Identification of Visual Scanning Deficits in Adults After Cerebrovascular Accident

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Key Words: eye movements • visual neglect

Visual scanning, which involves eye movements and fixation, is one of the primary means by which the central nervous system obtains visual information from the environment. Research has shown that deficits in visual scanning contribute to the failure of some adults who have had a cerebrovascular accident (CVA) to regain independence in many daily activities, including self-care, reading, arithmetic, and driving (Ben-Yishay, Diller, Gerstman, & Haas, 1968; Diller & Weinberg, 1970; Gianutsos, Glosser, Elbaum, & Vroman, 1983; Gianutsos & Matheson, 1987; Gordon, Hibbard, & Egelko, 1985; Hie, Mondlock, & Caplan, 1983; Weinberg et al., 1979). Traditionally, however, our profession has minimized the importance of such basic oculomotor functions as visual scanning by evaluating visual function in brain-injured adults primarily through the use of tests designed to measure higher level visuoconstructive skills such as visual closure, figure-ground perception, and visual memory. Although visual scanning factors into the scores obtained on these perceptual tests, it is not singled out for analysis. The influence of this area on the performance of daily living skills is often overlooked and the remediation of scanning deficits not addressed.

Literature Review

At least two modes of visual processing operate simultaneously within the central nervous system (Post & Leibowitz, 1986; Schneider, 1969; Zihl & Von Cramon, 1979). These two separate but interrelated systems, focal vision and ambient vision (Belleza, Rapaport, Hopkins, & Hall, 1979; Gibson, 1976), together provide the nervous system with an efficient and thorough means of integrating visual stimuli to make an adaptive response to the environment.

Focal vision describes the ability to pay attention to a single object in the environment in order to perceive or discriminate its features in detail (Gibson, 1976). It is used to identify objects and relates to the ability to read, perform calculations, identify faces, and discriminate similar objects or forms (e.g., the letter b from the letter d, a tangerine from an orange).

Focal vision is largely a learned skill, acquired and refined over a lifetime through interaction with objects in the environment. Focal vision is partially shaped by culture (Segal, Campbell, & Herskovits, 1966). For example, persons living in carpentered environments (i.e., among structures that incorporate right angles) have been found to be more susceptible to certain visual illusions than are persons who have grown up in uncluttered environments such as the African plains (see Figure 1).

Ambient vision, sometimes referred to as the second visual system, is used to detect stimuli and their

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location in the environment in relation to the self and other objects (Belleza et al., 1979). Ambient vision, a more generalized, holistic system, is present at birth across species and is refined through experiences with the environment (Gibson, 1976). It relies on visual scanning to gather information regarding the depth, distance, and constancy of objects in the environment and contributes heavily to topographical orientation in the environment.

For a fully operational and efficient visual system to exist, both focal and ambient vision must work together. Ambient vision provides a general awareness of surroundings, while focal vision concentrates on the specific characteristics necessary for object identification. A person given the task of buying a bag of Granny Smith apples will use ambient vision to locate the produce section of the store and focal vision to distinguish Granny Smith from Golden Delicious apples. Although both systems are necessary for efficient processing, ambient vision, because it is a more primary system, must be functioning properly for focal vision to be accurate. A person must first notice a stimulus and attend to it before he or she can identify it.

