navigation. To compensate for these mobility limitations, the client must consciously and regularly search the visual field on the blind side during movement.^{60, 98, 104, 176, 177, 242, 272} Specifically, the client must learn to:

- Initiate a wide and fast head turn towards the blind field.
- Anticipate visual input from the blind field by increasing head and eye movements toward the blind field.
- Execute an organized and efficient search pattern of the blind side.
- Attend to and detect important visual details on the blind side.

- Quickly shift attention to search between the central visual field and the peripheral visual field on the blind side.

The efficacy of C-VST has been established in multiple research studies including at least four randomized control trials.^{4, 56, 60, 199} A Cochrane review in 2019¹⁷⁶ stated that C-VST had the most evidence of effectiveness for improving visual search. It is an *important* performance skill for everyday living—all clients must be able to locate needed items in their environment and a *critical* performance skill for the client who wants to resume driving. Training focuses on increasing the speed, width, efficiency, and consistency of the client's search of the blind side.^{56, 98, 107, 176, 177, 199, 205, 272} There are several types of C-VST interventions

5.8.3.1 Light Boards

Many therapists use large computerized light boards to develop the components of efficient search patterns.^{23, 33, 56, 103, 222} The size of the light boards automatically elicits the wide head turn needed to search the blind side. The gaming format challenges clients to give their best effort each time and it responsively increases the skill level to facilitate progress. The devices record and analyze performance to identify deficiencies and help the client improve their performance. Figure 5.3 shows a client using the Dynavision D2²³ to improve visual search. The D2 was one of the first lightboards used in vision rehabilitation. It is no longer manufactured but many clinics still use it. Other lightboards include the Bioness-BITS,²²² Vision Coach,³³ and the NVT.¹⁰³ If you don't have access to a light board, you can use a laser pointer projected onto the wall and play "tag" games where the client searches to locate the projected laser dot as quickly as possible.

The goal of visual search training is to enable the client to quickly scan the blind side and search between sides to ensure safe navigation. Training focuses on developing these visual search components:

- Initiation of a wide head turn towards the blind side.
- Increased head and eye movement towards the blind field.
- Initiation of fast head and eye movement toward the blind side.
- Execution of an organized and efficient search pattern that begins on the blind side.
- Attention to and detection of visual detail on the blind side.
- Ability to quickly shift attention and search between the central visual field and the peripheral visual field on the blind side.



Figure 5.3: Client searching for and striking lighted button targets on the Dynavision D2.

5.8.3.2 Dual Scanning Activities

As the client masters the components of efficient visual search, incorporate them into dual task activities that require combining search with ambulation. The goal of this intervention is to train the client to keep the head up and continuously searching the environment as the client walks through it. Acquiring this skill enables the client to maintain orientation and avoid collisions while navigating environments. Intervention activities include:

- Completing extended scan courses (see section 4.5.4) using cards with letters taped onto walls in various locations along hallways.
- “Find red” activities where the client points out every red (or a different color) item in the surrounding environment while navigating towards a destination (like the gift shop).
- “Narrated walks” where the client points out landmarks, objects and changes in the environment while navigating towards a destination.
- As the client’s skill in searching improves, add in community environments. Create “treasure hunt” activities that require the client to find a specific item in designated location in the building or on the campus using landmarks and organized search strategies.

Note: If the client is unable to keep their head up during ambulation, consider trialing the use of a support cane. The cane tip provides additional tactile feedback and may help reduce the client’s desire to fix gaze directly the floor ahead.

5.8.3.3 Activities for Lower Functioning Clients

Not every client has the physical or cognitive ability to engage with dynamic light boards and community environments to improve visual scanning. Lower functioning clients require activities that proceed at a slower pace and place less cognitive demand on search and attention. Occupation-based activities carried out in quiet environments are a good place to start. Activities should emphasize initiating and completing a consistent wide search strategy to locate items on the blind side. Repetition is important. Figures 5.5 and 5.6 show examples of simple games and scan boards.



