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A teacher's handbook Post-traumatic Vision Syndrome: Awareness, assessments, accommodations

Elaine Ruth Lewis

A TEACHER'S HANDBOOK

POST-TRAUMATIC VISION SYNDROME:

AWARENESS, ASSESSMENTS, ACCOMMODATIONS

A Project

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Education:

Special Education

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by

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[redacted]

Dr. Roy Thurston, First Reader — March 7/06 Date

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Dr. Gary Sherwin, Second Reader

ABSTRACT

According to the Center for Disease Control (2004), 1.4 million children sustain traumatic brain injuries (TBI) annually, while an indeterminate number of head injuries are unreported or unrecognized. Approximately 28% of children who sustain TBI also experience Post Traumatic Vision Syndrome with impaired neurological and ocular motor functions as well as associated visual, physical, cognitive, emotional, and social implications.

This project, compiled from a review of literature in the medical, optometric, neuropsychological, education and special education disciplines, engages in a comprehensive discussion about PTVS. Initially the healthy visual system is discussed, focusing on the focal and global processes and associated visual skills, i.e., binocular functions (teaming), tracking, visual spatial perception and processing. Also discussed are the mechanisms of injury to these systems as well as the theories of neurogenesis, and visual therapy (orthopics).

The findings of the research demonstrate that students who sustain TBI and PTVS experience challenges in reading and writing, thereby, impacting on their ability to succeed academically.

The research explored assessments that may be indicated in evaluating the student with PTVS, i.e. medical, neuro-opthamalogical, neuropsychological, functional visual and learning media.

Appropriate accommodations, environmental, materials and instructional as well as assistive technology were discussed that may facilitate the student's ability to access the curriculum. The data recommends that a multidisciplinary approach be taken in working with students with PTVS to assess their physical and academic challenges and to provide the accommodations and environment that addresses their unique needs.

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CHAPTER ONE

INTRODUCTION

My personal experiences with Traumatic Brain Injury (TBI) and concurrent Post Traumatic Vision Syndrome (PTVS) have led me to endeavor to understand the visual system and processes as well as the subsequent impact of brain and ocular injury to these structures and functions.

The focus of my project was researching the multidimensional effects of TBI and PTVS on the preschool, elementary and middle school student. I was particularly concerned with developing an appropriate list of indicated assessments that would precisely identify the student's medical, neuro-opthamalogical, neuropsychological, functional visual as well as learning media challenges. Finally, I researched accommodations that could possibly enhance the student's visual abilities thereby facilitating his access to the curriculum and content.

I am hoping that my experience can facilitate educators, parents, and perhaps even the student's understanding and insight into these life altering

neurological and visual impairments. By comprehending these syndromes, all involved may be able to design and implement a plan to meet the individual needs of the student.

My Story

As a trauma and critical care nurse for twenty five years, I had a basic understanding of the brain and visual systems and the functions and challenges that occur subsequent to traumatic brain injury. However, it wasn't until my personal experience with head injury and post traumatic vision syndrome that I began to develop a greater understanding of the condition. For the purpose of this project, I will focus primarily on the multiple nuances of post traumatic vision syndrome concurrent with head injury as it relates to the educational process.

While working on my nursing unit one afternoon, I entered a patient's room to prepare her for a procedure. Noting a large splattering of ice on the floor, I bent down to remove it before anyone would come into the room, slip and fall on it. I have no conscious recollection about what occurred next. Suddenly, I became aware of falling into a large, heavy wood and metal door halfway

across the room. During my first moment of consciousness, I became aware of an intense pain in the left temporal and frontal areas of my head. Next I became aware of a dark visual field on which white, red and green stars were exploding. I experienced a sense that "something" in my head was bouncing back and forth, again and again and again. It seemed to go on for a long period of time, then, finally stopped. I stumbled to the nurses' station where I sat down and tried to regain a sense of equilibrium. My immediate sensations following the injury were that of being stunned and confused. I felt as though I was in a tunnel. The voices on the unit seemed garbled and distant. The faces of the nursing personnel seemed distorted. It was difficult to "read" the faces, even to tell who was speaking. I was unable to articulate how I felt as I could not remember the words. (Weeks later a nursing colleague noted that immediately following the incident, my right eye had "turned outward". I, however, had no subjective sense that my eye had turned outward). My world seemed blurry, cognitively and visually, as I was transported to the urgent care department, examined and discharged home.

During the following week, I continued to feel stunned and somewhat numb. My visual field continued to be blurry, and all things seemed to run together. I was unable to clearly distinguish objects from their background (figure ground confusion).

When walking, I experienced significant vertigo as I could not determine the precise locations of objects because of my impaired sense of depth perception. I frequently reached out for walls or other stationary objects for stabilization. Tracking, visually focusing on and following a moving object, large or small, was another significant challenge. The blurriness increased whenever I attempted to follow objects with my eyes, or turned my head in response to the object's movement

If I were sitting or standing and something in my environment moved, I became confused and anxious and reached out for stability. Any movement in my visual field produced a significant episode of vertigo. Driving was particularly troublesome because of my difficulty in tracking other vehicular movements as well as an impaired depth perception. Cars, trucks, busses and other motorized vehicles seemed to "run" together. All vehicles seemed to be traveling extraordinarily fast.

When attempting to read, I perceived the blurry text as "moving" on the paper. I kept losing my place and repeating what I had just read or jumping several sentences ahead to unrelated material. I expended an enormous amount of effort in trying to locate and follow the text. It was an exhausting and frustrating experience. Reading just didn't make sense. I did not comprehend the few words that I was able to read, and therefore, could not commit them to memory.

