8 Vision Rehabilitation Following Acquired Brain Injury

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Visual Problems Following Acquired Brain Injury

Why Is Visual Function Such an Important Concern After Brain Injury?

A supreme achievement of neurological functioning, vision is both precious and, unfortunately, vulnerable to central nervous system injury. This vulnerability stems in part from the fact that anatomically the visual system is a large target. The optic pathways extend from the eyes toward the back of the brain, partially crossing at the optic chiasm, forming a junction at the lateral geniculate bodies and then fanning out in the optic radiations before reaching the occipital cortex in the rear of the brain. A secondary visual system departs from the lateral geniculate bodies toward the superior colliculi. Many association areas and cortical circuits also are involved in visual perception and in planning and directing eye movements. In contrast, smell and hearing are controlled by pathways and centers that are proximal (near) to the sense organs themselves; the primary sensory pathways do not cross from one hemisphere to the other.

Vision tends to dominate the other senses, so that when information conflicts, visual information will be relied on over information from the other senses. For example, in driving simulators, nausea (so common that it is called simulator sickness) occurs when visual information suggests turning and weight shifting that do not actually occur.

Sensory information has primacy in the flow of information through the human nervous system. If information is lost or distorted on entry into the system, this loss or distortion becomes a problem when the individual attempts to perform a task that requires the use of that information. As computer people say: garbage in, garbage out. Clinically, I have observed people who have survived brain injury who became extremely frustrated, or languished in confusion, which abated when their visual problems were successfully treated. Sometimes, helping the visual problem is the key that unlocks the system—the reverse of the straw that breaks the camel's back.

Vision and Activities of Daily Living

Vision is, of course, integral to many daily living functions, including activities requiring distance vision and peripheral awareness, such as environmental mobility, and activities requiring near-point acuity and sustained visual attention, such as reading and paperwork.

Mobility includes walking around familiar locations, for instance in one's own home, as well as ambulation in more public or less familiar environments, such as guiding a cart around the supermarket. In this regard, fans of comedian W. C. Fields will recall the blind Mr. Muckraker, whose approach with his white cane struck terror into the greengrocer, who knew he would soon have to rebuild his mound of kumquats. The most prized of the mobility activities of daily living (ADL) is operating a motor vehicle. Here, the integrity of the visual fields is of paramount importance. Ranking a close second (among visual factors in driving) is far-point depth perception. Acuity, the only visual function routinely measured for licensure, is of somewhat lesser importance. Many sports activities also call for good far-point depth perception, for example, catching or hitting a ball and target shooting.

Near-point visual ADL include reading, working with numbers and charts, and maintaining eye contact in interpersonal situations. At near point, *acuity* (seeing detail clearly) and *accommodative skill* (ability to adjust focus) are especially important, for instance, in assembly work in a factory. Under- and over-reaching are also common visually related problems. However, unless one is a surgeon, sculptor, or welder, depth perception at near point is not likely to be a major factor in daily living.

Clinically, near-point vision becomes more significant when one is confined to a wheelchair, especially in the early stages of recovery when overall mobility is limited. It is unfortunate that the far-point acuity chart is the standard first step in testing vision and in some rehabilitation facilities is the only step. One acute medical rehabilitation setting had a policy that *near-point refractions* (optical corrections for poor near-point acuity) were only to be done in the outpatient clinic. Hence, while people were inpatients and most likely to be in a wheelchair, their most significant visual acuity needs were given the least attention! The occupational therapist's finely tuned appreciation of functional needs is frequently required to counter such policies.

Metavision

Remarkable as is the automaticity of visual system function, a negative aspect exists, namely, a lack of awareness of how one's own visual system is functioning (or, more significantly, *not* functioning). In other cognitive domains there is *metacognition*, meaning a person has knowledge about his or her own cognition. In the domain of memory, for example, it is metamemory that suggests that one might not remember something and should, therefore, write a note or apply some other mnemonic technique. In vision, by extension, we can speak of metavision. Let us take a minute to develop this concept and to show why it is important.

The human visual system is very sensitive to glare. Glare causes people to take such actions as wearing dark glasses, limiting driving, and going to the eye doctor for help. When it comes to glare, in other words, the human visual system is very well tuned. The opposite is true for several other visual functions, including oculomotor dysfunction, accommodation problems, and, especially, visual field losses. In the latter instance, the human system has a tendency to fill in the gaps to complete the image. The best example is the physiological blind spot associated with the area where the optic nerve exits the retina. This area is one of total blindness and is about the size of a fist at arms length. What is interesting is that, although we all have such blind spots, we are not aware of them. One can demonstrate that these areas exist (see Figure 8.1), but people do not experience them as missing, blank, or empty spots.

L **R**

Figure 8.1 A demonstration of the physiological blind spot. Instructions:

1. Hold at arm's length.
2. Close your left eye.
3. Look at the L with your right eye.
4. Slowly bring the page towards you.
5. Keep looking at the L, but notice what happens to the R.
6. At some point you will realize that the R is no longer visible.
7. Keep moving the paper closer and the R will reappear.
8. Repeat the process with the other eye.

Notice: Although the letter disappears, the paper does not. This phenomenon is known as the *completion effect.* The brain fills in gaps in the visual field with predictable patterns or surfaces.

Clinically, substantial visual field losses can exist yet the individual will staunchly deny that any visual problem exists, all the while complaining that things get in the way or that they cannot be found. People may report symptoms, such as headaches, frustration, and difficulty concentrating, but do not connect these symptoms with underlying visual dysfunction. Vision problems can cause behavioral symptoms like anger secondary to frustration and misattribution, similar to the case of a person who is hard of hearing but complains that everyone is mumbling. Accommodation problems can be experienced as frustration when attempting certain activities like watching a moving object come toward you or maneuvering in visually stimulating environments.

The person with a visual field loss often has a dual disability: the loss of vision and a lack of awareness thereof (metavision). People who are unaware of a partial loss of vision will feel little need to compensate.