Figure 5.5: Play solitaire or double solitaire

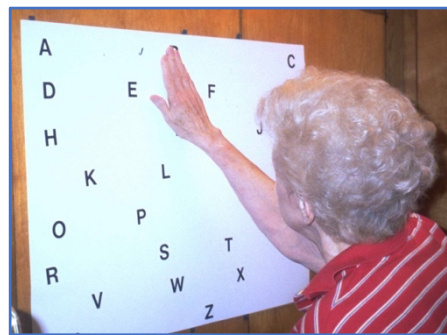


Figure 5.6: Point to letters in order on a poster board taped to wall.

5.8.4 Occupation-Based Community Activities

Combining compensatory visual skills training with occupation-based interventions is an effective way to develop these performance skills.^{18, 242} Persons with hemianopia feel least comfortable in dynamic community environments. These environments can trigger anxiety (see section 2.4.3) and the client may respond by avoiding all community environments or relying on someone to lead them through the environment.¹⁰² It is important to take the client into community environments to build confidence and independence. As the client becomes more confident navigating areas surrounding the clinic, introduce occupations in the community like shopping for groceries, mailing a letter or buying stamps at the post office, or walking through a park. To build the client's self-efficacy, carefully grade the challenge to ensure that the client will successfully complete the task. For example, begin with simple challenges like finding a single item in a small shop and expand to more difficult activities like navigating a large grocery store. Assign homework for the client to complete at least one task by themselves between sessions and increase the task demands each week. For example, homework for week one would be for a family member to walk with the client to the church sanctuary and the client goes in and locates a pew and sits down. Week 2 the family member drops the client off in front of the church and the client goes into the sanctuary, locates a pew, and sits down.

5.8.5 Supportive Habits and Routines

Teach the client to incorporate habits and routines that support independence within the home and community.

Supportive habits are especially important when navigating high-risk community environments with people and vehicle traffic, and environments with low contrast features, poor or variable lighting, pattern, and obstacles. The two most important supportive habits to ensure safe navigation are:

1. Stopping before entering an unfamiliar environment and slowly and deliberately scanning the environment to identify potential travel hazards. Common hazards include temporary and fragile displays in stores and low contrast features like curb cuts and other subtle changes in the support surface. This habit helps the client build a mental representation of the space before navigating it which increases the likelihood of success in locating needed items and avoiding obstacles. Successfully navigating a challenging environment increases the client's confidence and self-efficacy and increases the likelihood the client will regularly participate in community environments. It also reduces the client's risk of an unexpected collision and fall. It is a critical habit for every client to learn to ensure safety and participation.
2. Consciously identifying unique landmarks such as a picture on a wall or a change in wall color to assist the client to stay oriented when navigating an unfamiliar environment.

Using *supportive routines* to facilitate the use of compensatory strategies is equally important. Examples of key supportive routines include:

- Shopping at times of day when there are less crowds.
- Choosing well lighted walkways with minimal obstacles.
- Arriving early to social/community events to settle in before others begin to arrive.

Examples of supportive habits and routines that **ALL** clients should use to facilitate compensation include:

- Turning on room lights when navigating (don't navigate in the dark!).
- Placing task lamps with LED lights where tabletop tasks will be completed *and* turning on the light on to illuminate tasks.
- Structure cabinets, shelves, drawers to find a place for everything and then *return* everything to its place.
- Keep keys or other items in a bowl or on a hanger next to the door.
- Put the lid back on an item after using it (if you knock it over it won't spill).

5.8.6 The Client Who Wants to Resume Driving

Research shows that persons with hemianopia who have learned to compensate for their field loss can safely resume driving with specific training (see Bowers³⁰ for an indepth review of driving with hemianopia). Client factors that influence successful return to driving include:

- The statutes that govern driving in your state, province, country. Driving with a field deficit may not be permitted.
- The extent of the visual field deficit. The less field loss the better. Clients with quadrantanopia, macular sparing, and relative field loss have more vision to use than the client with a complete hemianopia and dense field loss.
- The presence of co-impairments. Clients with impaired contrast, hemiplegia, neglect, and aphasia are less likely to be able to successfully resume driving.
- The client's driving record. A client with a history of multiple accidents and citations was an unsafe driver before field loss and will likely be one after.
- The driving environment. Driving in rural areas is easier than driving in a city. Driving on flat, straight wide-open terrain (western Kansas-flat as a pancake) is easier than driving on hilly/mountainous curvy terrain.
- The client's driving needs. Running a few errands close to home vs. driving to work in rush hour traffic.

