Article

Management of Patients with Hemianopic Visual Field Loss

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Visual field loss is a common consequence of acquired traumatic brain injury, including stroke. It is estimated that the number of stroke patients who survive are more than three million annually and as many as one-third of those in rehabilitation have some form of visual field loss. In addition, visual field loss is a common consequence of head injuries and head trauma. Although there have not been good studies to determine how many of the surviving patients have visual field loss, there are approximately 500,000 patients who are hospitalized for the treatment of traumatic head injury annually. Many of these patients learn on their own to compensate with head and body movement; however, they are often not proficient and are apprehensive, often restricting their quality of life.

My experience with this patient population began when I was hired as a staff optometrist by a VA hospital whose program expanded over the years eventually becoming a teaching facility for both a medical school and SUNY State College of Optometry. Subsequently, I was appointed Chief of the Optometry Service and Residency Director, and in this capacity I helped to develop a residency program in rehabilitative optometry. Despite the importance of this problem, I found very little information in the literature describing the management of visual field defects, which made it necessary for me to develop my own clinical treatment strategies.

The model presented in this article has evolved over more than 35 years. As I became more involved with this patient population, I realized that optical devices alone did not allow the patient to benefit fully from the optical shift created by prism lenses because they could not appropriately respond to the shift. I soon discovered that as I added additional therapy sequences, which enhanced peripheral awareness and ocular scanning, my patients reported greater acceptance of the optical device and increased awareness of objects in the affected visual field. Over time, I refined my therapy protocol, which I feel at this point is truly a "melting pot" consisting of behavioral optometry and low vision concepts, as well as the contributions from many optometrists. The end result is a rehabilitation program, similar to the approach used for stroke and cardiac rehabilitation. This visual rehabilitation program incorporates full scope optometry, basic primary care optometry, visual therapy, optics, and underscores our unique input into this population. With this in mind, the emphasis of this article is clinical and procedural rather than technical.

I. Overview of the Management of Hemianopic Visual Field Loss
   A. *Patient Education:* The first important element is to discuss clearly the following pros, cons, and limitations of the rehabilitation program.
      1. A clear discussion is needed about the fact that there is no cure for a visual field loss and that the goals of this rehabilitation is to enhance the patient's ability to scan the environment more efficiently using ocular scanning and specific optical devices. During this education-

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al phase, it is important to reinforce the fact that the process takes time and that there is a learning curve. The patient must understand that there will be a continued need for some head movement in addition to scanning to achieve optimal benefit.

2. There must be a demonstration and discussion of some of the optical changes that the patient will have to adjust to if prism lenses are used.
   a. "The Jack in the box affect" created by the prism
   b) Blur, distortion, diffraction, caused by the prism
   c) Magnification changes

B. *Patient Selection:* The second important element is to identify which patients would benefit from this therapy. This group is further divided into patients who would benefit from a yoked prism lens system (YPLS) and therapy and those who would benefit most from only ocular scanning.
   1. Patients who will benefit from YPLS are the following.
      a) Patients who want to read and perform computer functions
      b) Patients who want to continue to move about in the environment, such as walking in malls
      c) Patients who want to drive
      d) Patients with right acquired brain injury versus left acquired brain injury
      e) Patients between 25 and 65 years of age
      f) Women versus men
      g) Patients without significant binocular vision problems
      h) Patients who are ambulatory
   2. Patients who benefit least from (YPLS) are the following.
      a) Patients with aphasia associated with left brain trauma
      b) Patients who are not ambulatory
      c) Patients with Parkinson's disease and progressive supranuclear palsy
      d) Patients with paresis of medial or lateral rectus muscles
      e) Patients who have significant visual perceptual deficits
      f) Patients who are not motivated

C. *Life Style Change:* The third important element is to make the patients aware of how their life styles are affected by the visual field loss and to educate them about how this rehabilitation program can increase their qualify of life. This is crucial to a successful outcome. Possible considerations included the following:
   1. Improving activities of daily living (ADL)
   2. Increasing reading speed within limitations
   3. Improved computer use
   4. Increasing ease and safety when performing ambulatory activities.
      a) Walking in unfamiliar environments
      b) Restaurants
      c) Work place
      d) The ability to continue being an independent person
   5. A discussion about driving
      a) It is important to underscore that the rehabilitation program is not a driving course and the patient's ability to drive will not be attested to by the optometrist. The decision to drive is a personal and family issue.
      b) It is recommended that the patient enroll in a driving course followed by an assessment of driving skills by a driving instructor.
      c) The patient should have medical clearance by their family health care provider.

