This case report presents the evaluation and treatment of a 35-year-old woman who was referred to a low vision rehabilitation program because of reading and writing difficulties after a traumatic brain injury. Before the low vision evaluation, the woman had received extensive multidisciplinary rehabilitation services over a 15-month period, including inpatient and outpatient therapy services and vocational evaluation and training. Although she succeeded in regaining independence in all self-care and homemaking tasks that did not require reading and writing, her vocational opportunities were limited because of her inability to accurately read print and write.

History

The client sustained an anoxic encephalopathy on February 18, 1990, after receiving a gunshot wound to the chest. The injury resulted in severe cognitive and perceptual deficits and quadriparesis. The client received intensive occupational therapy, physical therapy, and speech therapy during inpatient hospitalization, and was eventually transferred to a transitional living unit before returning home. During her rehabilitation, she made good progress in regaining physical and cognitive abilities, but her difficulties in reading and writing persisted. Her inability to complete these activities was attributed to visual perceptual deficits described in her medical records as “a left visual field neglect” and “problems with visual processing.” It was also determined that she had an inferior visual field deficit. The therapists working with the client at the rehabilitation facility attempted to use large print materials to assist her reading and also used treatment protocols that addressed visual-motor skills (visual tracing and saccades) and visual-perceptual skills such as design copy. These treatment protocols did not result in any notable improvement in the client’s ability to read or write.

The presence of the inferior visual field deficit qualified the client for state rehabilitation services for the blind. State services funded a vocational evaluation while the client was residing in the transitional living unit. After completion of the evaluation, it was recommended that the client use a computer with a speech synthesizer for home and vocational activities and that she participate in a basic computer training program. Computer instruction took place at a training facility for the blind, where an attempt was also made to teach the client to read braille. The braille instruction was unsuccessful because sensory deficits in the client’s hands made it difficult for her to distinguish the tactile patterns. After completion of the basic computer training program, the client was referred by state services to a vocational rehabilitation facility for clerical training and job placement. During the clerical training, the client successfully used a screen reader to help her access files on a computer. However, she was unable to accurately read hard copies of documents.
handwritten materials, telephone books, and textbooks. The client's case manager decided to refer her for a low vision evaluation to provide recommendations to help her access printed materials because the clerical training staff members believed that her inability to read printed materials would greatly limit the vocational opportunities available to her.

Low Vision Evaluation

A comprehensive low vision evaluation was performed by an ophthalmologist and occupational therapist. The ophthalmologist evaluated acuity and contrast sensitivity function, visual field integrity, and macular perimetry and completed a refraction. His report indicated that the client's central visual acuity without correction was 20/30 in both eyes. Contrast sensitivity appeared to be slightly reduced. Computerized automated perimetry was used to test the client's visual field. A full field 120-point screening test confirmed the results of a visual field examination conducted during the client's inpatient rehabilitation, which indicated the presence of an inferior visual field cut extending into the macula in both eyes (see Figure 1). Macular perimetry completed with a scanning laser ophthalmoscope (see Figure 2) revealed that in both eyes the client's fovea was bordered on three sides with dense

Figure 1. Results of automated full field 120-point screening test. Squares = dense field losses, Xs = threshold field losses, Os = points seen. Left pattern represents the client's left eye; right pattern represents her right eye.

Figure 2. Results of macular perimetry performed on scanning laser ophthalmoscope. Fixation is indicated with a white cross encircled with a solid line. Dense scotomata are outlined with a solid line and labeled DS. Threshold scotomata are outlined with a dotted line and labeled TS. Figure 2a represents the client's left eye; Figure 2b represents her right eye.
scotomata, and on the fourth side with a threshold scotoma. A dense scotoma, or blind spot, is an area of the retina that does not respond to light at any intensity. A threshold scotoma responds to light at high intensity, but behaves as a blind spot in low lighting situations (Fletcher, Schuchard, Livingstone, Crane, & Hu, 1994).

As part of the comprehensive low vision evaluation, the occupational therapist completed an activities of daily living screening and a writing evaluation and assessed reading through observation of client performance and completion of the Pepper Visual Skills for Reading Test (VSRT) (Baldasare, Watson, Whittaker, & Miller-Shaffer, 1986). Observation of the client's performance in reading revealed that she was able to read individual letters and two- to three-letter words but had much difficulty with longer words. The client also was unable to stay on the correct line and could not consistently locate the next line of text. The VSRT is designed to evaluate the visual components of the reading process in persons with low vision. A high-intensity lamp was used to improve the luminance of the reading material to minimize the effects of the threshold scotomata. Even with this additional light, the client's corrected reading rate as measured by the VSRT was 15.3 words per minute with 94% accuracy. She often spelled words out loud before saying them and required extra time to locate the next line of text. The client also performed a continuous text reading task with single spaced 1.5M print (standard newspaper print size is 1M) and read at a rate of 68 words per minute.