Do not refer the client to a driving program until they have mastered compensatory visual scanning in dynamic community settings and fully understand how their field loss affects the ability to use their vision during driving. Driver's training should focus on minimizing risk:

- Select routes with minimum merges and lane changes.
- Avoid multi-lane traffic.
- Position the car so that evasive maneuvers, if needed, can be made towards seeing side.
- Restrict night and dusk/dawn driving.
- Use wide rearview mirrors and select a vehicle with good rear visibility.
- Restrict driving to just what is needed to complete the task.

5.8.7 Reading

Reading is an important fundamental skill needed to participate fully in daily activities. The inability to read not only reduces the person's ability to complete pleasurable activities but also to acquire information needed to be healthy, safe, and autonomous. Persons with hemianopia often have the language skills but not the visual skills to read. They stop reading because they must put so much effort into seeing words and navigating text. Research shows that, with daily practice and persistence, persons with hemianopia can improve their reading speed and accuracy.^{4, 164, 211, 212} Not every client can or will devote the time and energy required to improve reading performance, but every client needs to be able to acquire information normally provided in print form. The intervention goal should be broad: *to enable the client to compensate for the vision impairment to obtain and understand printed information*. You can achieve the goal by improving the client's ability to read printed text or by using technology to enable the client to obtain needed information via another method.

5.8.7.1 Intervention for the Client Strongly Motivated to Resume Reading Print

The primary challenges in reading occur because the client is trying to read using a saccade strategy designed for a wider unrestricted perceptual span. To improve reading speed and accuracy, the client must adapt their saccade strategy to the new perceptual span created by the hemianopia. This is a demanding task that can be extremely frustrating for the client. Provide a structured home program focused on daily periods of short practice. Evidence-based interventions to improve reading are being developed^{164, 212} but currently many require special equipment and significant practice time which reduces their feasibility as an OT intervention. I have used the following two step intervention for many years to assist clients to put in the practice time required to improve their reading performance. Depending on the client's progress, Step 1 is usually completed while the client is still receiving therapy and Step 2 as a long-term home program following discharge.

Step 1: Begin with search and find exercises that require the client to locate, and mark designated letters, numbers, or words on worksheets (see Figure 5.7). Use pre-reading exercises such the Warren *PreReading and Writing Exercises for Persons with Macular Scotoma* (available as a free resource download on www.courses.visabilities.com or purchase the Wright and Watson *Learn to Use Your Vision Reading Workbook* Large print word and number search books and crossword puzzles are also excellent practice materials and are widely available in stores. The low cognitive requirements of these exercises enable the client to focus on perfecting the saccade strategy needed to move the new perceptual span across the page. The client completes these worksheets daily, devoting 20-30 minutes each day.

Modifications like drawing a bold red line down the margin of the text will assist the client with a left hemianopia to find the beginning line of text or a client with a right hemianopia find the end of the line of text. Clients with difficulty staying on the line of text, or moving from line to line, may benefit from using a ruler or card to maintain their place. These modifications improve accuracy but reduce reading speed. They should NOT be permanent modifications; the client should relinquish them up as reading performance improves.

Step 2: As the client's ease and accuracy improves, switch to an occupation-based approach to transition into reading continuous text. Assist the client to select a large print book on a familiar topic or by favorite author and instruct them to read a chapter a day. The large print format reduces the density of the text, requiring less saccade precision, and the familiar subject matter reduces the cognitive demands on the client. The client should continue reading books daily until reading becomes less taxing-this could take several months to a year.

As the client's saccade pattern changes with practice, a client who wore bifocals prior to the hemianopia may have trouble seeing clearly through the reading portion (bottom of the lens) due to its restricted field of view. The client may need to be fitted with single lens reading glasses or possibly executive line bifocals to provide a wider field of view.