D. *Goals and Objectives of the Rehabilitation Program:* It is important that the doctor explain the concept of what visual field awareness therapy encompasses. It is imperative that the patient understands that we are not curing their visual field loss or making their visual field larger; rather, that we are using optical devices in conjunction with enhanced functional visual skills to increase their ability to

identify an object in their visual space. If this concept is not fully understood, the patient may feel that your treatment did not do what he or she expected. An excellent analogy to use for discussion is the concept of how we use rear view and side mirrors when driving a car.

1. During this discussion, I usually show the patient a demonstration of ground in prism and fresnel prism membranes. I explain why I begin my rehabilitation program with fresnel membranes and wait until 2 months after I discharge the patient from in-office therapy before prescribing ground in prism lenses. If at the 2-month evaluation, the patient is happy and successfully using the fresnel membranes, I would then prescribe ground in prism lenses. I have found that this procedure works very well and results in successful use of the final ground in prism system.
2. There should be a discussion that underscores the importance of a total rehabilitation program that incorporates optical lens systems and visual therapy. In my practice, I will not prescribe a yoked prism lens systems without rehabilitative visual therapy. It is my experience that if this rule is not adhered to, the patient will ultimately not experience the full impact of visual field awareness and generally will not continue to use the prism lens system.

II. Visual Field Awareness Systems (Currently Available)

A. *Yoked Prism Lens Systems (YPLS):*

1. The purpose of the YPLS is to reduce the need for excessive head and body movement in order to identify objects in the affected visual space. The YPLS shifts the image in the direction of the apex of the lenses approximately 1° for every 2 prism dioptors of power. By prescribing yoked prism lenses with the base of each in the direction of the visual field loss, that aspect of the visual field will be shifted in the direction of the apex, reducing the need for head and body movement to identify objects in the affected visual field. The prism can be either ground in or by using Fresnel membranes. There are several methods of achieving this.

a) *Full Lens Yoked Prism Lens Systems (FYLS):*
An FYLS incorporates prism power throughout the entire lens, thus creating an instant shift of visual space requiring very little ocular scanning. In my experience, this has limited use for the ambulatory patient because of the optical effects caused by the prism: distortion, diffraction, magnification, and spatial shift, which are disturbing to the ambulatory patient. However, this system is very effective for reading, computer work, sports, and TV and for patients who are wheel chair bound. The amount of power prescribed is empirical. When prescribing for distance use, such as TV and sports, I usually start with 15 prism dioptors with a maximum of 20 prism dioptors, prescribed binocularly, with the bases in the direction of the visual field loss. For reading and computer use, I usually will prescribe 6 to 10 prism dioptors. Although most patients can usually adjust to this lens system fairly quickly, I will prescribe a short term of rehabilitative vision therapy consisting of sequences that enhance ocular motor control, peripheral awareness, left-night sequencing, and the elimination of significant binocular vision problems.

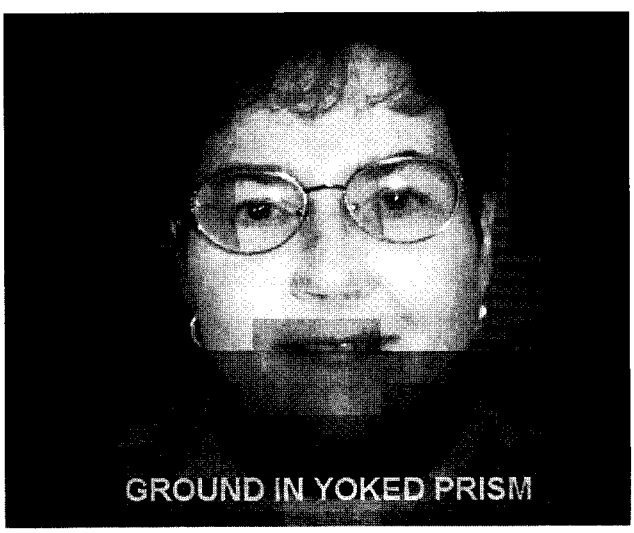
b) *Hemi Field Prism Lenses (HYLS):*
The rationale for this lens system is similar to using side and rear view mirrors when driving an automobile. The lenses are