Visual scanning occurs primarily through saccadic eye movements. Saccades are rapidly executed eye movements designed to locate an object of interest in the environment and focus it on the fovea of the eye. Such movements can occur automatically when a novel or important stimulus appears in the peripheral field or are purposefully executed to search for an object in the environment (Leigh & Zee, 1983). Control of saccadic eye movements can be disrupted after a CVA in either hemisphere (Belleza et al., 1979; Chedru, Leblanc, & Uhermitte, 1973; DeRenzi, 1982; DeRenzi, Colombo, Faglioni, & Gibertone, 1982; Joynt, Benton, & Fogel, 1962; Locher & Bigelow, 1983; Posner & Rafal, 1987). Saccadic deficits associated with CVA include (a) a failure to initiate saccades toward the field contralateral to the side of the lesion, (b) an increased latency period in initiating saccades toward the contralateral field on the involved side, (c) a decreased saccadic accuracy in the involved hemifield, (d) an inability to fixate gaze in the contralateral field, (e) a tendency to fixate first on the most peripheral visual stimuli in the hemifield on the sound side, and (f) a tendency to be distracted by peripherally occurring stimuli in the sound hemifield. These oculomotor deficits are often associated with the syndrome of unilateral spatial neglect, which is defined as the failure to report or respond to stimuli occurring in the visual field on the impaired side of the body (Heilman, 1979). The severity of the syndrome varies. Milder forms are chiefly characterized by extinction, in which a person presented with two simultaneous visual stimuli attends to the stimulus on the sound side and "extincts," or ignores, the stimulus on the involved side. In severe cases, the person acts as though vision is absent on the involved side and will, for example, pick up food from only half of the plate or address only those persons standing on the sound side. Although visual field deficits (hemianopsia) often occur with unilateral spatial neglect, Albert (1973) and others (Chedru et al., 1973; Heilman & Valenstein, 1979; Leistlich, Sidman, Stoddard, & Molin, 1969) have shown the condition to occur with intact visual fields. The consensus is that unilateral spatial neglect results from an attention deficit (Mesulam, 1981). The brain fails to register and integrate visual information coming from the involved side and, therefore, does not attend to it. Visual neglect is often accompanied by somatosensory and auditory input neglect as well (Heilman, 1979).

The visual scanning deficits associated with brain damage may result in the person’s use of an ineffective visual search pattern to explore the environment. Chedru et al. (1973) studied the scanning patterns of 36 normal subjects and 115 subjects with brain injury. They found that when normal subjects were asked to locate a specific figure hidden among others projected on a screen, these subjects consistently employed a systematic scanning pattern to search for the figure. Most of the normal subjects employed a circular clockwise or counterclockwise scanning pattern, beginning in the left upper quadrant. Most subjects spent an equal amount of time exploring each half of the visual field and an equal amount of time studying each figure until the correct one was located. Conversely, few of the subjects with brain injury demonstrated a systematic search pattern. Most began exploring visual space in the hemifield on the sound side. The subjects with right hemisphere lesions spent a greater amount of time...
scanning in the right half of the visual field. Saccadic excursions into the left half of the visual field were delayed and brief. As a whole, the brain-injured group scanned more slowly, fixated longer, and was less accurate in locating the correct form.

Belleza et al. (1979) found similar results in comparing brain-injured and non-brain-injured subjects on a design copy test to determine if patterns of visual exploration influenced performance on drawing tasks. All brain-injured subjects with drawing impairment on the design copy test demonstrated "abnormal scanning patterns" (p. 30). The subjects with brain injury had more fixations but shorter fixation durations and spent less time studying the most informative areas of the design than did the non-brain-injured subjects. Their scanning patterns also tended to be asymmetrical, with more time spent exploring the portion of the design in the sound half of the visual field. Belleza et al. suggested that ambient vision enables one to detect salient visual information peripheral to the area of fixation, which in turn engages visual attention mechanisms and focal inspection for detail. When the visual scanning pattern is disrupted, focal inspection is incomplete or absent. This makes it difficult for the brain to construct an internal representation, or perception, of the object and to formulate the correct spatial judgment. Tyler (1969), studying the visual scanning patterns of post-CVA patients with aphasia, found that those with significant expressive and receptive aphasia incompletely scanned pictures for detail, thereby resulting in simplistic interpretations of the picture's content. The more complex the picture, the more the aphasics' eyes seemed to fatigue and fail to search for more information in the picture. Tyler concluded that the defect in visual exploration interfered with the cognitive processes involved in visual perception, thus causing a reduction in thinking about and interacting with the environment. According to Tyler, certain types of aphasia cannot be explained solely by concepts limited to speech and language. Severe deficits in visual scanning may contribute to the language deficits observed in some persons with sensory-receptive aphasia.

Posner and Rafal (1987) reported that visual attention can be disrupted by deficits in visual scanning. They suggested that visual attention is activated through a cognitive process involving three scanning steps. A disengage operation is initiated first to remove the eye's focus from the object currently under study. This is followed by a move operation, in which the eyes shift to locate the next object, followed by a compare operation, in which the previous object is compared to the new one for similarities and differences. For example, a subject instructed to find the number 9 on a list of digits will focus on the first digit, then disengage (Step 1) and move to the second digit (Step 2), then refocus and compare the first two digits (Step 3). This three-step process is continued down the list until the 9 is found. Posner and Rafal found that the disengagement mechanism (Step 1) can be affected by an injury to the parietal lobe, which causes unilateral spatial neglect. Subjects with unilateral spatial neglect were slower to disengage a stimulus and shift the eyes toward the contralateral field. Those with right lesions were slower moving from the right to left than from left to right regardless of the visual hemifield being explored. They were also less likely to reengage and explore an area that had been previously inspected, which resulted in incomplete visual perception of the area under exploration.