Writing was also challenging as my hand - eye coordination was impaired. I felt as though my hand would not write the desired letters and words and the resulting text was large, sloppy and illegible.

Performing math tasks was another significant challenge. Numbers in vertical alignment seemed to "move" about the page. I felt it difficult if not impossible to "stop the movement" long enough to calculate the figures.

Performing simple math operations of fractions created such visual disturbance that it was enormously difficult to calculate the numbers. For instance, when adding fractions, the numbers would "jump" around and

intermingle with other numbers in horizontal as well as vertical alignment.

Visualizing numbers in vertical alignment was also frustrating because in my "mind's eye", I could not stabilize the numbers sufficiently enough to allow me to tally the figures.

All of these symptoms were confusing, and though I was familiar with medical terms, I could not articulate my subjective visual and associated symptoms. I did, however, recognize that something was significantly impaired in my visual processing.

Two weeks following my accident, I consulted my regular optometrist and described and discussed my visual concerns. After conducting acuity and field of vision exams, the doctor diagnosed my vision as "within normal limits." Trusting the doctor's report was correct and thinking that perhaps my post concussive symptoms were transient, I attempted to return to nursing. However, the visual as well as cognitive impairments were so overwhelming that I was unable to function effectively and left the nursing field permanently.

Four months after my injury, I was referred for neuropsychological testing and evaluation during which

a battery of tests was performed. The results relating to my vision reflected that I experienced "severely reduced visual perceptual and visual motor integration skills, suggesting construction dyspraxia." Visual memory assessments indicated that I "was severely impaired in immediate recall, delayed recall, and recognition of complex visual stimuli."

My subjective feelings during the testing periods were that I could not accurately see the text or objects presented, therefore, I could not articulate what I had read or the characteristics of the object seen. The ensuing construction dyspraxia reflected my inability to reproduce pictures of graphics I had just seen and was instructed to copy. I was also unable to accurately reconstruct simple tasks that had been modeled by the neuropsychologist.

The assessment findings confirmed that my subjective complaints of visual dysfunctions were indeed accurate. However, I did not know what steps to take to find solutions to my visual deficits.

My visual impairments continued during the following year, and I was referred to a developmental optometrist in my area. After a comprehensive visual examination,

including ocular motor functions, the following findings were noted:

- Visual system free of pathology.
- Visual acuity R. 20/40 w/lens
  L. 20/30 w/lens
- Severe Ocular Motor Dysfunction
- Binocular Dysfunction
- Suppression of binocular vision
- Severe perceptual processing and integrating dysfunction.

The optometrist's diagnoses, Post Traumatic Vision Syndrome, confirmed my subjective complaints that my vision was indeed impaired. The doctor recommended visual therapy to provide exercises and strategies by which I could strengthen my ocular motor system and reclaim visual functions.

While visual therapy, a type of physical therapy for the eyes, may facilitate visual healing, it is not considered a cure. The various exercises are designed to retrain the brain and ocular motor muscles to strengthen the visual system.

Since my visual challenges were significantly problematic and negatively affected my activities of

daily living, i.e., reading, performing math operations, shopping, traveling, as well as other essentials of life, I decided to pursue the recommended twenty four sessions of therapy. Admittedly, I was skeptical that vision therapy or any other type of therapy would effectively improve my vision.

The exercises conducted during the therapy included teaming, convergence and divergence, near and far focusing, isolating text, numbers or objects in a visual field, visual memory games, mazes, tracking, following moving small and large objects, as well as other exercises. Home exercises were also recommended and I performed them faithfully as I was desperate to regain my visual skills and to function effectively once again.

On the way home from my sixth therapy session, I was sitting in traffic and tried to focus on the auto along side my car. To my amazement, I was able to focus on the car and track it until it disappeared from view. It was the first time in a year that I had been able to track any object, large or small. At the same moment, I experienced a brief sense of visual organization and calmness rather than the confusion and anxiety I had prior to the treatments. Several weeks later, I was able

to visually focus on one word in a text, then subsequently to follow words to complete a sentence, a paragraph or complete article. The process was exhausting; however, even these small steps were incredibly encouraging.

As I was able to follow the words, though slowly and laboriously initially, I began to notice an improvement in my concentration as well as comprehension.

After completing the recommended therapy sessions, I have continued the exercises as they facilitate ocular motor muscle strength, and therefore, my ability to accomplish essential visual tasks.

Several months later, I returned to the local junior college hoping to regain some of the academic skills that had been impaired. I enrolled in classes in writing, reading, math and art. I found the college campus to be a busy, bustling place and all the activity visually confusing. The classroom setting, itself, presented unique challenges as I engaged in the reading, writing and math assignments. Though I had developed compensatory techniques to allow me to function in my daily life, the increased demands of the academic environment challenged me significantly. I soon learned

that I needed to develop effective strategies that would allow me to manage the multidimensional challenges of post traumatic vision syndrome in the classroom setting. Among the challenges were environmental lighting, materials management, visual and cognitive strategies, in class seating as well as other classroom related activities.

Environmental light, outdoors as well as indoors, was a significant concern upon my return to the academic setting. The bright outdoor light would cause visual distress and fatigue that was frequently followed by a headache. One solution to this issue was to wear polarized sun glasses when outdoors which reduced the glare and irritation of the sunlight. The indoor light, usually florescent, also caused similar symptoms. Utilizing tinted lenses in the classroom was helpful in minimizing the glaring indoor light.

Another light related issue in the classroom was that of the white marker board. Frequently, the overhead light would cause a glare on the board making accurate visualization of the text difficult if not impossible. The darker marker colors, black, blue and purple, would be easier to distinguish while others, i.e., red, orange,

etc. seemed to make the text and graphics more difficult to visualize.