fabricated so that a segment of the carrier lens has a prism placed so that they are not in the line of sight while the patient looks straight ahead. The prism segments are placed approximately 1 mm from the limbus on the side of each lens matching the field loss (for a right visual field loss, the left lens will be nasal to the limbus and the right lens will be temporal to the limbus, with both bases facing right). I have found that 18–20 prism dioptors is the most effective prism power, providing a shift of approximately 10° (4–5 inches) while creating the least amount of chromatic aberration and distortion. The patient is then provided with rehabilitative visual therapy sequences, which enhance his or her ability to scan into the prism segment to be more aware of objects in the affected visual field.

c) *Uniocular Prism Systems:*

(1) *Visual Field Awareness System:* The Visual Field Awareness System incorporates a small, wedge-shaped circular ground plastic prism, mounted within a carrier lens. The prism base is in the direction of the visual field loss and is monocular and mounted usually before the eye closest to the visual field loss. The prism power recommended by Dr. Gottlieb, a doctor of optometry who developed this lens system, is 18.5 prism dioptors. The process to determine the location of the prism button is based on a system that helps to locate the edge of the field loss while the patient binocularly views a central fixation point utilizing The Visual Field Awareness System Grid, developed by Dr. Gottlieb. If the patient has strabismus, suppression, or loss of vision in the eye closest to the field loss, then the prism is placed in the lens before the fixating eye. The patient has greater awareness of the lost visual field because of the superimposition of the field that is not seen over the seen area. Once the device is prescribed, the patient goes through a structured visual therapy program to teach him or her how to scan into the lens segment.

(2) *Peli System:* The concept of this system, as documented by Dr. Peli, a doctor of optometry who developed this lens system, is also based on expanding the awareness of the affected visual field by creating superimposition of the lost visual field over the intact field. The uniqueness of this system is that fresnel prism segments, 30–40 prism dioptors in power, are placed on the upper quadrant of the carrier lens down to the limbus and another segment placed in the lower quadrant. The prism segments are placed in front of the eye on the side of the visual field loss with the base



of each facing out. According to Peli, this creates superimposition of the scenes by shifting the image 15–20°, thereby increasing awareness of the lost visual field.

III. Rehabilitative Visual Therapy

As I described in the introduction, I feel that the full benefit from optical devices is more successfully achieved when the patient is actively involved in a structured visual therapy program based on good learning principals. The ultimate goal of this process is to develop visual skills which allow the patient to process visual information in the least amount of time by eliminating or reducing the affects of binocular vision problems, ocular motor deficits and visual perceptual deficits on the overall process of ocular scanning for visual field awareness. Additionally, the goal is for the patient to efficiently utilize the spatial shift created by the prism system to identify information in the lost visual field by scanning into the prism segment. It is important that the YPLS should not be dispensed until the patient is committed to the recommended visual rehabilitative program. If this is not adhered to I find that the patient will have an immediate negative response to the lenses and ultimately will be noncompliant. Thus an important element in my practice is that I will not accept a patient unless that patient accepts a minimum of 6–10 visual therapy visits or more depending on the diagnosed binocular vision and visual perceptual processing deficits. If there are no binocular vision or visual perceptual problems then my minimum treatment protocol incorporates a basic program of peripheral awareness, ocular scanning and speed and span of perception as well as the use of YPLS if appropriate.