Impact of Hidden Visual System Dysfunction

Unappreciated or underappreciated visual system problems will often appear as frustration or inability to sustain a work effort. For example, difficulty with sustained near-point work such as reading and studying may be reported as an inability to concentrate, resulting in avoidance or dislike of such activities. Clinically, it is easy to miss breakdowns in visual system functioning that are brought on by extended use. Some such instances may even be diagnosed as attention deficit disorder. However, one can often infer visual problems from self-report and observations.

On a social level, relations can be disrupted by poor eye contact, especially when the two eyes are not aligned. A person who bumps into people in a crowd because of a visual field loss may be regarded as rude. Similarly, poor acuity can impede facial recognition.

How Do You Know What to Expect?

Occupational therapy is a clinical endeavor in which it is important to know what kinds of individuals are at risk for which kinds of visual system breakdown. All such diagnoses will fall under the umbrella of *acquired brain injury* (ABI). *Acquired* means that the person began neurological development normally but that something happened to bring about brain injury. *Injury* includes, but is not restricted to, *traumatic brain injury* (TBI). *Stroke* (cerebrovascular accident or CVA) is a very common form of ABI and is third in the list of life-threatening conditions (after heart disease and cancer) prevalent in the United States. Anoxia (often caused by near drowning, near electrocution, attempted suicide, and surgical mishap) and brain infections belong in the ABI category, as do chronic debilitating disorders of the central nervous system such as multiple sclerosis, Lyme disease, and AIDS-related encephalopathy. Much of the author's experience is with the nonprogressive forms of brain injury; these will be the focus of the discussion in this chapter. It is likely, however, that the same principles will apply to debilitating progressive conditions as well.

Some empirical data on the incidence of different kinds of problems are offered by Gianutsos, Perlin, and Ramsey (1988); however, a more comprehensive study with systematic sampling of different etiologies and controls for medication side effects is clearly needed. On the basis of clinical experience, people with TBI are likely to have accommodative problems, binocular dysfunction, and eye movement dysfunctions, while people after having a CVA are more likely to experience losses in the fields of vision. Patterns of incidence and underlying neuropathology notwithstanding, in the rehabilitation clinic all kinds of visual problems need to be investigated.

In the author's opinion, visual field impairment is the most disruptive to the safe and effective performance of ADL. Diller and Weinberg (1970) have documented falls and other mishaps following visual field loss or neglect. The safety factor is compounded by impaired metavision—the individuals frequently do not perceive a problem. By underestimating their visual loss and overestimating their ability to compensate, for example, people with visual field losses often do not anticipate any difficulty with driving.

People with TBI are much more likely to have problems with the dynamics of visual system function—anything that involves the muscles in and around the eye, including maintaining fixation, pursuit and saccadic eye movements, accommodation of the lens to different focal distances, and maintaining binocular alignment. Eye movement dysfunction and incoordination in the use of both eyes may often lead to patient reports of headaches, difficulty keeping the eyes focused, dizziness, and balance problems. Accommodative insufficiency or infacility is often manifest as frustration; while binocular dysfunction will result in inability to sustain visual work. When driving, accommodative problems make it difficult to shift focus from the road ahead down to the dashboard and back. Binocular dysfunction often brings on road fatigue. These problems can be devastating and may be misunderstood or misinterpreted. Recognition of the problem is often itself therapeutic, and it is crucial that such patients receive a visual evaluation by an optometrist who has expertise in rehabilitation.

Current Practices and What Is Needed

Acute Medical Care

In the acute medical setting, eye care is typically ophthalmological. For people who have survived brain injury, the emphasis is on the immediate effects of the trauma with an evaluation of the patient's ocular health (e.g., eye infections, detached retinas, cataracts), distance visual acuity, and refraction. Neuro-ophthalmologists address the neurological integrity of the visual system and will order tests to help localize injury. However, the author's experience is that in the United States ophthalmologists are rarely trained, experienced, or interested in visual system rehabilitation or function. In medical settings, the commonly held presumption that ophthalmologists offer complete eye care for rehabilitation patients needs to be addressed. Important as ophthalmologists are, their specialty shares little with brain injury rehabilitation.

Optometry

In the United States optometrists are eye doctors (doctors of optometry, or ODs) who have completed a four-year postgraduate training curriculum that addresses all aspects of eye health and function. An increasing number of optometrists have experience and interest in rehabilitation, which represents a natural extension of the emphasis within optometry on visual function and training (Cohen & Rein, 1992). We can offer some practical suggestions for developing a list of referrals that will take you beyond the yellow pages. In addition to local colleges of optometry, national professional associations such as the American Optometric Association and the Academy for the Advancement of Optometry are such a source for referrals. Specialty organizations exist within optometry for optometrists who have particular concerns with rehabilitation and training. Members of the College of Optometrists in Vision Development (COVD), the Neuro-Optometric Rehabilitation Association (NORA), and the Optometric Extension Program (OEP) are likely to have experience and interest in treating people who have survived brain injury. Similarly, optometrists who have expertise in low vision, vision therapy, or behavioral optometry may be helpful. Contact information for these organizations is given in the Resources at the end of this chapter.

Perhaps the ideal setting for outpatient rehabilitation optometric services is a specialized clinic like the Head Trauma Vision Rehabilitation Unit at the State University of New York State College of Optometry in New York City. Here several optometrists and a neuropsychologist (the author) work as an integrated team. Each patient is given a thorough eye exam, addressing both near- and far-point acuity, eye health, eye movements and binocular function, visual fields, and perception. This evaluation can be followed with specialty evaluations of eye movements, low vision, and functional visual fields. Interventions include not only conventional spectacle correction but also various kinds of prismatic lenses, vision training, and computerized exercises. It is hoped more such treatment centers will become available in the future, and a logical way to look for one is by contacting your nearest college of optometry.

Many head injury rehabilitation facilities have developed relationships with individual optometrists in their community. In some instances, the optometrist makes rounds within the facility, and in other cases arrangements are made for the patients to go to the optometrist's office.

Finding a suitable optometrist and developing a collaborative relationship takes time and effort (Gianutsos & Ramsey, 1988). Interest and flexibility are important; experience, though highly desirable, may be a luxury. When approached, most optometrists will be quite receptive. However, some kinds of optometric practices are not likely to prove suitable, for example, large practices in which much pretesting is done by technicians, or where a heavy emphasis is placed on contact lenses.