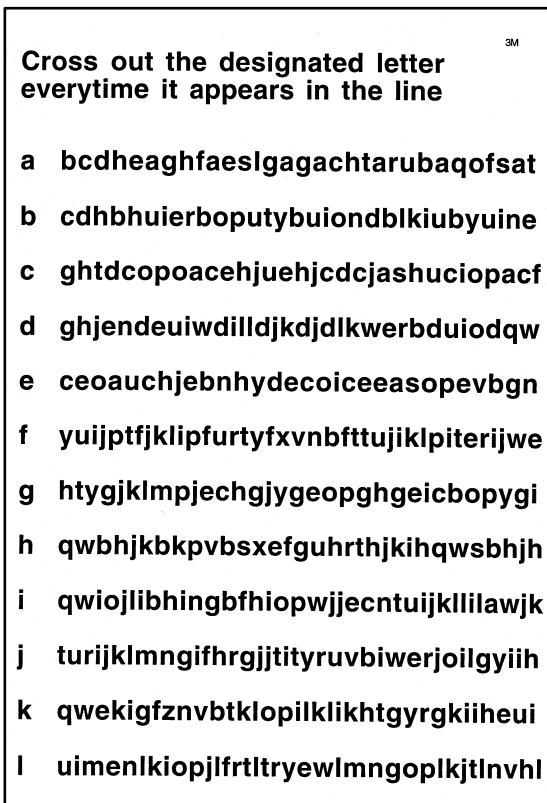


Figure 5.7: PreReading exercise sheet from the *PreReading and Writing Exercises for Persons with Macular Scotoma* (free download). The client is instructed to cross out all of the letters on the line that match the designated alphabet letter on the left side of the page (e.g., a, b, c,).

5.8.7.2 Key Interventions for ALL Clients with Reading Limitations

Assistive devices and technology enable clients to acquire information without reading. The OT assists the client to determine the best device, app, and software to meet their needs.⁵² Begin by modifying accessibility features on devices the client already uses (e.g., smartphone, computer, iPad).

- Adjust the brightness and background color of the screen.
- Enhance the size, color, and boldness of text, icons, and cursors.
- Train the client to use built-in features, such as zoom, voice-over, and speech to text.
- Locate apps and software that will enable the client to complete a specific task using voice commands.
- Train the client to use talking devices. Examples include talking glucose monitors, scales, blood pressure meters, watches, clock, calculators, and food scales.

Train the client to use internet-connected virtual assistants (e.g., Siri, Echo etc.). Program the device to perform functions such telling the time, outside temperature, and weather forecast, ordering items, dialing the phone, and setting the thermostat or a timer. Remember that training is critical-be sure to provide instruction on how to use all apps, software, or devices to ensure the client can use them to meet their daily needs.

Require that the client “teach back” instructions on using all new devices. Teach-back is an evidence based and effective method for ensuring that a client understands the instructions they have received.⁹⁷ Before ending the session, ask the client to repeat back or demonstrate what they learned. For example, the client repeats back the instructions for using the voice over feature on their phone. Observing the client repeat instructions provides an opportunity to review and reinforce important steps. Older adults need at least two teach back sessions to consolidate their learning of new information: one immediately following instruction and one two weeks later.¹¹⁹

Whenever possible try to eliminate the need for the client to read and write—for example set up automatic prescription refills from the pharmacy (while you are at it-alert the pharmacist that the client needs large print labels). Set up automatic bank payment for regularly recurring bills like water, electricity, gas, and the internet.

5.8.8 Handwriting

Increase the client’s handwriting legibility by teaching the client to slow down and monitor the pen tip as the hand moves across the page into the blind side. Activities that require the client to trace lines and shapes help them learn how to position the paper and pen so that the pen tip stays visible on the line (see Figure 5.8). The Warren *Prereading and Writing Exercises for Persons with Macular Scotoma* provides practice sheets to improve handwriting legibility (available as a free resource download on www.courses.visabilities.com). Other occupation-based activities include practice filling out a blank check and check register, addressing an envelope, and filling out a form (collect sign-up inserts from magazines to use for practice).