A. *Visual Scanning Therapy:* The overall goal of this sequence is to develop an efficient process to scan the visual environment and, ultimately, to use a YPLS effectively. My therapy begins with basic ocular motor therapy sequences with the following goals.

1. The development of a "burst" type saccadic movement into the side of the visual field loss. Sequences are provided that develop visually guided saccadic fixation jumps and peripheral field awareness. I call this the *Slingshot Phase.*
2. A process that allows for the patient to systematically scan visual space with the least amount of extraneous eye movements. I call this the *3-Step Scanning Process.*
3. When appropriate, a process to teach the patient to identify and/or manipulate objects in the visual environment using the YPLS. I call this the *Rear View Mirror Phase.*
4. The integration of scanning with ambulation. I call this the *Automaticity Phase.*
5. To enhance visual functioning for increased reading and writing performance

a) *Slingshot Phase:* The purpose of this initial phase of therapy is to provide the patient with experience in using the ocular motor system to scan the space world using excursion of the eyes (approximately 20°). The important aspect is that the patient begins to feel his or her eyes move to their fullest extent into the affected visual field while also being aware of the overall visual scene, although not necessarily the detail within it. The analogy of a slingshot is used as a tool to help the patient to visualize a fast and easy flow eye movement. Mastery of this visual skill will help the patient to move his or her eyes past the edge of the prism when scanning, and thus reduce the "Jack in the box effect."

b) *3-Point Scanning Phase:* Patients with visual field loss develop adaptive head and body movements; however, their eye movements are usually erratic and characterized by multiple, random, saccadic fixations. The purpose of this phase is to teach

the patient a systematic search using the least amount of random eye movements while they scan into the prism segments. Gottlieb et al. originally described a 2-step process during which the patient looks laterally into the prism and then straight ahead. My experience using this scanning method was that many of my patients reported injuring themselves by colliding with objects in their lower field. The 3-Step Scanning process teaches a first scan to the inferior field in the direction of their affected side followed by a saccadic jump horizontally to the affected side and then out of the prism to straight ahead gaze. This works well because, in most instances, objects in the superior field are not as common, and there are usually clues that prompt us to look up, while objects in the lower field are more common and dangerous. Although I recommend this scanning sequence whenever the patient is walking or moving in space, my patients usually will modify this, depending on where they are. For example, they usually relax this phase when in their homes or familiar environments and use it mostly when driving, walking in malls, and familiar environments.

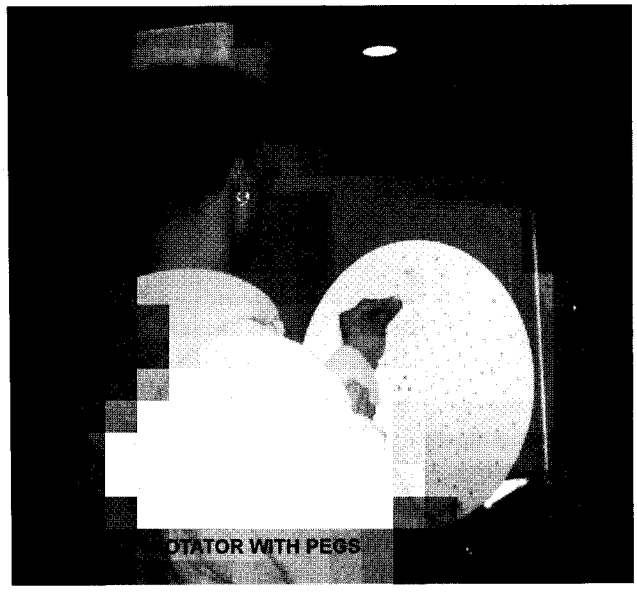
c) *Rear View Mirror Phase:* The goal of this phase is to familiarize the patient with the image jump created by the HYPLS and to teach a systematic saccadic fixation out of the prism in order to identify and manipulate objects in the environment. In my experience, this is the most difficult concept for the patient to learn. An approach combining a discussion of the use of side and rear view mirrors while driving as an analogy followed by a demonstration of how a prism shifts the image helps the patient understand this process more easily. The training of this phase is accomplished by teaching the patient the third step of the scanning process; a saccadic jump to straight ahead followed by a head and eye turn toward the objects located during the scanning process. It is important that the patient clearly understands the concept that the YPLS does not expand the visual field but rather increases an awareness and the speed of identifying objects in the affected field. Once the patient accepts this, the Rear View Mirror Phase becomes effective. In most situations, the important issue is that the patient is aware of something in their space that they need to avoid and that what it is of little importance. This is effectively provided by scanning and the YPLS. If the patient needs to identify what the object is, such as reading a sign or grasping an object, then the Rear View Mirror Phase is performed.