Finding an optometrist may involve helping an optometrist in general practice to work with people who have survived brain injury. Typically, little explicit training is offered in the general optometric curriculum for rehabilitative optometry. The occupational therapist should not be bashful about offering help and feedback to the optometrist. If the optometrist is responsive to this input, it bodes well for the collaboration between the occupational therapist and the optometrist and, ultimately, for the patient. Not all optometrists will show a special interest in or talent for working with people who have survived brain injury. Sometimes it will be necessary to find another eye care professional who will work with these people.

The single most useful question to ask is, How often have you worked with people who have survived brain injury (TBI, stroke, etc.) in the last year? If the answer is not at all, then you have to consider the alternatives, as well as try to assess the professional's receptivity to your input. A doctor who listens and communicates well can often make up for limited experience.

A few patients need to be seen at home or in the hospital. Although this may limit the tools the optometrist has at hand, many optometrists will extend themselves to meet this need. Institutional settings may have a home-care program for this purpose. If you are asking an optometrist to go into a hospital or nursing home, you will have to obtain the facility's permission. Most hospitals will offer optometrists privileges, although this practice is not yet common. Some optometrists are eager for this kind of medical recognition, and the occupational therapist may be able to lend support from within the medical setting.

Rehabilitative Optometric Consultation—Sooner or Later

Underdiagnosis and consequent lack of treatment are significant problems in brain injury rehabilitation. For example, the Gianutsos, Perlin, and Ramsey (1988) study found that half of the residents in a long-term head injury rehabilitation center had significant, yet mostly treatable, visual system dysfunction. Each of those patients had been in at least one other hospital, and most were many months post-onset. Despite this care, their visual problems were undiagnosed and most likely would have remained so if we had not done our vision screening. These visual problems would have persisted, unrecognized and undermining the intensive rehabilitative efforts in other areas. We can speculate on why this happens: Acute care is rendered in medical settings where eye care is focused on disease and eye health rather than on visual system function. Not all eye exams are alike.

Further, because some people do not experience visual disorders for what they are (the metavision problem), they do not articulate their concerns or seek help. For this reason, one should not wait for the patient to complain of a visual field problem: Aggressive evaluation is needed because of the safety implications of visual field problems combined with a total or partial lack of awareness.

A final consideration is the cost efficiency of rehabilitation optometric services. The evaluation itself may involve two or three office visits. In the majority of cases, treatment may be limited to one or two sets of lenses. Even if custom-made lenses are needed, these are a relatively small expense, especially in view of the advantage the lenses convey for other therapies. In my clinical experience, I have seen many people who went through comprehensive rehabilitation with poor acuity, balance problems caused by untreated binocular dysfunction, and inability to sustain a work effort and concentrate because of binocular system dysfunction. One can only speculate how much quicker these people would have completed their therapies had their visual dysfunction been recognized and treated earlier.

Professionals often disagree on when to initiate rehabilitation optometric services. Logically, the earlier it is begun, the better. Gianutsos, Perlin, Mazerolle, and Trem (1989) state that rehabilitation optometric services can be offered even to persons who are in coma. Sometimes the argument is made that the visual problems may resolve spontaneously and that rehabilitation optometric services should be deferred for up to 6 months. This argument fails to take into account the fact that without treatment patients may adapt in an ultimately undesirable manner. For example, to deal with double vision, people learn to squint or adopt other ways to suppress visual input from one eye. They become functionally monocular and lose the three-dimensional awareness most efficiently achieved by binocularity. Waiting 6 months for visual problems to resolve or stabilize makes as much sense as waiting 6 months to see if patients who have had a stroke can learn to walk again before doing a physical therapy evaluation.

What Occupational Therapists Can Do

Occupational therapists situated in acute and rehabilitative care settings have a key role to play in drawing attention to the possible presence of visual problems and facilitating optometric diagnosis and treatment. Occupational therapists can also provide follow-up activities that give individuals the opportunity to use vision functionally after participating in optometric exercises. (For more detailed discussions on this topic, readers may refer to the following sources: Arnsten, 1994; Bouska & Gallaway, 1991; Bouska, Kauffman, & Marcus, 1990; Gianutsos et al., 1988; Hellerstein & Freed, 1994; Suter, 1995; Warren, 1990; Warren, 1993a; Warren, 1993b; Warren, 1994).

Occupational therapists have taken a leading role in bringing visual problems after brain injury into focus. The author remembers well the workshop Clinical Vision Assessment by the late Mary Jane Bouska that became a professional turning point for her and for many others in the field. In this course, practical methods for vision screening were offered, along with guidelines for working with optometrists. Some years later a similar presentation by Laurie Ritter, OTR/L, and Joel Warshowsky, OD, attracted several hundred therapists.

Not only do occupational therapists need to communicate with each other about vision after brain injury, but they also need to communicate with other professionals with expertise in brain injury rehabilitation. Unless an occupational therapist speaks up, the physicians who manage acute care often may not appreciate the relationship between vision and functional activities. Further, medical doctors are likely to prescribe ophthalmological services unless an occupational therapist conveys the need for a *functional* rehabilitative orientation. Neuropsychologists, especially those trained in clinical psychology, may have very little training in clinical vision assessment. They may acknowledge visual problems but not take them seriously enough even to ask for, or look for, a patient's glasses before launching into their assessment.

One way to assure that vision is addressed properly is to develop policies and procedures that mandate that visual problems be carefully addressed, including local screening, consultation with appropriate eyecare practitioners and systematic follow through on treatment recommendations.

Occupational Therapy Vision Screening

For the therapist, the beginning of the clinical process is a good time to begin vision screening with questions concerning the patient's ability to perform functional tasks requiring visual skills such as reading, shopping in stores, and locating items. Attention should be given to headaches and dizziness following certain activities. The formal assessment includes near and far acuities, binocular function, visual fields, and perception. Many of these issues can be addressed at the bedside with simple tools and good clinical skill. However, for many patients a stereoscopic vision screener, such as the Keystone VSII, Titmus, or Stereo-Optical vision testers, can provide needed answers in a few minutes. I would also recommend computerized testing of the functional visual fields, which can be done using software I have developed (PERFIELD and CENFIELD, available through Life Science Associates, Bayport, NY).