Reading and writing materials, placed on a flat desk or surface, also presented problems as the over head glare made seeing the text more difficult. One solution to this problem was to place the reading and writing materials on a 20 to 40 degree angle which decreased the overhead glare.

Utilizing color overlays on written material was also beneficial as it created a contrast that allowed me to more easily distinguish the text from the background. Color highlighting of vital text was a similar technique that not only allowed me to view the content more easily, but was an additional strategy to help me remember the emphasized data. Again, the color of the highlighting was a personal matter, and I chose the tool which was most effective.

Since my visual challenges persisted to varying degrees, it became important to utilize other effective materials and learning strategies more efficiently. Using color coded materials facilitated my ability to locate the information I needed in a timely manner.

Another technique that enhanced my learning strategies was to reduce the content to be learned into simple, do-able components. One extremely important strategy was the use of graphic organizers. The various organizers, frequently in colors, presented the concepts in concise and articulate form, meanwhile, reducing the need for extensive reading of the subject content.

An additional organizational strategy was the utilization of a check list that required me to ascertain that I had viewed and performed the assignments.

As a student with disabilities, I was given the opportunity to take examinations in the Students With Disabilities Center. I utilized a number of accommodations which allowed me to access the testing materials more effectively. One accommodation essential to my success in taking examinations was that of extended time. Since visual fatigue was a significant problem, it was very helpful to have the extra time to be able to rest visually when needed. Another significant accommodation was having the written test materials in large print. Accessing the test content was much easier when I was able to read the text with greater ease. Interestingly enough, when attempting to read a test on

the computer with enhanced graphics, I discovered the enlarged text to be blurry and distorted. Though other computers presented somewhat clearer text and graphics, I found taking tests in large print much more efficient and effective than relying on computer assisted technology. Other students, I noted, seemed to find this technology acceptable and helpful in facilitating their access to the curriculum content as well as testing data.

Another important tactic to conserve visual energy was to select a seating position in an area of minimal distraction, i.e., away from doors the pencil sharpener and other high traffic areas. Sitting in a quiet area allowed me to focus more intently on the task at hand.

These strategies as well as others made it possible for me to function effectively in the school and classroom setting. I realized that by sharing my successful strategies in the classroom as well as researching and documenting other recommended techniques, I might provide the information essential to further the understanding of teachers as well as others as they work with students with PTVS.

My understanding of the multidimensional challenges of this syndrome has led me to construct a MA project

entitled: A Teacher's Handbook Post Traumatic Vision Syndrome: Awareness, Assessments and Accommodations.

Statement of the Problem

According to the Centers for Disease Control (CDC) in Atlanta, Georgia (2004), 1.4 million children in the United States sustain traumatic brain injuries (TBI) annually. Approximately 28% of children with TBI also experience concurrent ocular motor injury (Shokunbi, T., Agbeja, A., 1991). Many more children sustain brain injuries that are unreported and unrecognized. Notably, many children are injured within the school environment.

Post Traumatic Vision Syndrome (PTVS) is a comprehensive term which describes and defines the multidimensional nuances of ocular motor dysfunctions, i.e., physical, neuro-opthamalogical, cognitive and emotional complications as a result of the injury. Signs and symptoms of PTVS may not be apparent and subsequent cognitive, academic and life challenges may arise.

Significance of the Project

Though blindness and partial blindness are well established as visual challenges which impede a student's

ability to learn, it is imperative to also recognize the nuances of PTVS as potentially limiting a student's ability to read and write and to succeed academically. This project addresses the student's learning challenges subsequent to PTVS.

Purpose of the Project

The purpose of this project is to construct a handbook for pre school, elementary and middle school teachers that will provide the information essential in developing an awareness of the signs and symptoms of traumatic brain related ocular motor injury. Also included in the handbook are recommended assessments and accommodations that can be utilized in the management of PTVS.

Context of the Project

The context of the problem is to address the need to develop an easily readable reference, a teacher's handbook proposal entitled: A Teacher's Handbook: Post Traumatic Vision Syndrome: Awareness, Assessments and Accommodations.

Goal of the Project

The goal of the project is to provide educators with the knowledge, skills and tools to provide the environment in which the student can successfully learn.

Definition of Terms

The sources of the following terms are:

American Optometric Association

College of Optometrists in Vision Development

Taber's Cyclopedic Medical Dictionary

Acuity - clarity of vision.

Asthenopia - Eye fatigue accompanied by pain, headache (migraine), visual dimness and nausea.

Counter Coup - Trauma at the opposite side of the impact.

Coup - Trauma at the site of the impact.

Dyspraxia - An impaired ability to control and perform voluntary tasks.

Esophoria - Tendency of the visual axis to diverge inward.

Exophoria - Tendency of the visual axis to diverge outward.

Figure Ground Perception - The ability to distinguish figures against a complex background.

Functional Visual Assessment - Evaluations that describe a student's use of vision in various environments and situations, in the classroom, the library, the playground and the home.

Learning Media Assessment - Evaluations that determine the type of literary media effective in facilitating the student's access to the curriculum.

Neuroischemia - Deficiency of cerebral blood flow.

Ocular Motor Exercises - Exercises designed to retrain the brain and ocular motor system to regain visual skills.

Ocular Motor Occlusion - Complete or incomplete patching of one eye to stimulate effective ocular muscle function in the other eye.

Orthoptics - Vision therapy.

Post-Trauma Vision Syndrome (PTVS) - Secondary symptoms that follow traumatic brain and ocular motor injury, including double vision, binocular dysfunction, visual tracking, light sensitivity, visual fatigue, as well as cognitive deficits, i.e., confusion, disorientation, short and long term memory impairments, information processing impediments, and loss of executive function.