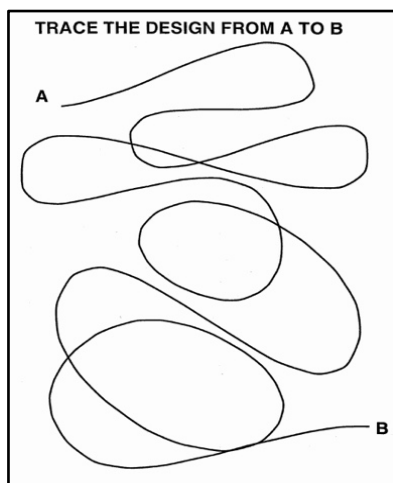


Figure 5.8: Prewriting Exercise Sheet from the *PreReading and Writing Exercises for Persons with Macular Scotoma* (free download). The client is instructed trace the line from A to B.

5.9 Neglect

Persons with neglect have trouble locating and using resources from the environment to complete daily activities. Performance limitations may include difficulty locating items on the

left side in daily tasks,¹⁰ sustaining attention long enough to complete an activity,²⁴⁵ dividing and shifting attention between tasks,²⁴⁵ and rapidly and accurately assessing situations in dynamic environments.²⁷⁵ Generally, the more dynamic and ambiguous the environment, the greater the limitations the client will experience due to the increased demands on visual attention.^{29, 245}

The goal of OT intervention is to enable the client to use their attentional capabilities to complete needed daily activities. The OT intervention focuses on creating an environment that supports attention, improving the client's ability to compensate for inattention when searching tasks and environments, improving the client's ability to sustain attention to task completion, and developing habits and routines that reduce visual stress.

5.9.1 Chronic vs. Acute Neglect

The incidence of visual spatial neglect averages between 50-70% in the early stages of recovery from a right hemisphere brain injury.^{83, 107, 244} Fortunately, most neglect resolves during the first year of recovery and is significantly diminished by three months post injury in most persons.^{83, 120, 61, 244} Disruption of the pathways that connect the frontal, temporal, parietal and occipital lobes to each other may account for the initially high incidence of neglect immediately after injury and the good potential for recovery.⁶⁵ Person's whose neglect persists beyond three months may have significant and chronic deficits that reflect structural rather than pathway damage within the brain.¹²⁰

5.9.2 Education

Education is a key component of intervention process as the client must develop insight into how neglect has changed their visual search and attention before they can learn how to reorganize visual search to compensate for neglect.^{130, 228, 229} Education begins during evaluation by using cuing and feedback to alert the client to deficiencies in their search pattern. During intervention the OT can use the client's difficulties or mistakes as "teachable moments" to improve insight into capabilities and limitations.^{123, 130, 228}

5.9.3 Environment and Task Modification

The most powerful tool in the OT toolkit is to create an environment that **facilitates and supports attention**. The key question to ask when planning the intervention is "How can I modify the task/environment to help the client use their current attentional capability more effectively to complete occupations?" Then focus on modifications that reduce demand on the client's visual attention to help them use their limited attention capabilities. The most important modification is to eliminate and minimize features that place stress on visual processing. The components of this modification include:

- **Reduce pattern.** This is the most important modification as dense pattern forces the client to use more selective attention to locate desired objects.⁷⁰ The client may not be able to sustain the mental effort needed to sift through lots of pattern and subsequently

views the environment as filled with “visual noise” rather than meaningful objects. Reducing distractors has been shown to improve effectiveness of the search pattern in persons with neglect.^{55, 112, 161}

- ***Increase the visibility of features that trigger prediction and sequencing.*** Remember that the neocortex initiates and guides actions by predicting what is going to happen, verifying it through sensory feedback, and modifying as needed (see section 1.2).¹⁴ The process begins with detecting and recognizing the environmental feature that will trigger memory and unlock the sequence. A visible and explicit environment makes it easier for the client to recognize key features and create a meaningful context for action.⁷⁰ Research has shown that making targets more explicit elicits an efficient and faster search pattern in persons with neglect by creating a “pop out” effect that grabs the person’s attention.^{55, 70, 112, 161} For example in a hospital setting wrap a piece of bright orange fluorescent tape around a call button cause it to pop-out against the bed sheets and railing.
- ***Strategically add task lighting to spotlight the components of an ADL task*** helps the client focus attention to complete the task (see Figure 5.2). Green et al.⁹⁴ found that adding a task lamp to spotlight the components of a grooming task enabled clients with neglect to perform the task more quickly and independently resulting in an improved FIM score.
- ***Add structure and organization:*** Finding a place for everything and keeping everything in its place is the final critical piece in creating an “attention promoting” environment.⁷⁰