The primary purpose of this screening is to rule out visual problems, if possible. If the possibility of any such problems is present, expeditious referral to an optometrist is in order. Extensive vision screening is rarely appropriate in suburban and urban settings where an eye care professional may be available. An important purpose of the occupational therapy vision screening is to offer a timely alert to the existence of problems and to serve as a basis for an informed referral. Screening not only identifies referrals for rehabilitative optometric services, but it also helps the occupational therapist ascertain that the relevant vision issues have been addressed. For example, in a hospital cited earlier, eye care was the responsibility of the ophthalmology department, which had a policy of doing near-point refractions only on outpatients. Using their own screening data that showed problems with near-point vision, occupational therapists were able to convince the ophthalmology service to be responsive to the near-vision needs of the inpatients undergoing brain injury rehabilitation.

Occupational therapy screening for visual system dysfunction is used primarily to identify those patients who can benefit from referral for rehabilitative optometric services. An additional benefit is that visual screening can begin the process of educating patients about the current status of their visual system. This educational process is especially important because visual disorders are often not obvious to the person who has the problem—the issue of metavision discussed earlier.

Is Occupational Therapy Vision Screening Always Necessary?

I believe that every person who has survived brain injury should be evaluated optometrically. The thoroughness and type of occupational therapy vision screening will, of course, depend on the kinds of other services available. If optometrists are an integral part of the treating team, it might constitute an unnecessary duplication of services to require comprehensive occupational therapy vision screening first. In such an ideal situation, the occupational therapy evaluation would emphasize the functional impact of visual system problems.

Over the years, my clinical experience suggests that rarely can nonoptometric vision screenings be relied on to rule out visual problems. In Gianutsos et al. (1988), mentioned earlier, approximately half of the cases screened were determined to have some problem warranting rehabilitative optometric services. All but one of those sent for rehabilitation optometric services were determined to have visual system problems, most of which were ameliorated by treatment. Our high hit rate probably made the administrators happy: Few unnecessary consultations for rehabilitation optometric services were made. What we must be concerned about, especially in view of the high hit rate, is the possibility that our screening misses someone who has visual problems. If any doubt exists that a rehabilitation optometric services consultation is in order; it is always preferable to have an optometrist rule out any need for treatment.

Information the Occupational Therapist Gathers to Be Helpful to the Optometrist

This information ranges from the practical (special methods of communication, toileting needs and ability to transfer, the reliability of the patient as an informant, medications) to the more interpretive (such as underlying visual problems being mistaken for patient inattention). Is a visual problem accounting for what appears to be an aphasic reading disorder? Are there visual problems that might interfere with this person's ability to drive safely? The therapist should describe the behaviors observed that indicate a possible vision problem, for example, Ms. X sits very close to the television; Mr. Y holds his head askew when reading. A behavioral observation record form, such as the one in Gianutsos and Ramsey (1988), might be useful and has been reproduced in Figure 8.2.

A clear list of medications and suspected side effects is helpful. For each medication the person is taking, the occupational therapist can use the Optometric Drug Information Summaries (ODIS) software database (Levine, 1993) to determine effects and side effects on the visual system. Several classes of medications taken by people who have survived brain injury have visual side effects, including anticonvulsant (antiseizure) and antispasticity medications, antipsychotics, and tranquilizers. Some of these can be substituted for and some cannot. It is important for the optometrist to know what medication is being taken and for what purpose. Ask the optometrist to review and comment on the list of medications. The occupational therapist can be helpful in facilitating the interdis-

CHECKLIST: Vision Problems

Name ____ ____________ Date ______ Therapist _ __________
(Adapted from *The Primary Visual Abilities Essential to Academic Achievement,* Optometric Extension Program Foundation, Inc., Santa Ana CA, 1968.)

Rating Codes: Typ = typical pattern
Obs = observed
NO = not observed
IO = insufficient opportunity to observe

	Typ	Obs	NO	IO
1. APPEARANCE OF EYES:				
One eye turns in or out at any time	___	___	___	___
Reddened eyes or lids	___	___	___	___
Eyes tear excessively	___	___	___	___
Encrusted eyelids	___	___	___	___
Frequent styes on lids	___	___	___	___
2. COMPLAINTS WHEN USING EYES FOR CLOSE WORK:				
Headaches in forehead or temples	___	___	___	___
Burning or itching after reading or close work	___	___	___	___
Nausea or dizziness	___	___	___	___
Print blurs after reading a short time	___	___	___	___
3. BEHAVIORAL SIGNS OF VISUAL PROBLEMS:				
A. *Eye Movement Abilities (Ocular Motility):*				
Head turns while scanning, e.g., as reads across page	___	___	___	___
Loses place often during reading	___	___	___	___
Needs finger or marker to keep place	___	___	___	___
Displays short attention span, e.g., in reading or copying	___	___	___	___
Too frequently omits words	___	___	___	___
Repeatedly omits "small" words	___	___	___	___
Writes up or down hill on paper	___	___	___	___
Rereads or skips lines unknowingly	___	___	___	___
Orients drawings poorly on page	___	___	___	___
B. *Eye Teaming Abilities (Binocularity):*				
Complains of seeing double (diplopia)	___	___	___	___
Repeats letters within words	___	___	___	___
Omits letters, numbers or phrases	___	___	___	___
Misaligns digits in number columns	___	___	___	___
Squints, closes, or covers one eye	___	___	___	___
Tilts head extremely while doing close work	___	___	___	___
Consistently shows gross postural deviations in close work activities	___	___	___	___

	Typ	Obs	NO	IO
C. *Eye-Hand Coordination Abilities:*				
Must feel things to assist in any interpretation required	___	___	___	___
Eyes not used to "steer" hand movements (extreme lack of orientation, placement of words or drawings on page)	___	___	___	___
Writes crookedly, poorly spaced, cannot stay on ruled lines	___	___	___	___
Misaligns both horizontal and vertical series of numbers	___	___	___	___
Uses his hand or fingers to keep his place on the page	___	___	___	___
Uses other hand as "spacer" to control spacing or alignment on page	___	___	___	___
Repeatedly confuses left-right directions	___	___	___	___

Figure 8.2 Behavioral checklist of symptoms of visual system dysfunction.