Prism Correction - Wedge shaped lenses that bend light,

and are intended to improve vision due to visual misalignment or visual field loss.

Saccadic Movements - The ability of the eyes to direct and coordinate movement as they voluntarily shift from one visual target to another.

Suppression - The brain's cancellation of signals from one eye to avoid confusion and discomfort that arise during binocular dysfunction.

Vision Therapy (Orthoptics) - A comprehensive program of visual exercises and activities, which may include the use of selected lenses and prisms that are applied in an effort to explore, extend, and enhance the visual abilities.

Visual Form Perception - A developed skill that enables a child to accurately discriminate visible similarity and dissimilarity so that understanding can be immediately followed by appropriate actions.

Visual Perceptual Processing - Awareness of visual data coming from specific sites and attributing significance to that information.

Visual Spatial Perception - The ability to discern spatial relationships from visual presentations in one's environment.

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

The literature review will present significant information on post traumatic vision syndrome in the following sections: Awareness, Assessment and Accommodations.

Initially, awareness of PTVS is developed by constructing a basic understanding of the healthy visual system, its functions and processes. Next, traumatic brain injury and concurrent post traumatic vision syndrome are explored with focus on etiology and mechanism of the disease, neurogenesis and visual therapy. A final discussion focuses on the implications and costs of PTVS within the home, school and community.

Secondly, several types of assessments are noted and explored: i.e., medical examinations including indicated diagnostic tests, CT scans, MRI, and Pet Scans, neuro opthamalogical assessment including visual acuity and ocular motor function evaluations, neuropsychological evaluation, Functional Visual Evaluation and Learning Media Assessment.

Lastly, accommodations, including environmental and materials modifications, instructional strategies and assistive technology are discussed that might be utilized to facilitate the student's vision, and thereby, his learning process.

Awareness

The Vision System

According to the American Optometric Association (2001),

> Vision is more than the concept of sight measured in terms of visual acuity. Vision is the process of deriving meaning from what is seen. It involves fixation and eye movement abilities, accommodation (eye focusing), convergence (eye aiming), binocularity (eye teaming), eye-hand coordination, visual perception and visual-motor integration.

Effective vision skills are essential in the process of learning. In Theoretical Models and Process of Reading, Goodman (1994) purports that visual information is transformed into "orthographic, syntactic

and semantic systems of language." He elaborates that visual input, therefore, impacts on perceptual processing which impacts syntactic processing which in turn impacts the semantic input.

Fleener (2002) discussed visual perception as one of the most essential visual skills in one's learning process. She notes that visual memory and visualization are vital components of perception. Visual memory includes the ability to precisely recall information in the order in which it occurred, while visualization is the ability to manipulate information previously seen to construct a new concept or entity.

The vision system, comprised of two individual processes, focal and global (Kolb, 1996) is essential in identifying and comprehending one's environment.

The focal process, a sensory skill, is integrated with central vision, allows the eyes to focus on and distinguish objects in one's visual field, thereby being able to clearly determine the object's shape, color as well as other characteristics (Kolb, 1996).

The second visual process, global, a motoric skill, relates to peripheral vision (Kolb, 1996) and defines one's spatial orientation. The global process

facilitates one's awareness of his location in the environment such as posture, balance (Padula, Argyris, 1994) and kinesthetic activity. It also creates a sense of stability in one's environment. Both visual processes, focal and global (Kolb, 1996) are neurally related to the temporal and posterior parietal cortexes.

Specific visual motor functions include binocular functions, tracking as well as visual spatial perception and processing.

Binocular function necessitates aligning both eyes to present one articulate image. The muscles of the eyes must work simultaneously to fuse the images from each eye into one clear image. When the muscles are unable to coordinate and fuse the images effectively, multiple images or double vision may occur, and can create visual and cognitive distortion and perplexity. Subsequent symptoms may include visual fatigue, headaches, dizziness, nausea as well as other signs of ocular muscular dysfunction.

Effective visual tracking of persons and objects in one's environment also requires bilateral eye coordination. It is essential to be able to focus with clarity, visually "attach" to an object, and to follow

its movement while viewing peripheral stimuli with less clarity and acuity.

The inability to visually track can cause blurriness of vision, a constant sense of speeding or whirling environmental stimuli, vertigo, and may contribute to a sense of visual as well as cognitive confusion.

Kolb (1996) defines visual spatial perception as the visual data that comes from specific locations in space and attributes significance to that data. Visual spatial perception is a vital component in one's comprehension of his environment; conversely, spatial misperception may cause one to feel confused and unbalanced.

Mechanisms of Traumatic Brain Injury and Post Traumatic Vision Syndrome

According to the Merck Manual of Diagnoses and Therapy, (2004) the mechanism of traumatic brain injury and post traumatic vision syndrome is closed head injury (concussion) with rapid brain acceleration or deceleration, resulting in injury to the site impacted, the coup, as well, perhaps, as injury to the opposite site of the impact, the countercoup.

Areas of the brain and vision system that may be affected during injury include the visual cortex located

in the posterior portion of the brain, optic neural networks that transmit visual impulses within the brain as well as components of the eye itself, the cornea, iris, lens and retina.

During the injury, multiple neurological structures may be damaged, i.e., blood vessels, nerves, axons and dendrites and associated structures can be ruptured, torn or sheared. It is trauma to these structures that create neuro ischemia (inadequate oxygen), neurological disruption, cerebral swelling and hemorrhage.

Traumatic brain injury can impact the visual system in a number of ways. However, the global system, according to Kolb (1996), may be more effected than the focal.