5.9.4 Compensatory Visual Scanning Training

Compensatory visual scanning training (C-VST) has a sufficient level of evidence to be considered a practice standard for interventions aimed at reducing the effect of spatial bias on the client’s search pattern.⁴⁶ VST is a top-down compensatory approach that employs the higher-level functions of language and cognition to help the client learn and employ a structured search pattern that begins on the left side of a visual array and progresses left to right.^{18, 83, 88, 178, 129} This structured pattern helps the client compensate for the tendency to restrict visual search to the right side and increases the symmetry of the search pattern. You can use a variety of activities, and occupations to provide practice using this compensatory pattern.^{123, 242} Use these guidelines to select an optimal visual scanning task:

- ***Select activities that require the client to search as broad a visual space as possible.*** To help the client learn to initiate and complete a wide visual search, make the working area of the activity large enough to require the client to either turn their head or change body positions to accomplish the task.
- ***Select activities that require the client to interact physically with the target.*** Attention is more focused when the person must act on what is seen.

- **Select activities that require conscious attention to visual details and careful inspection and comparison of targets.** To facilitate selective attention, require the client to consciously study objects to identify their relevant features. Games such as solitaire, Connect Four, checkers, and dominoes have these qualities. Large piece puzzles, word or number searches, crossword puzzles, adult coloring books and crafts such as latchet hook, knitting and paint by number also require selective attention. Encourage the client to recheck their work to make sure that critical details are not missed.
- **Select activities that require the client to sustain attention.** Several influential researchers believe that the inability to stay on task underlies neglect and contributes to its chronicity, and that rehab focused on sustaining attention can reduce neglect behaviors.^{185, 223, 235, 237, 245} Interventions that employ continuously challenging and interactive activities have been shown to increase alertness and the ability to sustain attention.^{223, 235, 245} Fast-paced light board and video games that use a go-no-go format are examples of activities that challenge the client to sustain and shift attention.^{235, 245} All instrumental ADLs require sustained attention and most also require the client to interact with left and right space. Activities with these qualities include:
 - Large (outdoor) versions of popular games: checkers, Connect 4, chess, tic tac toe (check out good ole Amazon to see the selection).
 - Light boards (see section 5.8.3.1) provide many wide, interactive games.
 - Low-cost games include scatter sticky notes of various colors over a wide wall and instruct the client to locate and group them by color or playing laser tag- where client uses a laser pen to “tag” a laser dot that you project onto the wall.
 - Occupations that require physical interaction with a wide visual space including planting, watering, and weeding flowers in a garden, cooking, cleaning, and laundry.

5.9.4.1 Visualization

Niemeier¹⁵⁸ demonstrated that clients with severe chronic neglect could be taught to search left space using a visual imagery technique called the “lighthouse strategy” (p. 40). The intervention placed a simple line drawing of a lighthouse in the client’s line of sight to act as a visual cue. The client was instructed to look at the image and imagine searching like a lighthouse to scan widely from left to right. All rehab staff cued the client to imagine being a lighthouse before completing an activity. Study participants required various amounts of rehearsal to learn the strategy and a statistically significant improvement in search performance was found following the training. The findings were replicated in a second study that showed statistically significant improvements in route finding, navigation (with or without a wheelchair) and problem-solving tasks.¹⁵⁹