Figure 8.2 *Continued.*

	Typ	Obs	NO	IO
D. *Visual Form Perception (Visual Comparison, Visual Imagery, Visualization):*				
Mistakes words with same or similar beginnings	___	___	___	___
Fails to recognize same word in next sentence	___	___	___	___
Reverses letters and/or words in writing and copying	___	___	___	___
Confuses likenesses and minor differences	___	___	___	___
Confuses same word in same sentence	___	___	___	___
Repeatedly confuses similar beginnings and endings of words	___	___	___	___
Fails to visualize what is read either silently or orally	___	___	___	___
Whispers to self for reinforcement while reading silently	___	___	___	___
Returns to "drawing with fingers" to decide likes and differences	___	___	___	___
E. *Refractive Status (Nearsightedness, Farsightedness, Focus Problems, etc.):*				
Comprehension reduces as reading continues; loses interest too quickly	___	___	___	___
Mispronounces similar words as reading continues	___	___	___	___
Blinks excessively at near vision tasks (i.e. reading) and not elsewhere	___	___	___	___
Holds book too closely; face too close to desk surface/ computer screen	___	___	___	___
Avoids near-point tasks or close-up work	___	___	___	___
Complains of discomfort in tasks that demand visual interpretation	___	___	___	___
Closes, covers, or squints one eye while reading or doing close work	___	___	___	___
Makes errors in copying information from the distance to paper (e.g. copying a sign from the wall)	___	___	___	___
Makes errors copying from reference book to notebook	___	___	___	___
Squints (e.g. to read signs on the wall) or requests to move nearer	___	___	___	___
Rubs eyes during or after short periods of visual activity	___	___	___	___
Fatigues easily; after doing close work blinks to clarify distance information (e.g., sign on the wall)	___	___	___	___

OBSERVER'S COMMENTS:

ciplinary process by communicating to other team members the visual side effects of a person's medications.

The occupational therapist is often able to obtain historical information regarding the patient's vision. A good place to begin is with the eyeglasses the patient wore before the injury. Look around. Ask the family to bring in the patient's glasses from home. If you cannot find the glasses, you can often find the relevant records with a phone call to the former eye doctor. These records contain useful information that will be appreciated by the current eye doctor. If available, the old lenses are probably a better interim solution (pending an optometric consultation) than no lenses. Unless the patient appears to reject the lenses, the glasses belong on the patient, not in the bedside table.

Eye doctors have a device that allows them to determine the prescribed correction in a pair of eyeglasses. Pending optometric consultation, the ability to infer what conditions a given pair of lenses was intended to treat is helpful when looking at the glasses last worn by a comatose patient.

The following techniques are useful for reading a pair of eyeglasses:

- If the lenses magnify the image, they correct for farsightedness (hyperopia) or are reading lenses for a person over 40 years old, perhaps with presbyopia.
- If the lenses minify, they correct for nearsightedness (myopia). If you are not sure, try moving the lenses from side to side. If the image moves with the lenses, the lenses are minifying—they are minus lens power and are meant to correct for nearsightedness. Conversely, if the image moves against the lens, the lenses are magnifying—they are plus lenses and probably correct for hyperopia or presbyopia. This basic magnification or minification is the spherical correction in the lens.
- In some cases, the correction may be cylindrical or, loosely speaking, correcting for a warped (or astigmatic) eye. Correction for astigmatism appears as distortion when you rotate the lens one at a time. Subjectively, astigmatism may not produce any obvious impairment, although an astigmat who is accustomed to corrective lenses may feel out of sorts and experience eye fatigue.
- Older people often need a different correction for near- and far-point activities. Bifocal lenses are the traditional approach. In recent years, progressive lenses have become common in which the near-point correction (or add) is incremental in the lower portion of the lens. This can complicate the techniques described above for reading lenses. A good idea is to practice on lenses that have a known correction, for example, over-the-counter reading glasses are plus spheres with no astigmatic correction.

• Lenses that have prisms ground in are more complicated. If you look at the lens sideways, you will see that the lens is thicker on one side and thinner on the other. The thick side is the base of the prism, and the effect is to displace the image toward the thin side, away from the base.

The Optometric Consultation

It is especially helpful for the occupational therapist to accompany the patient to the optometrist. This experience is often an excellent learning opportunity, as well as a good way to develop lines of communication with the eye doctor. The occupational therapist sometimes has to serve as an interpreter, both for the patient to the optometrist and for the optometrist to the patient and concerned others. While often receptive to rehabilitation needs, optometrists may have little experience. They usually are very interested and feel rewarded by the opportunity to learn and to be helpful. However, they may need to be alerted to the special problems of the person who has experienced ABI (e.g., poor memory), so always back up oral recommendations with written ones.

During the session, the accompanying occupational therapist should make notes and be available for clarification and assistance if the optometrist and the patient have a communication problem. Remember that the patient is the one getting the consultation. Sometimes the eye doctor forgets this; you should encourage direct communication with the patient. Be a facilitator and a scribe. Even patients who do not have memory problems are likely to appreciate having someone to make notes on their behalf.

The occupational therapist can be helpful in discussing the implications of proposed treatment options. For example, it may not be a good time to introduce bifocals when the person is becoming ambulatory again. The near-point correction in the lower portion of the lens may interfere with monitoring the path ahead. It takes time to adjust to bifocals; following a brain injury this adjustment may be difficult. In some cases, two pairs of glasses (one for reading and one for distance) may be recommended—unless the patient's memory is very poor or the patient cannot change glasses easily. Progressive lenses can be of special value when the patient's medical condition warrants, and when the amount of near-point lens power varies.