Ocular motor functions damaged may negatively impact one's ability to visually accommodate, to converge effectively, thereby specifically effecting one's ability to track, team and employ binocular functions.

Post traumatic vision syndrome can effect one's ability to comprehend his environment by distorting images, i.e., objects, figure (body) locations and distinguishing objects from their background, (grounding), facial expressions, environmental and text

print, thereby creating gaps in understanding as well as subsequent misinterpretation of the information.

The gaps in comprehension and learning, therefore, may impede one's ability to effectively achieve the essential elements in various stages of development and to scaffold subsequent information in the academic process.

According to Amerson (1999), students who expend significant energy manipulating their impaired ocular motor functions may have inadequate residual visual and cognitive resources to devote to the learning process.

Neurogenesis

Prior to the 1990's, scientific belief was that though other anatomical structures could regenerate following trauma, the brain was not plastic and would be unable to repair or restructure. The visual system was also thought to be inflexible and unable to regenerate, in fact, its growth was confined to the stages of specific developmental processes.

In 1992, neuroscientists, Australian Perry Bartlett and Canadian, Sam Weiss discovered that mammalian brain cells can divide, thereby, generating new cells (Bull, 2004). According to Bull's research, neurons regenerate

on a daily basis, thereby facilitating repair as well as creating new neurons.

Scientists, assisted by modern technology, i.e., MRI and PET scans as well as other technology, concur that the brain can, in fact, regenerate. Bach-y-Rita (2003) purports that the brain can broadly "restructure" following neurological insult.

The brain's plasticity is thought to occur in the following ways:

- Healthy neurons may adapt and assume the functions of the traumatized tissue.
- Axons may regenerate and reconnect at the site of the damage facilitating communication at the neuron levels.
- New axons may generate in response to specific stimulation.

Vision Therapy

Vision Therapy is a program designed to facilitate neurogenesis and thereby ocular motor healing. According to Nova, (2004), plasticity of the brain and vision systems is the basis on which vision therapy is based. When traumatized, neurons are unable to function effectively. By utilizing "precise patterns of

stimulation", the neurons that have sustained damage or even those undamaged, may regain varying degrees of functions.

Components of the program may include the following:

- Lens with refractive correction
- Ocular motor occlusion
- Prism correction
- Ocular motor exercises
- Biofeedback
- Color overlays

Implications and Costs

Students who have sustained Post Traumatic Vision Syndrome concurrent with brain injury may experience significant challenges within the academic environment and their daily lives. Undiagnosed PTVS may be one of the leading causes of student failure in the educational setting. Students and "illiterate" adults, according to Johnson (2002), may confuse sight with vision and may determine that they are unable to read or learn.

If the student is sighted, yet experiences challenges in the skills of literacy, he might conclude that he is unable to comprehend the curriculum as well as other text. He may not realize that though he has sight, his

visual skills may be impaired and he cannot see well enough to comprehend his surroundings. Unless the visual problems are diagnosed, the student may become frustrated, angry, discouraged, depressed and may experience a sense of failure when attempting to read, write, perform math operations or engage in every day activities.

The student's behavior may reflect feelings of inadequacies, and he may choose to engage in problematic behavior, perhaps, resulting in assignment to the criminal juvenile justice system.

During the latter 1980's, Stanley Kaseno, O.D., conducted a battery of visual skills evaluation including comprehensive visual development and perceptual assessments on wards of the California Department of Youth Authority. The study included two groups, both of whom had identified visual deficits.

The first group, treated with prescription lenses and visual therapy, were found to have a 15% recidivism rate. The second group, the control group, did not have visual therapy and were found to have a 70% recidivism rate (Kaseno, 1989).

This study suggests that when visual and ocular motor deficits remain untreated, the errant behavior in youth with PTVS continue, thereby causing a significant burden on the student himself, the family, the school system, community and society.

The student may view his lack of ability to succeed academically and in life in general that he chooses behavior that is in the least unproductive and at worst criminal.

The family may experience significant emotional distress because of the student's anger, irresponsibility and deviant behavior as well as the financial costs resulting from such decorum.

According to Turnbull (2002), students with visual deficits may have difficulty fitting in socially due to their physical as well as academic challenges. The students may also be unable to perform acceptably in extracurricular activities, i.e., art, music, sports as well as other areas in the school or community. The student may be perceived as being "weak", clumsy or incompetent and may be the subject of ridicule.

Schools may also be affected by the inability of the student to succeed academically. Students who fail to

achieve the level of knowledge and skills outlined in the state standards may obtain scores so low that the school and possibly the school district's academic record and standings are negatively reflected.

The community may also be affected as the student's lack of responsibility and misbehavior may impact on persons and property within the neighborhood.

The cost to the society of a non productive citizen may be enormous as it may have to support the financially targeted programs to which the student may have been assigned as well, perhaps, as the costs of incarceration.

Assessments

Appropriate assessments for students with PTVS include a medical examination, a neuro ophthamological assessment including acuity as well as ocular motor functions, a neuropsychological analysis, a Functional Visual Assessment and Evaluation (FVA/FVE) and Learning Media (LMA) as well as other relevant evaluations.

A comprehensive medical examination should be conducted to determine the presence and extent of brain damage as well as other physical impairments. Other diagnostic medical tests that might be ordered to

determine the presence of brain or ocular motor injury include CT scans, MRI and or PET scans.

A neuro opthamalogical assessment is essential to determine the presence and degree of brain, visual and ocular motor involvement.

