FUNCTIONALLY BASED EVALUATION FOR LOW VISION PATIENTS

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ABSTRACT

Classical evaluation programs for low vision patients usually center on mobility and orientation skills evaluations and/or independent living or daily living skills evaluations. Visual skills evaluations are more frequently directed toward non-low vision patients about to enter vision therapy programs to improve binocular, accommodative and oculo-motor dysfunctions. This article discusses the need for evaluating visual efficiency skills of low vision patients. A specific diagnostic battery of techniques is discussed for speed and span of recognition, stability of fixation and localization, saccadic eye movement efficiency and dynamic visual acuity. This battery was developed from the basic behavioral and functional approach to vision.

KEY WORDS

low vision, visual efficiency, functional, behavioral, speed and span of recognition, localization, stability of fixation, saccadic efficiency, dynamic visual acuity, rehabilitative optometry

A clinical population that has been overlooked as candidates for visual therapy are low vision patients. While we turn our attention to children and adults who have inefficient visual function caused by inadequate binocular fusion, accommodative deficiencies, oculo-motor dysfunctions or visual motor perceptual lags, most low vision patients with severely reduced visual efficiency have been virtually ignored.

Those people who have had recent severe vision loss are not generally operating on a binocular basis because of the gross symmetrical ocular insults they have sustained. The acquired diseases, e.g., diabetic retinopathy, macular degeneration, terminal glaucoma, retinitis pigmentosa and other insults and injuries, can create the physical conditions so that the individual is unable to make optimal use of his/her residual vision. This results in a loss of visual efficiency.

Prior to their reduction of vision, the majority of low vision patients have had the opportunity to develop adequate temporal-spatial relationships of visual space. Furthermore, these patients have had the experience of integrating visual information with environmental data obtained by the other peripheral sensory systems. The adventitious as well as the congenital low vision patient can come to appreciate that integrated vision offers one the ability to receive a great deal of information in the least amount of time with minimal stress.

In 1955, an American Medical Association's Council on Industrial Health report entitled "The Estimation of Loss of Visual Efficiency"[1] mathematically defined the basis for determining total and partial visual impairment for individuals. This definition and description of the visual system included the eyes, the adnexa oculi, and the optic pathway. The AMA guide sought to provide a simplified method for determining permanent visual impairment and its effects on an individual's ability to perform the activities of daily living. Diminished visual ability was expressed as a mathematical percentage of the impairment of the visual system, and diminished ability of the individual was expressed as a percentage of the impairment of the whole person. However, it has become apparent to many professionals that behavioral performance can and does vary for individuals who possess the same mathematical percentages of impairment. Individuals with best corrected 20/200 acuity who are designated as having a 30% decrement of the central acuity by virtue of these AMA standards may, within these limitations, vary in their visual and overall behavioral performances. This functional variation may be related to any or all of the following conditions:

1. Onset of the visual problem
2. Etiology of the visual impairment
3. Magnitude and location of the involved site
4. Ability to adapt to new retinal areas of fixation
5. Ability to mediate stationary as well as moving forms

6. Development of new systematic eye and head movement
7. Ability to perceive information quickly and accurately

From a more functional stance, we know that visual efficiency is often more important in the determination of an individual's rehabilitative potential and/or work potential than is visual acuity alone. We will define visual efficiency as the relative competence of the eyes and their directly related systems to accomplish their physical, physiological and psychological functions. A basic level of visual efficiency is estimated by clinically determining the patient's level of:

1. Uncorrected or corrected visual acuity for distance and near
2. Visual fields configuration
3. Ocular motility with effective pursuit and saccadic fixations
4. Binocular sensory fusion (if possible)
5. Self spatial orientation
6. Ability to localize objects in the environment
7. Contrast sensitivity
8. Reading performance

In order to qualify and quantify major visual functions for the severely visually impaired patient, we have developed an additional test battery which further stresses a functionally based assessment of vision. The results provide a baseline of performance which assist in determining the design and intent of any consequent therapy program which may be recommended for an individual as well as to compare progress to a post therapy assessment.

Specifically, the suggested therapy work-up would evaluate the following visual performance parameters:

1. Speed and span of recognition
2. Stability of fixation and localization
3. Saccadic eye movement efficiency
4. Dynamic visual acuity

SPEED AND SPAN OF RECOGNITION

A projection type tachistoscope[a] can be utilized to check the speed and span of recognition of single or multiple digits. The size of the exposed stimuli should be equivalent to the patient's best corrected distance acuity. This test should be performed monocularly and, if possible, binocularly.

The patient should be placed at an intermediate distance (five to 10 feet) from the target. If the patient has difficulty seeing the form then the patient should be moved closer to the projection screen (see Figure 1).

Figure 1. Tachistoscopic speed and span of recognition testing.