Whatever decisions are made, the occupational therapist should make clear notes including who is responsible for what. In collaboration with the optometrist, the occupational therapist can assist by explaining (in writing as well as orally) the findings and recommendations to family and concerned others (e.g., the treating team, the school). When the occupational therapist has made notes regarding the evaluation and recommendations, it is a good idea to have the optometrist review the notes for accuracy and emphasis.

Optometric Interventions After the Optometric Consultation

In rehabilitation, interventions generally fall into one of three categories: (a) restorative exercises, (b) compensatory devices and techniques, and (c) environmental redesign. The discussion below concerns interventions for visual system dysfunction. For other areas you should consult textual material in those areas. For example, in the field of cognitive rehabilitation an excellent text by Sohlberg and Mateer (1989) contains innumerable practical suggestions for interventions.

Restorative Exercises

Within optometry, restorative approaches are usually subsumed under the title, vision therapy. It is important to appreciate that these exercises are often not designed to strengthen weak muscles; rather they are techniques or activities that are used to maximize coordination in the visual system through speed and automaticity. Many of these exercises use simple devices, the most elegant of which is the Brock String. This "device" is a piece of string from 3 to 20 feet long with three colored beads. Several tasks can be devised, including fixating on one bead and monitoring to see if the patient sees two lines that appear to cross at the bead itself. Your patient may need a little extra reminding about the purpose of this exercise (focusing and maintaining an image with both eyes). The optometrist may ask the patient to move the bead closer, while maintaining images in both eyes (both lines remain visible) and crossed at the bead (otherwise the eyes are not focusing on the bead). Advanced Brock String exercises involve shifting focus from one bead to another, while simultaneously maintaining vision in both eyes.

People who have survived brain injury may need to be guided through these exercises with careful monitoring because they may lapse into bad habits, such as suppressing vision in one eye so that only one line is seen. Structure is often helpful, such as a checklist to keep count of how many times the exercise is done. If one is supposed to hold a fixation on a target, the therapist may suggest counting out loud.

The Brock String needs to be adapted for use with hemiparetics, who cannot hold the string to the bridge of their nose and move the bead at the same time. Here, a baseball cap put on backwards can be helpful. Tie the string around the plastic fastener and wear the hat pulled down to the bridge of the nose.

As with any exercise program, it is helpful to show interest. Keeping scores helps in this regard; the score sheet is something the therapist can examine with great interest. Bear in mind that exercises sometimes do not produce instantaneous or substantial results. All, however, is not lost: The process of doing exercises with feedback should at least improve the individual's metavision. Perhaps the best example of this is in the case of training visual field awareness using REACT (Reaction Time Measure of Visual Field; Gianutsos, 1988). In this task the individual monitors the computer screen for numbers that can appear suddenly on any part of the screen. The numbers are actually counters; so when a response is finally made, the response time is displayed, offering immediate feedback. Patients find it useful to practice with this task, attempting to compensate for delayed processing on their affected side. Often they discover the limits of their ability to compensate. Although this exercise does not solve the underlying visual field problem, it does give information necessary to manage the problem. (Remember, visual field losses are often not experienced as such.)

The occupational therapist can help with many vision exercises. Some exercises require special equipment, although computers are used increasingly for exercises, for example, those listed in the Resources at the end of this chapter. As the relationship with the optometrist grows, the occupational therapist may become increasingly active. Susan Arnsten, an occupational therapist specializing in vision, illustrates this occupational therapy role in her article "Vision Therapy Within Occupational Therapy" (1994). It is even possible for an occupational therapist to become a vision therapist, working under the direction of an optometrist (see chapter 4, COVTT).

If the software is available in the occupational therapist's clinic, offer the patient an opportunity to do the exercises during therapy sessions, enabling more frequent practice in a location where the patient is already going to be. Many exercises within occupational therapy address visual perception. Some of these will bear a close similarity to the optometric exercises, especially those that emphasize visual perception.

In their zeal to be helpful, therapists need to recognize that the optometrist has overall responsibility and authority for the vision therapy program. Much as the occupational therapist operates under prescription from a physician, in the area of vision the optometrist prescribes. In most states an optometric practice act legally defines the activities that are the responsibility of optometry. A key feature of optometric practice is placing lenses in front of a patient's eyes. Strictly speaking, this would include anaglyph (red-green/blue) glasses used to dissociate images to each eye, use of a stereoscopic vision screener, and over-the-counter reading glasses (useful in the clinic for testing, especially when patients forget to bring their glasses). Some optometrists are comfortable with therapists using these devices on a temporary basis; however, the occupational therapist should always work closely with the optometrist.

Compensatory Devices

The compensatory device that we are all familiar with is eyeglasses, or spectacle correction for refractive (optical) error. This treatment is commonplace, but the occupational therapist can still be helpful. When spectacles have been prescribed, the occupational therapist can contribute to further decisions. For example, if more than one pair of glasses is to be made, each pair should be distinctly different, and the purpose indicated clearly on the lens case if not on the frames themselves. The occupational therapist can assist in obtaining a spectacle case that can be placed in an accessible and secure location. For a hemiplegic, spring loaded frames can be of special benefit. Otherwise, frames will easily get pulled out of alignment by being donned and doffed with only one hand.

Sometimes lenses do not produce an immediate sense of satisfaction. This may be an indication that the glasses were not filled or fitted properly. The doctor may also advise that it is to be expected and to use the glasses for a designated period of time and to observe performance. In either situation, the occupational therapist should monitor the situation and communicate with the optometrist so corrective action is not unnecessarily delayed. In general, the occupational therapist should monitor adherence to the treatment plan and encourage optometric follow-up sooner than originally planned, if needed.

Prisms

Prismatic correction refers to the use of optical correction to displace the image. This approach can be done (a) to treat an eye turn or deviation, (b) to bring an unseen portion of the visual field into a seeing area, or (c) to induce postural improvements. We shall discuss each of these.