Neuropsychological assessments, informal as well as formal, explore a variety of cognitive and functional skills in students with suspected brain and ocular motor damage. Turnbull, (2003) lists the following skills assessments in neuropsychological evaluations:

- Complex attention (sustained, selective alternating, and divided).
- Memory skills (new learning and perspective memory).
- Verbal communication skills (word retrieval, thought formulation, and expression.
- Written communication skills (word retrieval, thought formulation, expression).
- Verbal information processing skills (listening and auditory processing).
- Written information processing skills (reading comprehension and retention).
- Executive functioning skills (planning,

initiating, self monitoring).

- Reasoning skills (concrete abstract, decision making, problem solving).
- Mathematical skills.

Upon compilation and analysis of the assessment results, the neuropsychologist recommends strategies that may that enhance the student's ability to function more effectively cognitively as well as behaviorally.

Miller (1999) recommends two assessments to determine the learning needs of the student with visual impairment, the functional vision assessment/evaluation (FVA/FVE) and the learning media assessment (LMA). Though these evaluations have been primarily utilized with students with low vision or no vision, selected elements of FVA/FVE and LMA may be applied to students with post traumatic vision syndrome as the symptoms dictate.

Functional vision assessments are designed to establish the student's visual abilities, to determine the educational implications of the visual deficits, and to recommend effective strategies and techniques that may be employed to facilitate the student's visual access to the curriculum.

The Functional Visual Assessment is based on the observation of the student's responses to a variety of environmental and literacy situations throughout the day. Parents are also requested to observe the student in the home and community and contribute their observations to the FVA.

Indiana Department of Education, Division of Special Education Functional Literacy Assessment Guidelines for Student who are Blind or Visually Impaired (1996/97) includes the following components in their Functional Visual Assessment:

Efficiency of Vision and Potential.

Object Recognition.

Distance Requirements.

Size Requirements.

Lighting Requirements.

Color Perception.

Visual Discrimination.

Subtle/Obvious.

Contrast Sensitivity.

Exploration of Objects.

Visual, Tactile and Auditory Evaluations.

Learning Media Assessments evaluate a variety of materials, tools and technology that may facilitate the student's ability to access the curriculum and content Lavigne, E., Adkins, A., (2003). The assessments establish the following:

1. Effectiveness of the student's ability to obtain information through his senses, i.e., visual, auditory and tactile.
2. Types of learning materials and technology the student will utilize to accomplish his work.

Accommodations

Accommodations, environmental and materials modifications, instructional strategies and assistive technology can be utilized to enhance the student's vision and thereby engage more fully in the learning process.

Environmental Accommodations

Lighting

- Sufficient lighting free of glare Erin (2003).

- Students may find tinted glasses effective in minimizing the discomfort of photophobia.

Desk and Seating

- Minimize clutter and distractions on the student's desk Lash (2000).
- Manipulate the slant of the student's desk for optimum visual access, i.e., 20-40 degrees.
- Seat the student in an area of minimal distractions.

Materials

Print

- Enlarged print when available.
- Graphics: Enlarged graphics when available.
- Graphic Organizers: i.e., Cognitive and semantic maps that demonstrate associations between relationships and/or concepts and features of concepts Kim, Ae-Hwa, Vaughn, S., Wanzek, J., Wei, S.

  Color code for each subject Lash (2000).
- Colored Filters, color overlays that filter out confusing visual stimuli and allow the

visual information to be processed in a coherent and organized manner Irlen (2005).

- Authentic objects as related to the curriculum.

Instructional Strategies and Methods

- Simplify instructions for in class and homework assignments, provide examples of work to be done Wagner (2001).
- Allocate small, "do able" components of the assignments. Construct a sequential schematic for completing the assignment or project Wagner (2001).

  Ascertain student understanding of the assignment.
- Provide checklists for assignments and homework along with due dates and time Lash (2000).
- Allow additional time for completing assignments and for testing Lash (2000)

Assistive Technology

Available assistive technology according to Puckett (2003) can be vital in assisting students with visual deficits to access the curriculum, i.e., reading, writing, math as well as other subjects. The technology,

low technology as well as high technology, may include the following:

- Magnifiers, Handheld or other similar devices.
- Calculators, Large display with high contrast.
- Computer enhanced text and graphics (larger print) i.e., screen enlargement and navigation systems (Turnbull, 2002).
- Alternate keyboards with large symbols
- Software reading and math programs, multimedia programs,
- Closed circuit televisions with magnification of selected objects placed on viewing platform (Turnbull, 2002).
- Audio technology, i.e., tape recorders and CDs.
- Voice recorders. Allow student to tape record assignment rather than submitting it in written form Wagner (2001).

Discussion

Because of the multidimensional implications of Traumatic Brain Injury and Post Traumatic Vision Syndrome, it is imperative that educators recognize the signs and symptoms that may occur subsequent to identified or unidentified head injury. Early referral to appropriate medical personnel, school, psychologists and counselors and other indicated professionals is essential to facilitate the proper assessments and diagnoses of PTVS. Early responses to the student's needs through accommodations, environmental, materials, instructional strategies and assistive technology are critical to facilitate the student's access to the curriculum.

There are, however, a number of concerns when working with students with known or suspected PTVS. First, screening all children to evaluate ocular motor dysfunction, though ideal, can be a laborious and expensive endeavor. Some schools do not have the budget available to finance the personnel or equipment essential to perform the screening process.

Secondly, though assessments are invaluable in determining the presence and severity of PTVS, there may

be times when the multidimensional evaluations and tests do not accurately reflect the student's visual and neuropsychological status. Therefore, it is essential to monitor the student's progress and reassess when indicated.