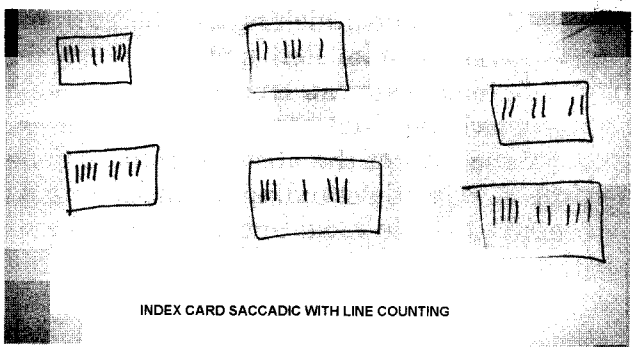
d) *Automaticity Phase:* The goal of this phase is to automate the 3-Step Scanning Process into a "real life" routine. The same concepts used by athletes to develop "muscle memory" are used for this phase and can only be achieved by practice and repetition. The out-of-office therapy program accomplishes this by incorporating real-life situations in which to practice.

e) *Reading Performance:* Therapy sequences are prescribed to enhance the quality of stimulus-generated saccadics, left right sequencing, and peripheral awareness. Eventually, speed of processing is emphasized. The therapy is performed utilizing the YPLS if appropriate.

IV. My Favorite In-Office Techniques
  A. Basic Eye Movement Control:
    1. Rotator therapy
      a) With a Russell loop; for example, a pipe cleaner with the end bent to form a small, circular loop
      b) With pegs
      c) Stress proprioceptive feel of the eyes moving. Increase range of motion by using yoked prism and controlling head and body movement
  B. *Slingshot Saccadics:*
    1. Wayne fixator
    2. Wayne fixator with near to far fixation attachment
    3. Overhead Hart Chart saccadics with Russell Loop
    4. Vogel Track and Read software
      a) Rotations
      b) Letter tracking basic sequence
    5. Computer Orthoptics arrow saccadics
    6. Wayne Directional Sequencer basic programs
    7. Loop Hoop: A board with several rows of dowel sticks organized in a left–right sequence. On each dowel are number tags placed randomly. The patient is to find the numbers in order and loop the dowels with a plastic loop. The patient must scan his or her eyes to find the numbers always starting on the extreme left side and finishing on the extreme right side. Red and blue tags for each side can be used initially as a visual clue
      a) All of the above should be done while standing balanced with as little head and body movement as possible
  C. *3-Point Scanning:*
    1. Wayne Stickups with laser light flash
    2. Electric Brock String Saccadics with pointing
    3. Wayne Windows
    4. Index card saccadics with number sequence in random order
  D. *Rear View Mirror:*
    1. Wayne Stickups with flash and call out letters
    2. Wayne Windows with tachistoscopic flash
    3. Electric Brock String saccadics with pointing or loop
    4. Tootsie toss
    5. Valente Virtual Reality Saccadics
  E. Peripheral Awareness:
    1. McDonald Letter Spread
    2. VO Stars
    3. Valente Virtual Reality software
    4. TOP with Brock String
  F. *Reading Performance:*
    1. Sequences that develop left right, stimulated saccadics with peripheral awareness:
      a) Track and read software (Gary Vogel, OD Computer-Aided VT)
      b) Visual search, visual scan, speed of visual processing, visual span (Sid Groffman, OD, Computerized Home VT)
    2. Fusional therapy stressing fusional facility, fusional sustenance, and speed of fusional recovery