Diller and Weinberg (1970) linked impairment in visual scanning to accident-prone behavior in post-CVA adults. Persons with right CVA who experienced accidents during activities of daily living tended to perform visual scanning tasks rapidly, with many errors, indicating visual inattention to the task. The majority of accidents in this group occurred during wheelchair transfers or when the patient was alone and involved failure to properly set the wheelchair's brakes before transfer and other mistakes reflecting inattention to the environment. The accident-prone behavior of persons with left CVA was related to speed but not to accuracy on a scanning task. These patients were slow but accurate on the scanning task. Their accidents tended to occur at bedside, where the patient attempted to get something for himself or herself rather than ask for help, which possibly reflected difficulty with communication. Hier et al. (1983) found a relationship between neglect and dressing apraxia. In a factor analysis of the behavioral deficits of 41 patients with right CVA, they found that lack of persistence, extinction, neglect, denial, and dressing apraxia loaded strongly on one factor. The factor was identified as inattention, because each deficit involved attention to the environment.

The literature on visual scanning deficits in patients with brain injuries clearly indicates that deficits in this area significantly affect performance in many aspects of daily living. An evaluation of scanning ability should be an established part of the visual evaluation completed on patients with brain injury. The present study examined the reliability and validity of five tests designed to measure visual scanning in the post-CVA adult patient. The following research questions were asked:

1. Do the tests demonstrate interrater and test-retest reliability?
Do post-CVA subjects achieve significantly lower scores on the tests than normal subjects of comparable age and sex?

Methodology

Sample

The study sample consisted of 23 subjects with documented right and left hemisphere lesions secondary to CVA and 23 control subjects with no known neurological dysfunction. The subjects in the groups were matched by sex and by age to within 6 months. The subjects in the hemiplegic group were chosen randomly on the basis of availability from the inpatient population of the Rehabilitation Institute of Kansas City, Missouri. The subjects in the nonhemiplegic group were chosen randomly on the basis of availability from the community.

To qualify for the study, the subjects in the hemiplegic group had to meet the following criteria: (a) be 16 years of age or older and have a documented unilateral lesion in the right or left hemisphere secondary to a CVA, (b) demonstrate consistent orientation to person, place, and time before evaluation; (c) possess sufficient attention span to complete each test without redirection to the task more than one time during the testing session, and (d) possess sufficient speech and language comprehension to understand the directions to the tests (questionable subjects were screened by a speech pathologist before testing). Those persons with medical histories of bilateral CVAs, tumors, traumatic brain injuries, or other neurological conditions that resulted in diffuse brain damage were excluded. The selected hemiplegic sample consisted of 11 males and 12 females. Fifteen of the subjects sustained right hemisphere lesions and 8 sustained left hemisphere lesions. The age range of the sample was 44 to 83 years, with a mean age of 68.4 years.

The subjects for the control group were screened with a questionnaire for a history of neurological and visual deficits. Those persons with a history of unexplained loss of consciousness, sudden unexplained transient weakness of the limbs or difficulty with speech, or sudden onset of confusion were excluded. Persons with a history of seizures, head injury, brain tumor, CVA, alcohol or drug abuse, severe macular degeneration, cataract, or glaucoma were also excluded.

Instrument

To measure visual scanning, I used five tests that I had developed previously: light show single, light show double, light show scanning, scan board, and design copy test. The staff occupational therapists and I had been using these tests routinely for several years in the occupational therapy clinic to screen post-CVA and head-injured patients in inpatient, outpatient, and driving programs. A brief description of each test follows.

A light show is a simple perimetry device consisting of 36 LED lights arranged in 12 columns with 3 lights per column, across three panels (see Figure 2). The panels are arranged to form an arc of approximately 120° around the subject. The subject's head is held steady in a chin rest placed in the center of the arc 17 in. from the center panel, and the subject's hands rest on the table inside the arc (see Figure 3). The subject is told that a single light will appear on one of the panels and that he or she is to point to the light as soon as it is noticed. The subject is allowed to shift his or her eyes during the test to locate the light but cannot remove the chin from the chin rest or turn the head. A verbal cue is given before the presentation of each stimulus to alert the subject that the light is about to appear, but no indication is made regarding the location of the stimulus. Three light show tests, described below, were given.