There is debate in the medical community about the effectiveness of vision therapy and rehabilitation programs. Some medical professionals wholeheartedly endorse vision therapy for students with ocular motor dysfunctions believing the "physical therapy for the eyes" can retrain the brain and ocular motor system to function more effectively. Others question the effectiveness of vision therapy and believe it is "too expensive" and may not yield the desired results. Vision therapy, as any other type of medical treatment, may prove extremely effective for some children while minimally effective for others. Factors that may influence the effectiveness of therapy include parental support during the program as well as the child's compliance in performing the assigned exercises and recommendations.

Though therapy may be costly initially, the potential long term benefits of improved visual and

literacy skills may outweigh the initial expense.

When considering the use of the technology in students with PTVS, a number of issues need to be evaluated. First, the process of referral for evaluative use of the technology can be prolonged, thereby causing the student to miss out on essential curriculum. One resolution to this concern is to have assistive technology available in all classrooms for students with varied abilities to utilize as they engage in their learning process. However, the financial impact of equipping each classroom with adequate technology to meet the needs of the students can be enormous and unrealistic for many schools to achieve. Other financial concerns include the cost of training teachers and other personnel to acquire competency in utilizing the technology.

Lastly, another significant consideration in the use of technology is that it must be evaluated to determine the efficacy for the individual student. Some technology may provide distorted images or auditory output which may further confuse or distress the student. It is imperative that the technology facilitate the student's ability to access the curriculum content.

In conclusion, management of PTVS may be a complex, and expensive course of action, however, addressing and responding to the needs of the student early in the post traumatic period may enhance his visual and cognitive skills which in turn may facilitate his learning process and academic achievement in subsequent years.

Recommendations

Students with suspected PTVS may benefit from the following measures:

1. Visual screening, ocular motor function as well as acuity for all school children annually and when suspected to have ocular motor dysfunction or traumatic brain injury.
2. Medical examination and indicated tests.
3. Neuro-opthamalogical evaluation.
4. Neuropsychological assessment.
5. Functional Vision Assessment.
6. Learning Media and Assistive Technology Assessment.
7. Accommodations as recommended.
8. Psychological support.

9. Ongoing assessments and interventions as indicated.

Summary

The literature essential to this project was introduced in Chapter Two. The information within the project was presented in the three subsequent components: PTVS: Awareness, Assessment and Accommodations.

The literature integrates the research conducted by foremost scientists and educators in the areas of brain and vision science. The data suggests that the incidence of TBI and concurrent PTVS is significant and that the needs of students experiencing the syndrome must be addressed. This handbook will inform teachers about PTVS, normal visual functions, the etiology, mechanisms and symptomology of the disorder, the indicated assessments essential to diagnose the physical and learning needs of the student and the accommodations that may effectively manage the syndrome and facilitate the student's access to the academic curriculum.

CHAPTER THREE

METHODOLOGY

Introduction

Chapter Three outlines and defines the processes utilized in construction of the handbook. The research data were obtained through resources as listed in the reference section.

Population Served

The target population for this project is the general education teacher, however, the information within the handbook would be beneficial to the student himself, parents and guardians as well as others involved in the student's academic and life pursuits, i.e., special educators, school staff, athletic coaches and community members.

Project Development

The content of this professional handbook proposal has been developed subsequent to research in the areas of Traumatic Brain Injury and Post Traumatic Vision Syndrome. Experts in the field of TBI and PTVS were consulted during the development of this handbook, i.e.,

optometrists, visual therapists, perceptual consultants, and neuropsychologists. Research also included educational texts, journals, the web as well as interviewing educators and special educators.

The research was conducted in the following manner:

1 Development of an awareness of brain and ocular motor functions, with emphasis on focal and ambient visual processes as well as visual skills essential in reading and writing.

2. Development of an understanding of brain and ocular motor mechanisms of injury.

3. Development of an understanding of Post Traumatic Vision Syndrome and symptoms.

4. Development of a list of recommended assessments.

5. Development of recommended accommodations: environmental, materials, instructional and assistive technologies.

5. Discussion of visual therapy as a mode of PTVS management.

Focus of the Project

The focus of this project and handbook is to provide elementary educators with the following:

- Information on the normal visual processes.
- Information on the mechanisms of brain and ocular motor injury.
- Information of the multidimensional
- impairments subsequent to brain and ocular motor injury including physical, visual, cognitive, emotional and academic.
- Recommended accommodations, environmental and instructional strategies and assistive technology in response to various PTVS challenges.

Program Resources and Content Validation

The research documented in Chapter 2 confirmed the validity of this project. Texts, journals, worldwide web resources and professionals in PTVS, optometrists, neuropsychologists, educators, including special educators supported the information in the handbook.

Project Design

The handbook was designed to be an easily readable reference to which pre-elementary, elementary and middle school may refer when working with students with diagnosed or suspected post traumatic vision syndrome.

APPENDIX A

HANDBOOK

A Teachers' Handbook:

Post Traumatic Vision Syndrome

Awareness, Assessments and Accommodations

Preschool

Elementary Grades K-12

By

Elaine Ruth Lewis

MA Education with Special Education Option

March 2006

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Introduction

According to the Center for Disease Control (2004), more than 1.4 million children are diagnosed with Traumatic Brain Injury (TBI) annually, meanwhile, many more children may have injuries that are unreported or perhaps even unidentified. Approximately 28% of children who sustain traumatic brain injury also experience ocular motor complications (Shokunbi, T., Agbeja, A., 1991). Post Traumatic Vision Syndrome is a comprehensive term which describes and defines aspects of ocular motor dysfunctions concurrent with brain injury.

The focus of this handbook is to educate teachers about post traumatic vision syndrome:

1. To facilitate teachers' awareness of the nuances of PTVS, with emphasis on the healthy vision system processes and functions, the mechanisms of trauma, signs and symptoms of the injury, vision therapy and neurogenesis.