5.9.5 Sensory Input Strategies

Sensory input strategies use a bottom-up approach that alters sensory input into the brain to reduce rightward spatial bias and increase attention to the left.^{83, 90, 160, 172} Yoked prism adaptation is currently the most widely used sensory input intervention.⁸³ Multiple studies, including several randomized control trials, have been published on the use of this intervention in patients with neglect.⁸³ For the intervention the client wears strong prisms (embedded in an eyeglass frame) while completing a task that requires monitoring of the hand such as placing or painting an object. The prisms shift the image of the task items toward the right side. To successfully complete the task, the client must learn to shift towards the left to compensate for the rightward shift of the items. Repeatedly completing tasks while wearing the prism results in increased attention to left space after the prism is removed. While most studies show increased attention to the left some show inconsistency in the lasting effect of the shift. Further research is needed to establish the best protocols to achieve an optimal outcome.^{61, 83, 88, 130}

Small studies have shown that applying galvanic vestibular or optokinetic stimulation, neck muscle vibration, transcranial magnetic stimulation and using constraint-induced therapy with patching can increase orientation towards the left side in persons with neglect.^{83, 88, 125, 178, 272, 276} More research is needed to determine the most appropriate clinical application of these interventions before they will be used widely in rehabilitation.^{88, 125, 252}

5.9.6 Occupation-Based Intervention

Using occupation as the intervention helps you select emotionally relevant and meaningful activities. Emotions tell the brain to “pay attention-this is important” and valued and practiced activities enable the client to tap into expertise to reduce effort and fatigue.^{74, 102, 130, 181, 203} The effectiveness of using occupation to improve attention is supported by a body of research showing that engaging persons with neglect in emotionally relevant and motivating activities increases attention to the left side.^{26, 102, 130, 163, 203, 204, 229} Tham et al.²²⁹ found that participation in everyday activities that were personally relevant and meaningful made it easier for clients with neglect to learn compensatory search strategies because the client was interested in using the strategy to complete the task. Klinke et al.¹³⁰ confirmed the importance of using daily activities in a qualitative study on persons with chronic neglect. Participants reported that it was easier to attend to concrete and meaningful tasks, and tasks that held high emotional relevance. For example, one participant reported how much easier it was to hold her baby and prepare formula for her than to make coffee (which she did not drink) and hold a coffee cup. Participants also reported that it was easier to apply compensatory strategies when using familiar items to complete the task.²²⁹ Activities that place too much demand on attention can exacerbate spatial bias in persons with neglect.^{29, 245} To avoid overwhelming the client, grade the activity to provide the “just right” attentional challenge. For example, start with preparation of a simple breakfast and progress to a four-course meal. Occupations that incorporate both sides of the body like playing musical scales on a piano or listening to music played through headphones have also been shown to reduce neglect.^{20, 27, 42, 105} Delivery of the intervention is also important. Tham and Kielhofner²²⁸ and Klinke et al.¹³⁰ found that nurturing and positive

responses from staff and family increased the participant's motivation to learn compensatory strategies to increase awareness of the left side.

5.9.6.1 Provide Explicit Instruction and Outcomes

Persons with neglect respond poorly to ambiguous situations because they put more stress on working memory.⁵⁵ To reduce stress provide complete and simple directions and an explicit outcome. For example, instead of instructing the client to "*put the cookies on the baking tray*" say "*place 12 cookies on the tray*" and instead of "*brush your teeth*" say "*brush your teeth for 10 counts.*"

5.9.6.2 Repetition is Important

Repeatedly applying the compensatory left to right search strategy under varied circumstances, helps to generalize it as a performance skill that can be applied to new situations.^{123, 238} Ensure that the client consistently uses the pattern with all ADLS. For example, to select clothes from a closet, search for items in a refrigerator, or shop for groceries. Utilize cafeterias, gift shops, and office areas within your facility and surrounding restaurants and shops to expose the client to more demanding visual environments.

5.9.7 Metacognitive Approaches

The metacognitive approach is an effective intervention for clients capable of using language and cognition to focus attention.⁴⁶ The intervention uses a reflective, problem-solving approach that requires the client to plan, execute and evaluate the successful completion of a task. An example of a metacognitive approach is to require the client to first describe the steps to putting on a shirt, then state each step out loud while donning the shirt and conclude by reviewing whether the shirt was donned correctly. Tham et.al.²³⁰ used a metacognitive approach to improve ADL performance in with participants with chronic neglect. They found that teaching the participant to consciously reflect on how to proceed before beginning (to plan the activity) and continue to consciously reflect while completing the activity (to monitor performance) increased the likelihood of a successful outcome. An OT intervention-the *Cognitive Orientation to Occupational Performance (CO-OP)*-has been used extensively to facilitate occupational performance in persons with neurological conditions²⁰⁴ and specifically shown to improve performance in persons with mild TBI.^{3, 46, 57, 58, 110}