When the eyes do not align on a particular target at the same time (strabismus) or do not converge and aim outward (exophoria or exotropia), or when they turn in (esophoria or esotropia), prismatic lenses can help bring the eyes close enough so that they can complete the alignment process. Here the prism in one eye is going the opposite direction from the prism in the other eye. Occasionally, a small amount of magnification will accomplish the same thing. The point here is that prisms are being used to facilitate the coordinated use of both eyes, or to achieve binocularity. This use of prisms is fairly standard.

Other uses of prisms are not so conventional, including the use of prisms for increased visual field awareness. Here prisms are yoked, that is, both eyes have prisms directed in the same way. So if a person has a left *homonymous hemianopia* (lost vision in the left half of each eye), base left prisms might be used to bring the image from the left into the right field. It is important for the therapist to check this out: it would not be the first time that an occupational therapist discovered a prismatic correction going in the opposite direction.

Another use for yoked prisms is for postural adjustment. This is a creative application pioneered by optometrist William Padula, which takes advantage of the primacy of vision over other senses (see chapter 9). The idea is to modify vision in such a way as to induce a postural correction. For example, if lenses make it look as if you are tilting to one side, you will adjust yourself accordingly. A patient who slouches can be induced to sit up in this manner. We had a patient who was a long-term head injury survivor. For a variety of reasons, he tended to lurch backwards on his heels and had fallen backwards on several occasions. Because of a severe memory, frontal lobe, and attentional disorder, he was unable to learn to compensate by leaning forward without constant prompting. Base-up prisms (which gave him the sensation of walking downhill) required that he pitch his head forward in order to look where he was stepping and indirectly enhanced his stability. The dilemma was that within 2 weeks this benefit had vanished. He did somewhat better alternating between his prismatic lenses and his old glasses—an alteration introduced to prevent a chronic adjustment to the prisms. Occupational therapists should be aware that prisms do not always have an enduring effect. Observation of the temporary nature of the prisms' effects is more likely to take place by an occupational therapist, who may see the patient more frequently, than by the optometrist. If this is the case, the occupational therapist should encourage the patient to return to the optometrist or inform the optometrist directly of any problem encountered.

Prismatic correction can be implemented in two ways: (a) ground prismatic lenses and (b) Fresnel prisms. Ground prismatic lenses are a customized optical correction that usually requires extra time and expense. When the magnitude of the deviation is large, these lenses can be heavy and cosmetically unappealing. Fresnel prisms are used for temporary prismatic correction. They are made of plastic that is overlaid, so if one runs a fingernail across, serrations are obvious. The smooth side is pressed onto the individual's eyeglasses. They cling to the lenses with a good, clean bond. Fresnel prisms are instantaneous and relatively inexpensive; however, they get dirty easily and then the clarity of transmission of light is reduced. Furthermore, they are not subtle: other people will definitely notice, which becomes a problem for patients who are very self-conscious.

What can the occupational therapist do to be helpful when a patient has Fresnel prisms? Probably the most useful thing is to help the patient keep them clean. Also, if the Fresnel prism does not cover the lens, it may slip out of position: the occupational therapist can monitor and rectify slippage. Because they are easily shaped, Fresnel lenses have been used to create a kind of spot viewer to compensate for hemianopic field losses (Perlin & Dziadul, 1991). Here the positioning is especially important. Finally, the occupational therapist can reinforce the Fresnel prisms' advantages and help the patient persevere, or help the patient recognize the options, for example, time and expense versus clarity and appearance.

Reversing Mirror

An optical approach to dealing with visual field loss is a wedge-like mirror mounted on the inside of the lens (Cohen & Waiss, 1993a; Cohen & Waiss, 1993b). Not unlike a rearview mirror, this allows information from the nonseeing field to be brought into view. Reports describe clinical test cases with some enthusiasm; however, some patients reject the approach because of appearances. It is possible that the reversing mirror might be reserved for certain special circumstances, such as driving. This approach has not been proven, but it is certainly worth further investigation. In fact, no intervention for visual field loss has proven to be a spectacular success. Often, interventions are not appreciated because the individual fails to recognize that a problem exists.

Environmental Redesign

The final intervention strategy is to design the individual's environment to improve function. Here, the most basic issues apply, such as checking the home environment to be sure it is well illuminated and that things are located where they can be seen. Consider installing lighting that is activated by motion detectors. Good contrast is important in the home environment. Steps should be clearly delineated, particularly when binocular depth perception is poor. Large-print labels and color coding are helpful. Iconic (nonverbal) symbols are also more easily visible than verbal signs. However, the downside is that the individual has to remember what the symbols mean.

For profound homonymous hemianopic visual field impairments, one might consider placing important objects on the side where the person does see, as suggested by Zoltan (1983). This solution is simplistic but quite common. It is probably best when used to accomplish a specific end, such as rotating the dinner plate when the person has finished the right half of the meal to allow a view of the other half. This approach might be more promising from the standpoint of therapy if the patient learned to rotate his or her own plate.

Summary

Because of the occupational therapist's ability to determine how underlying deficits affect functional performance, the occupational therapist has an important role to play in assuring that persons who have survived brain injury receive appropriate diagnosis and treatment for the visual system dysfunction that often follows central nervous system injury. This is an opportunity to be active and interdisciplinary. The occupational therapist's unique emphasis on ADL is an important contribution to the overall process.

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REFERENCES

Arnsten, S. (1994, December 9). Vision therapy within occupational therapy. *Occupational Therapy Forum,* 411.

Bouska, M. J., Kauffman, N., & Marcus, S. (1990). Disorders of the visual perceptual system. In D. Umphred (Ed.), *Neurological rehabilitation.* St. Louis, MO: Mosby.

Bouska, M. J., & Gallaway, M. (1991). Primary visual deficits in adults with brain damage: Management in occupational therapy. *Occupational Therapy Practice, 3,* 111.

Cohen, A. H., & Rein, L. D. (1992). The effect of head trauma on the visual system: The doctor of optometry as a member of the rehabilitation team. *Journal of the American Optometric Association, 63,* 530–536.

Cohen, J. M., & Waiss, B. (1993a). An overview of enhancement techniques for peripheral field loss. *Journal of the American Optometric Association, 64,* 60–70.