Light show single. This test is used to measure the subject's general awareness of stimuli in the visual field. A single light is shown for a 1-sec interval. The subject is asked to point to the light that comes on. A total of eight lights are shown: four in the right half of the visual field and four in the left half of the visual field. Two lights appear in the upper half of the board, two appear in the lower half, and four appear in the middle. One point is given for each light identified, with a maximum score of 8 points.

Light show double. This test is used to measure extinction in the visual field when the subject is presented with simultaneous visual stimuli. Two lights are shown simultaneously for a 1-sec interval. One light appears in the central right or left hemifield, the other appears in the lateral portion of the same hemi-
The subject is asked to point out both lights. A total of eight lights (four sets) are shown, two sets in the right hemi-field and two in the left hemi-field. One point is given for each light identified, with a maximum score of 8 points.

**Light show scanning.** This test, which indicates scanning speed and efficiency, measures the time required for the subject to locate successive stimuli in the visual field. Three lights are presented simultaneously. The subject is asked to point out the lights with the unaffected arm in succession as quickly as he or she sees them. The lights are distributed randomly on the three panels. A stopwatch is used to measure the speed of the subject's response from the moment the lights appear to the moment the last light is located. A total of 15 lights are shown in five sets. Eight lights appear in the right visual field, and 7 appear in the left visual field. The total number of seconds required to identify the three stimuli is recorded and divided by the five trials to get a mean scanning time.

Besides the light show tests, two additional tests were given, as follows.

**Scan board.** A scan board identifies disruptions in the scanning pattern and screens for unilateral spatial neglect. A 34 in. by 32 in. board with 10 numbers (0-9) arranged in a butterfly pattern (see Figure 4) is centered in front of the subject 20 in. from the mid line, with the middle of the board at eye level. The subject is told that there are 10 numbers on the board and is asked to point out the numbers in the order they are seen. The sequence in which the subject identifies the numbers is recorded to indicate the scan pattern. The subject receives 1 point for each number identified and loses 1 point if a number is identified more than once. The maximum test score is 10 points.

**Design copy test.** This test is used to screen for unilateral spatial neglect and other deficiencies in visual scanning. The subject is asked to use the unaffected hand to copy four simple designs: a house, a flower, a clock, and a diamond. The designs are presented individually and each design is copied onto a separate sheet of paper. This test has no time limit. The subject is instructed to copy the design as accurately as possible and to put the pencil down when finished. The test is scored on the accuracy of the drawing. Points are lost for either omissions or additions in the detail of the drawing (e.g., the deletion of a window on the house or the addition of numbers on the clock). The maximum score possible for a single drawing is 4 points, with a maximum of 16 points for the complete test.

**Procedure**

Three therapists, trained in the administration of the tests, provided the testing. Each subject was given the five tests by the same therapist in a single setting. The tests were given to all of the hemiplegic subjects during the first week of inpatient hospitalization. The subjects in the control group were tested as they became available. All testing was done in the occupational therapy clinic, and approximately 30 min were required for each subject to complete the tests. To establish test-retest reliability, the tests were given a
Comparison of Spearman Rank Order Correlations on Five Visual Scanning Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Rho Correlation Coefficients</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>Interrater</td>
<td>Test-Reetest</td>
</tr>
<tr>
<td>Light show single</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>Light show double</td>
<td>0.97</td>
<td>0.70</td>
</tr>
<tr>
<td>Light show scanning</td>
<td>0.98</td>
<td>0.81</td>
</tr>
<tr>
<td>Design copy</td>
<td>0.91</td>
<td>0.73</td>
</tr>
<tr>
<td>Scan board</td>
<td>1.00</td>
<td>0.68</td>
</tr>
</tbody>
</table>

Results

The Spearman rank order correlations were statistically significant for both the interrater and test-retest comparisons for all tests (see Table 1), which indicates that the tests are reliable measures. The results of the Wilcoxon signed rank tests are shown in Table 2. Differences in performance between the hemiplegic and control groups were statistically significant for all tests. The hemiplegic group achieved lower scores on all tests as compared with the control group. The results indicate that the tests are valid measures with which to identify visual deficits in post-CVA persons. The Spearman rank order correlations did not reach statistical significance on the test comparisons, which indicates that the side of the lesion was not a significant factor in test performance in this study.