5.10 Complex Visual Processing

In everyday living, complex visual processing is applied to solve a problem, formulate a plan, and make decisions about specific situations. The OT's understanding of the client's visual processing limitations gathered from assessments and observation is helpful, but it can't predict how the client will actually perform within the context of a practiced and valued occupation. Typically, tasks that require complex visual processing also demand complex cognitive processing. The person relies not just on vision, but on a variety of sensory input and

memories to determine the right course and complete the task. A client who is very experienced in completing a complex task is quicker to recognize the salient features of the visual scene and recall and formulate a successful plan when performing within the familiar context of the occupation.¹⁵⁰ For example, an experienced driver who has lived in the same area for many years would likely perform more competently when driving the familiar roads he traveled a hundred times than in the artificial context of a driving simulator. Because of the contextual nature of complex visual processing, the best way to determine whether a client can complete a complex occupation is to observe their ability to accomplish the tasks required for the occupation. For example, if the client is a teacher, the OT should assess their ability to develop lesson plans, teach a lesson, grade a paper, or other aspects of the job. Providing the intervention in the actual environment (e.g., at the teacher's school) is optimal but not always possible. In this case, the OT should simulate as closely as possible the client's natural context for the task. This requires some creativity and effort, but it is the best way to provide a fair assessment and determine whether the client can resume the desired occupation. This is also the justification for using an on-the-road assessment to determine the client's ability to resume driving instead of a battery of neuropsychological tests or a driving simulator.

5.11 Final Thoughts on Intervention

Everything we do as human beings involves sequencing actions over time to accomplish our goals. The brain links incoming visual input with past experience to unlock the context for an action and predict what is going to happen next. The process begins with detecting and recognizing the task/environmental features that will trigger visual memory and unlock the sequence. Brain injury or disease that disrupts visual processing creates gaps in the visual information sent to the brain. The quality of a person's occupational performance decreases because the brain receives inaccurate or insufficient visual information to guide actions. The need for OT intervention depends on whether the visual impairment prevents the client from successfully participating in needed and desired daily living activities.

Assessment is the first step of intervention. The framework for assessment and intervention rests on the concept of a hierarchy of visual processing levels that interact with and sub-serve one another. Because of the unity of the hierarchy, a process cannot be disrupted at one level without an adverse effect on all visual processing. To understand how the client's vision has changed and more importantly, how well the client is able to use vision to complete daily activities, OT assessment must measure performance at all levels of the hierarchy and especially the foundation visual functions: acuity, oculomotor control, visual field, and visual attention. For example, left hemianopia may cause a client to miss objects in the left visual field, creating the impression that the client ignores the left side—a characteristic of neglect. In this case, assessment needs to answer the question of whether the client has normal attentional capability but poor ability to compensate for the hemianopia, or left neglect compounded by the presence of a left hemianopia.

The OT role is to ensure that the client participates in daily occupations. The most powerful tool in the OT toolkit is to use modification to create a visible and explicit environment that

facilitates the client's ability to use vision to complete occupations. Improving person-environment/task fit reduces the stress caused by vision loss and increases participation in daily occupations. There is no guarantee that the client's visual capabilities will recover, and much more research is needed to determine the most efficacious interventions to restore visual processing. Instead of focusing on a cure, the OT must maximize the client's ability to use their current visual processing to successfully complete valued occupations, keeping in mind that engagement in daily activities also promotes neuroplasticity within the brain and improves health related quality of life.^{63, 206, 229, 252}

The team approach is critical to achieve an optimal outcome. The client benefits most when a team approach is used to address vision impairment from brain injury. The optimal rehab team includes optometrists, ophthalmologists, and vision rehabilitation specialists. These professionals provide a different perspective and skill set that can help the client use their vision more effectively. Seek out these professionals and advocate for multi-disciplinary teams.