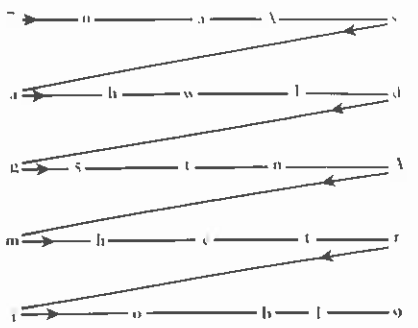
STABILITY OF FIXATION AND LOCALIZATION

A localization target (i.e. the Wayne saccadic fixator and sequence rotator)[a] can be utilized to assess the stability of fixation and localization ability. A random presentation of lights set at a 60 second time interval is presented to the patient who is placed approximately 20 inches from the fixator board. This test is performed binocularly and the average number of correct responses during three successive trials is recorded (see Figure 2).

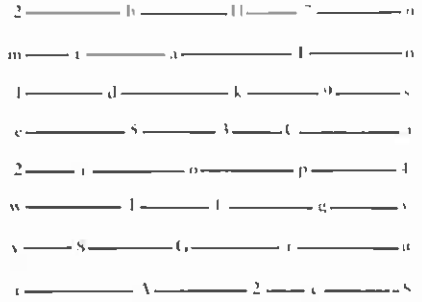
Figure 2. Saccadic testing employing a Wayne Saccadic Fixator

SACCADIC EYE MOVEMENT EFFICIENCY

In order to test the specific ocular motility (i.e. saccadic fixations) skills of low vision patients, numbers and upper and lower case letters of text from the Large Print Reader's Digest text (which are approximately 3.5M size) are presented to patients on four printed cards. These cards are a modification of the King-Devick test.[2] The first card is a demonstration card. The second card has lines which serve as guides. The lines are excluded on the next two cards. The letters on these cards become more randomly placed as one goes through the three cards. The test is performed with and/or without

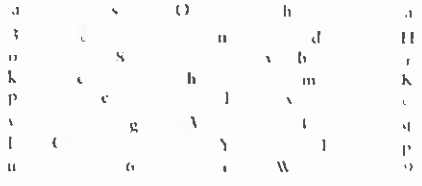


1. Demonstration Card



2. With Guide

3. Larger Spacing



4. Crowded Presentation

Figure 3. The four cards used to assess ocular motility

nearpoint optical devices. A record of the number of errors or omissions are made as well as the time it takes the individual to complete each test card (see Figure 3).

DYNAMIC VISUAL ACUITY

A dynamic visual acuity test can be performed utilizing the Kirshner Rotator[b] or a Keystone Rotator[c] with an angled mirror. The patient sits approximately five feet from the screen and letters equivalent to the patient's distance acuity are rotated on the screen in a circular pattern which is approximately five feet in diameter. The rotator is initially set at 40 RPM If the patient cannot read the rotating letter, the speed of rotation is reduced until the patient is capable of recognizing the letter or one can increase the letter size until the patient is able to correctly identify the letter (see Figure 4).

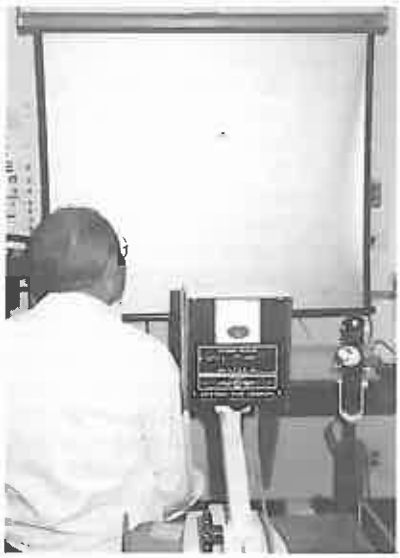


Figure 4. Dynamic visual acuity using a Keystone Kirshner Rotator.

In summary, vision therapy has customarily been recommended to increase visual efficiency of patients with binocular and/or accommodative deficiencies. The scope of the functional model of vision allows behavioral optometrists to include the visually impaired patient into the visual therapy population base. Clinical experience has demonstrated that we cannot assume that all low vision patients will adapt to his/her particular visual deficit in the most efficient manner. We have presented an evaluation battery that probes areas of visual function not usually assessed for these patients. In order to enhance functional visual behavior and maximize potential performance of individuals who are visually impaired, the diagnostic battery must be followed up with therapy. Applying the directed activities of visual therapy, we can give the low vision patient the opportunity to enhance his/her functional visual behavior within the limits of his/her residual vision.

REFERENCES

1. Spaeth E. Estimation of loss of visual efficiency. Arch Ophthalmol, vol 54, No. 2, Sept 1955: 462-8.
2. King AT, Devick S. The proposed King & Devick Test and its relation to the Pierce Saccade Test and reading levels, independent student research study. Illinois College of Optometry, Chicago, Ill, 1976.

BIBLIOGRAPHY

1. Backman O& Inde K. Low vision training. Malmo, Sweden: LiberHermods, 1979.
2. Jose R., Understanding low vision. Am Foundation for the Blind, New York, New York, 1983
3. Quillman RD. Low vision training manual. Kalmazoo: Department of Blind Rehabilitation, College of Health andHuman Services, Western Michigan University, 1980

SOURCE LIST

a. Wayne Engineering, 1825 Willow Road, Northfield, IL60093-2925
b. I/CT, Inc. 10 Stepar Place, Huntington Station, NYo11746
c. Kirshner Rotator from Mast/Keystone View Co.,Suite 3, 736 Federal St., Davenport, IA 52803

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