The result of the chi-square analysis of the scanning pattern on the scan board test was statistically significant. Fifty-two percent of the hemiplegic subjects demonstrated an organized scanning pattern, compared with 91% of the control subjects. This finding is consistent with that of Chedru et al. (1973) and others (Belleza et al., 1979; DeRenzi, 1982; Locher & Bigelow, 1983; Posner & Rafal, 1987; Weinberg et al., 1977), who reported that subjects with brain injury often display disorganized search patterns when viewing two-dimensional objects. The hemiplegic and control groups also differed in the preferred starting point on the board. Sixty-five percent of the control subjects started the scanning pattern in the left upper quadrant. Again, this is consistent with the findings of Chedru et al. (1973), who reported that most of their control subjects began scanning in the left upper quadrant. Conversely, the hemiplegic subjects showed a more evenly distributed preference for the starting point: 39% starting in the left upper quadrant, 22% in the right upper quadrant, and 26% in the left central portion of the board. Regarding scanning pattern, 52% of the control subjects used a clockwise pattern, 44% used a counterclockwise pattern, and 4% used a rectilinear or lateral pattern. This is similar to Chedru et al.'s (1973) findings of 46%

Statistical Analysis

Because of the restricted scoring range of some of the tests, nonparametric analyses were completed. Spearman rank order correlations were calculated on each pair of tests to establish interrater and test-retest reliability. Wilcoxon signed rank tests were used to determine the validity of the tests as measures of visual ability. Because the research indicates that the side of the lesion may influence performance on scanning tests (Belleza et al., 1979; Chedru et al., 1973; Diller & Weinberg, 1970; Schenkenberg, Bradford, & Ajax, 1980; Tyler, 1969; Weinberg et al., 1977), scores on each test were divided into right and left hemisphere lesion groups and compared with the Spearman rank order correlations to ascertain whether the side of the lesion factored significantly into test performance.

When visual inspection of the data on the scan board test indicated a difference in the organization of the scanning pattern in the hemiplegic and control groups similar to that reported in previous studies, additional nonparametric and descriptive analyses were completed. The scanning patterns of the hemiplegic and control groups were categorized as either organized or disorganized. To qualify as organized, the numbers had to be (a) scanned sequentially with either a clockwise or counterclockwise pattern, (b) all identified, and (c) identified one time only. A chi-square analysis with a Yates correction (Minium, 1978) was then completed to determine if a difference existed in the proportion of organized scanning patterns in the hemiplegic group compared with the control group. Additional descriptive data were gathered on the starting point on the board and on the direction of the scanning pattern for the two groups.

Table 2

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean Rank</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light show single</td>
<td>19</td>
<td>10.0</td>
<td>-3.823</td>
</tr>
<tr>
<td>Light show double</td>
<td>17</td>
<td>9.4</td>
<td>2.5</td>
</tr>
<tr>
<td>Light show scanning</td>
<td>19</td>
<td>10.0</td>
<td>-3.827</td>
</tr>
<tr>
<td>Scan board</td>
<td>4</td>
<td>2.5</td>
<td>-1.826</td>
</tr>
<tr>
<td>Design copy</td>
<td>15</td>
<td>8.4</td>
<td>2.5</td>
</tr>
</tbody>
</table>

The results of this study indicate that visual scanning speed, identification of visual stimuli in the hemifield on the affected side, use of a systematic search pattern, and ability to accurately reproduce visual designs are present following brain injury and can result in the misinterpretation of test performance because the current tests of visual perception focus on the evaluation of a higher level skill and rarely contain subtests that measure such basic oculomotor functions as scanning. The scores obtained on these tests categorize the patient's performance with such terms as visual closure, visual memory, spatial relationships, and visual discrimination. Although these terms describe the deficient behavior, they fail to provide insight either into the behavior's cause or a method of remediation. Such insight can be gained only through an evaluation of the efficiency of the visual system's acquisition of sensory information.