V. My Favorite Out-of-Office Therapy Procedures
  A. *Basic Eye Movement Control:*
    1. Tongue depressor rotations
    2. Wide wall corner fixations
    3. Index card saccadics
  B. *Slingshot Sequence:*
    1. Random index card saccadics
    2. Find objects in space without head and body movement
    3. Percon looping workbooks



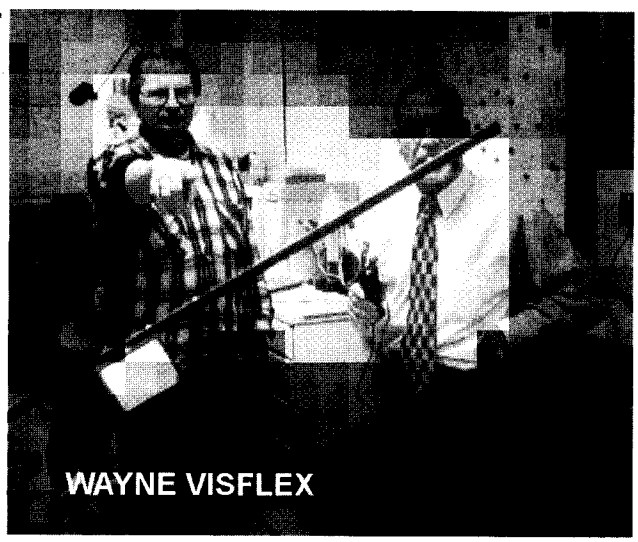


INDEX CARD SACCADIC WITH LINE COUNTING

C. 3 Point Scan and Rear View Mirror
   1. Random index saccadics with line counting
   2. Identify objects in space
   3. Walking in familiar environment and scan
   4. Walking in unfamiliar environment and scan

D. *Peripheral Awareness:*
   1. Mc Donald Letter Spread
   2. Brock String physiological awareness

VI. Hints for Driving:
   1. Set up a simulated driving situation such as in a parking lot.
      a) Practice scanning for signs, stop signs, and objects with YPLS.
      b) Take a defensive driving course with the YPLS and have the instructor appraise driving skills.
   2. Demonstrate the use of a slight head tilt toward the visual field loss to increase the field awareness.
   3. Discuss strategy for traffic patterns.
   4. Don't encourage driving.



WAYNE VISFLEX

CONCLUSION

Although the problems associated with hemianopic visual field loss that patients experience after acquired brain injury may be relatively mild during their initial rehabilitation process, once their acute medical problems have been resolved or maximum recovery achieved, the problem of moving around their space world safely becomes significant. Unfortunately, rehabilitation health care providers, as well as the average eye care provider, have very little positive experience in dealing with this population. My experience has shown that a visual rehabilitation therapy program utilizing Yoked Prism Systems and specific visual therapy procedures significantly adds to this population's quality of life. In most cases, reading ability improves, confidence in ambulation increases, and patients report that their general quality life is improved. In addition, depending on state law, they often can resume limited driving. This article describes a vision rehabilitation protocol for the management of patients with hemianopic visual field loss, which encompasses full scope of optometric care with an emphasis on creative optics and visual therapy.

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3. Perlin R, Dziadul J. Fresnel prisms for field enhancement of patients with constricted or hemianopic visual fields. JAOA. 1991;62:58–64.
4. Gottlieb D, Freeman P, Williams M. Clinical research and statistical analysis of a visual field awareness system. JAOA. 1992;63:581–588.

Software Programs

1. Wayne Engineering: 846-674-7166
   a. Electronic Visflex
   b. Windows
   c. Wayne Fixator
   d. Wayne Directional Sequencer
2. Computerized Home VT (HTS): Rod Bortel and Jeff Cooper, OD: 800-346-4925
3. Optometric Stereo Video Projector System: Claude A. Valenti: 858-453-0442
4. Computer-Aided VT: Gary Vogel, OD: Bernel Corporation
5. Perceptual Therapy System: Sid Groffman, OD: 800-346-4925