In functional writing tasks, the client reported having difficulty accurately writing in confined spaces (i.e., checks, forms, envelopes) and completing daily living tasks that required reading and writing, including financial management, filling out insurance claims, and reading labels, directions, and the newspaper. Writing ability was evaluated by having the client complete a job application and write numbers and text on regular-lined notebook paper. During writing tasks, she demonstrated great difficulty with staying on the lines and writing in confined spaces.

Results of the low vision evaluation suggested that the scotomata present in the client's central visual field and not visual perceptual deficits were the probable cause of her reading and writing difficulties. The difficulties reported and demonstrated by the client are consistent with those reported by persons with retinal pathology where the fovea is bordered by dense scotomata or blind spots (Plas, Schuchard, & Fletcher, 1995). The dense scotomata surrounding the fovea created a pinhole type of visual field, which prevented the client from viewing more than two to three letters at a time and limited her ability to recognize words and navigate a page of text. According to Legge et al. (1988), the critical number of characters needed to be viewed at one time for optimum reading speed is four to five. Any number below this significantly reduces reading speed and accuracy.

**Treatment**

The client was referred to the low vision program for occupational therapy services by the ophthalmologist. In treatment, the client was instructed about the nature of her visual deficits and trained in strategies to compensate for these deficits during functional tasks. The compensatory strategies taught included using extra light during reading and writing tasks to reduce the effect of the threshold scotomata and maximizing contrast between objects to compensate for reduced contrast sensitivity. Recommendations were made for environmental adaptations in her home, and instruction regarding how to apply the above strategies in her daily living was provided and reinforced with written materials. Treatment sessions were held twice per week for 8 weeks with an interim home program.

**Reading**

To maximize reading speed and accuracy, it was determined that the client needed to improve her ability to make quick and precise eye movements during the saccades in order to read successive words on a line and also during the return-sweep eye movements used to move the eye to a new line of text. The treatment protocol designed to reestablish these basic visual skills required the client to complete reading activities, which were graded according to the number of letters, distance between the letters on a single line, and the amount of space between the lines. Training materials were restricted to 1.5M to 2M print size, because letters larger than this would tend to fall outside her intact visual field. Treatment began with timed activities using single letters and wide spacing between targets and between lines of letters. The client was required to accurately identify each letter as quickly as she could. As she became proficient in performing the simpler tasks, more difficult tasks were introduced until the client was able to proficiently perform all assigned drills.

At the end of 8 weeks of treatment, the client was able to read continuous text at a rate of 112 words per minute with no errors and good comprehension of the material read. Reevaluation with the VSRT showed an increase in corrected reading rate to 33.5 words per minute, and the client no longer had to spell words before recognizing them. Functionally, the client was able to accurately read information from reference manuals and had resumed reading for pleasure and information during daily living tasks, including looking up telephone numbers, reading magazine articles, and reading books to her children.

**Writing**

The client's main concern with writing tasks was her inability to fill out forms that had confined spaces in which
to write. Other writing tasks were performed with some difficulty, but she reported being satisfied with her performance. These writing problems were consistent with the effect of the ring-shaped scotomata. Her constricted central visual field appeared to cause the client to miss the information she needed in order to process the layout of the form and the size of the space in which she was to write. The treatment protocol focused on training the client in compensatory scanning strategies to enable her to systematically gather the needed information regarding the layout of forms. She was also taught to closely monitor the movement of her pen to improve her ability to keep the writing on line and within confined spaces. Activities such as tracing exercises and repetitive writing tasks were assigned as homework to enhance the hand-eye coordination needed to perform these tasks. After the 8 weeks of treatment, the client demonstrated the ability to accurately fill out job applications, insurance forms, and other materials needed at home and in her pursuit of a new job.

Summary

The client described in this article had undergone intensive rehabilitation for physical and cognitive deficits that resulted from an anoxic encephalopathy. Her recovery was good in all areas except visual functioning. Her reading and writing deficits were initially thought to result from visual-perceptual problems. A low vision evaluation identified the deficits as resulting from a macular visual field loss. Warren (1993) has proposed that an intact visual field is one of the basic components of vision that must be present before higher visual processing can occur. Until the macular perimetry was performed on this client, the extent of her central field loss was unknown, and the treatment that focused on the higher level visual processing was unsuccessful. The low vision program targeted the central field loss as the probable cause for her difficulties and an effective treatment protocol was established. The client was instructed regarding the nature of her visual field deficit and was trained in methods to compensate for this deficit. Although she has not returned to work as of this writing because of financial disincentives, the training resulted in a measurable and functional improvement in the client's ability to read continuous print text, a task she had not performed in 4 years, and in her ability to perform all writing tasks needed for daily living.

References


Editor’s Note. To continue the Case Report department, we need and welcome reports that document the practice of occupational therapy for specific clinical situations. Guidelines for writing case reports are available from the Editor.