Before a definitive statement can be made as to whether a deficit exists in higher level visual processing, all deficits in primary visual skills must be identified and their influence on performance ruled out. According to Gianutsos and Matheson (1987), "if the [visual] sensory system is not operating properly...one must be aware that the effects of sensory dysfunction will be referred through the system. What appears to be hemi-inattention [neglect] or confusion may in fact be a normal response to abnormal inputs" (p. 234) Visual scanning is just one aspect of basic visual processing that should be measured; the presence of visual field deficits, reduced contrast sensitivity function, reduced accommodation, and reduced vergence are other basic sensory skills that can influence visual efficiency. The failure to evaluate these primary abilities before an evaluation of higher level perceptual skills makes interpretation of the test results a guessing game at best.

Another argument for the evaluation of visual scanning efficiency is that deficits in visual scanning are responsive to remediation, thus resulting in the improved performance of daily living skills. Weinberg et al. (1977, 1979) demonstrated that academic skills such as reading and arithmetic could be improved in brain-injured patients with systematic scanning techniques designed to draw the patient's attention to the space on the impaired side. Statistically significant gains were observed in the experimental group, who received scanning training, compared with the control group, who received conventional occupational therapy.

Diller et al. (1974) demonstrated that performance on block design could be improved in adult CVA subjects through the use of systematic and structured cuing. The organized and thorough scanning of each design was emphasized. The subject was given continuous feedback on performance and was required to correct all errors. The subjects receiving block design training demonstrated significantly improved organizational skills for eating, compared with the subjects not given the training. The carryover to feeding was attributed to an overall improvement in the subject's ability to visually analyze a task and organize problem solving.

Gianutsos and Matheson (1987) used what they termed the "intellectual override" to train patients to overcome visual scanning deficits. Using single-subject case studies, they demonstrated the effectiveness

Table 3
Search Patterns for Hemiplegic Group and Control Group on Scan Board Test (in %)

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Hemiplegic Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organized</td>
<td>52</td>
<td>91</td>
</tr>
<tr>
<td>Disorganized</td>
<td>48</td>
<td>9</td>
</tr>
<tr>
<td>Starting point</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right upper quadrant</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>Left upper quadrant</td>
<td>39</td>
<td>65</td>
</tr>
<tr>
<td>Right lower quadrant</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Left lower quadrant</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Right center</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Left center</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Direction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clockwise</td>
<td>35</td>
<td>52</td>
</tr>
<tr>
<td>Counterclockwise</td>
<td>35</td>
<td>44</td>
</tr>
<tr>
<td>Rectilinear</td>
<td>17</td>
<td>4</td>
</tr>
<tr>
<td>No defined direction</td>
<td>13</td>
<td>0</td>
</tr>
</tbody>
</table>

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of showing the patient how his or her visual-perceptual system normally operates and how it is failing to operate. By increasing awareness, these researchers enabled the patient to plan for situations that require compensation for deficient visual scanning, such as reading and driving.

The treatment principle common to each of these studies was first to make the person aware of the deficient visual performance and then to provide a systematic means of overcoming the deficit with intensive, structured training.

Conclusion

This study demonstrates that deficits in visual scanning are present in post-CVA patients and can be measured with simple clinical evaluations. The remediation of these deficits can greatly affect the patient's performance of daily living skills. By including in the visual evaluation tests that measure visual scanning performance, the therapist will have a more accurate assessment of the patient's visual ability and a starting point for therapeutic intervention.

Deficient visual scanning can result in incomplete and erroneous acquisition of visual information about the environment. This in turn can create deficits in complex visual perception, as measured by traditional visual perception tests. The clinician's failure to identify deficits in basic oculomotor function is likely to lead to ineffectual treatment strategies and subsequent failure to improve visual perceptual performance.

By placing the emphasis of evaluation and treatment on remediation of basic oculomotor function, we can provide a foundation for the reacquisition of new complex visuospatial skills. Such an approach is consistent with that used for the treatment of nearly all other functional problems identified in patients with brain injury. Clinicians advocate starting a dressing program by putting on a necktie or starting a muscle reeducation program with hand movements. Visual-perceptual dysfunction seems to be the only area in which, according to Gianutsos & Matheson (1987), a "top-down" approach is taken that emphasizes a higher perceptual skill, as opposed to a "bottom-up" approach that emphasizes the acquisition of basic skills. Why this approach has been taken is unclear, but if our profession is to justify the efficacy of treatment for visual perceptual dysfunction, the influence of basic oculomotor function on higher level perceptual skill must be studied and addressed in clinical evaluation. Further research is needed to define the extent of this influence and to develop remediation principles.

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References