Cohen, J. M., & Waiss, B. (1993b). An overview of visual rehabilitation for stroke and head trauma patients. *Aging and Vision, 6,* 311.

Diller, L., & Weinberg, J. (1970). Evidence for accident-prone behavior in hemiplegic patients. *Archives of Physical Medicine and Rehabilitation, 51,* 358–363.

Gianutsos, R. (1988). Computer programs for cognitive rehabilitation (Vol. 5): Software tools for use with persons emerging from coma into consciousness [Computer software]. Bayport, NY: Life Science Associates.

Gianutsos, R., & Ramsey, G. (1988). Enabling the survivors of brain injury to receive rehabilitative optometric services. *Journal of Vision Rehabilitation, 2,* 37–58.

Gianutsos, R., Ramsey, G., & Perlin, G. (1988). Rehabilitative optometric services for survivors of acquired brain injury. *Archives of Physical Medicine and Rehabilitation, 69,* 573–578.

Gianutsos, R., Perlin, R., Mazerolle, K., & Trem, N. (1989). Rehabilitative optometric services for persons emerging from coma. *Journal of Head Trauma Rehabilitation, 4,* 1725.

Hellerstein, L. F., & Freed, S. (1994). Rehabilitative optometric management of a traumatic brain injury patient. *Journal of Behavioral Optometry, 5,* 143–148.

Levine, L. (1993). Optometric Drug Information Summaries [Computer software]. Forest Grove, OR: Pacific University.

Perlin, R. R., & Dziadul, J. (1991). Fresnel prisms for field enhancement of patients with constricted or hemianopic visual fields. *Journal of the American Optometric Association, 62,* 58–64.

Sohlberg, M. M., & Mateer, C. A. (1989). *Introduction to cognitive rehabilitation.* New York: Guilford Press.

Suter, P. (1995). Rehabilitation and management of visual dysfunction following traumatic brain injury. In M. J. Ashley & D. K. Krych (Eds.), *Traumatic brain injury rehabilitation* (pp. 187–219). Boca Raton, FL: CRC Press.

Warren, M. (1990). Identification of visual scanning deficits in adults after cerebrovascular accident. *American Journal of Occupational Therapy, 44,* 391–399.

Warren, M. (1993a). A hierarchical model for evaluation and treatment of visual perceptual dysfunction in adult acquired brain injury, Part 1. *American Journal of Occupational Therapy, 47,* 42–54.

Warren, M. (1993b). A hierarchical model for evaluation and treatment of visual perceptual dysfunction in adult acquired brain injury, Part 2. *American Journal of Occupational Therapy, 47,* 55–66.

Warren, M. (1994). *Visuospatial skills: Assessment and intervention strategies.* Bethesda, MD: American Occupational Therapy Association.

Zoltan, B. (1983). Remediation of visual-perceptual and perceptual-motor deficits. In M. Rosenthal, M. R. Bond, E. R. Griffith, & J. D. Miller (Eds.), *Rehabilitation of the adult and child with traumatic brain injury* (pp. 351–365). Philadelphia: F. A. Davis.

RESOURCES

American Vision Therapy, PO Box 197, Cicero, IN 46034, (800) 346-4925, Fax and local phone (317) 984-9400. [Groffman's Vision Therapy Programs; Cooper's Automated Vision Therapy Instruments]

Bernell Corporation, 750 Lincolnway East, PO Box 4637, South Bend, IN 46634-4637, (800) 348-2225. [Vogel's Computer Aided Vision Therapy]

Learning Frontiers, 175 Admiral Cochran Drive, Suite 103, Annapolis, MD 21401, (410) 266-8244. [Ludlum's OPTI-MUM System]

Dr. Leonard Levine, Pacific University, Forest Grove, OR 97116, (503) 357-6151. [ODIS Software]

Life Science Associates, 1 Fenimore Road, Bayport, NY 11705, (516) 472-2111. [Gianutsos' Computer Programs for Cognitive Rehabilitation/PERFIELD, CENFIELD and PERCEPT]

Optometric Extension Program Foundation, Inc., 2912 South Daimler Street, Santa Ana, CA 92705, (714) 250-8070.

OPTOMETRIC ASSOCIATIONS

American Optometric Association (AOA), 243 N. Lindbergh Blvd., St. Louis, MO 63141.

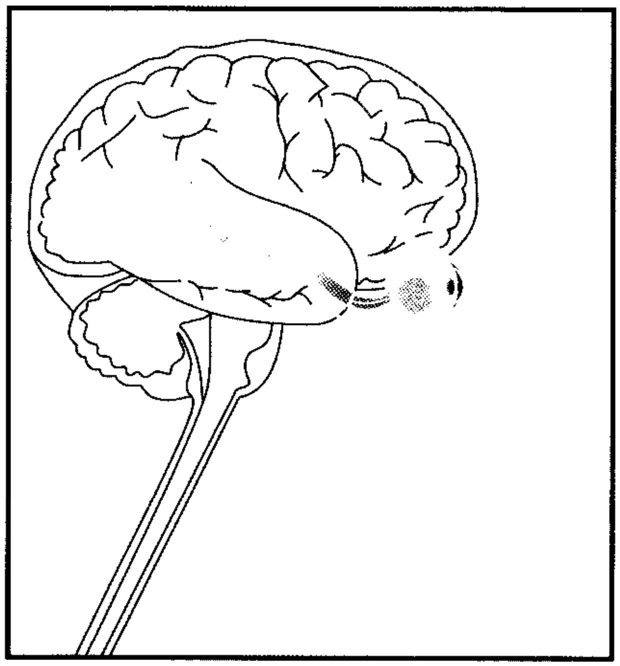
American Academy of Optometry (AAO), 4330 East-West Highway, Suite 1117, Bethesda, MD 20814-4408.

Optometric Extension Program Foundation, Inc. (OEP), 2912 S. Daimler St., Santa Ana, CA 92705.

College of Optometrists in Vision Development (COVD), PO Box 285, Chula Vista, CA 92012.

Neuro-Optometric Rehabilitation Association (NORA), PO Box 1408, Guilford, CT 06437.

FUNCTIONAL VISUAL BEHAVIOR



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