2. To explore appropriate assessments for students with suspected PTVS.

3. To explore modes of medical management through vision therapy.

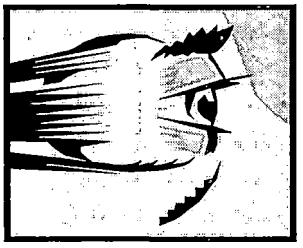
4. To explore effective accommodations, i.e., environmental, text related, assistive technology.

AWARENESS

What is Vision?

According to the American Optometric Association (2001),

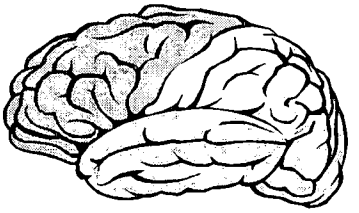
> *Vision is more than the concept of sight measured in terms of visual acuity. Vision is the process of deriving meaning from what is seen. It involves fixation and eye movement abilities, accommodation (eye focusing), convergence (eye aiming), binocularity (eye teaming), eye-hand coordination, visual perception and visual-motor integration.*



THE VISION SYSTEM

The vision system, as described in this handbook, concentrates on two processes of vision, the focal process and the global process. The focal process, a sensory skill, utilizes central vision and convergence to distinguish objects in one's visual field, allowing one to interpret the object's shape, size, color and other characteristics.

The global process, a motor skill, relates to one's spatial orientation, location in the environment, posture and balance and encourages a sense of stability within one's space.



Visual Processes

The visual processes, focal and ambient, are neurally related to the temporal and posterior parietal cortexes of the brain and direct the extrinsic muscle movements of the eye. The ensuing visual skills, tracking, binocular functions, and visual spatial perception and processing, thereby establish the focal and ambient functions.

Causes of Brain Injury and Post Traumatic Vision Syndrome

The causes of traumatic brain and ocular motor injury are numerous and may include the following:

- *Birth Injury.*
- *Child abuse, including shaken baby syndrome.*
- *Sports injuries.*
- *Traffic accidents, including whiplash.*
- *Falls.*
- *Missile or projectile injuries.*
- *Other blows to the head.*

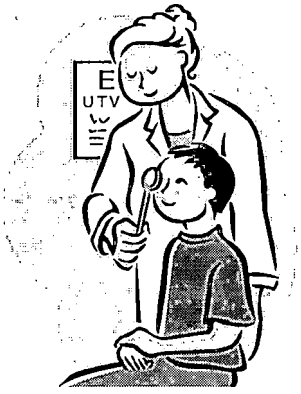
Mechanisms of Ocular Motor Injury

Post Traumatic Vision Syndrome is caused by disruption to the neurological system which innervates the extra ocular muscles that control eye movements as well as the system that regulates focusing (Cohen, 2000).

Neurogenesis

Neuroscientists in the 1990's discovered that the brain, formerly thought to be incapable of regenerating, was in fact, plastic, and able to repair it self in several ways:

- *Healthy neurons may adapt and assume functions of the traumatized tissue.*
- *Axons may regenerate and reconnect at the damaged tissue site and facilitate communication at the neuron levels.*
- *New axons may generate in response to specific stimulation.*



Medical Management of PTVS

Vision Therapy

Vision Therapy is program designed to facilitate one's ability to regain his visual skills and abilities subsequent to PTVS. The therapy, founded on the theory that stimulating the specific areas of the brain and ocular motor system that have traumatized, endeavors to support regenesis of brain and ocular motor structures thereby re establishing effective visual skills.

A Vision Therapy Program may include the following:

- *Lens with refractive correction.*
- *Ocular motor occlusion*
  The patching of one eye to encourage the opposite eye to function more effectively.
- *Prism correction*

Wedge shaped lenses that bend the light and improve the vision due to visual misalign or visual field loss.

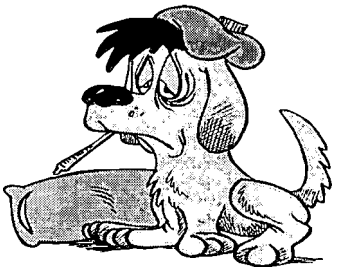
- *Ocular motor exercises*

- *Biofeedback*

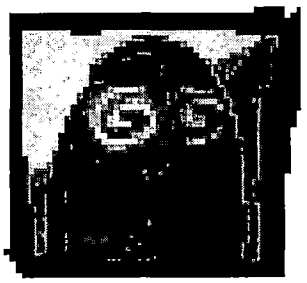
- *Color Overlays*

Signs and Symptoms of PTVS

Physical Signs and Symptoms



- *Vertigo and loss of balance.*
- *Headaches, tension or migraines.*
- *Nausea and vomiting.*
- *Student may appear clumsy, may stumble into objects, i.e., furniture, walls, or doors. He may reach out for objects to stabilize his gait.*
- *Student may reach for objects and not be able to visually articulate the item or the accurate location of the items. He may be unable to properly grasp and hold objects.*
- *Student may experience signs and symptoms of traumatic brain injury.*



Visual Signs and Symptoms

- *Accommodative Insufficiency*
- *Acuity Distortion*
- *Asthenopia*
- *Binocular Dysfunction*
- *Blurry Vision*
- *Visual distortion*
- *Convergence Insufficiency*
- *Esophoria*
- *Exophoria*
- *Diplopia*
- *Visual Fatigue*
- *Perceptual difficulty in accurately perceiving near and far points. May perceive print and text as "moving" or "coming off the page"*

- *Photophobia*
- *Saccadics Rapid, involuntary eye movements as the visual gaze moves from one point to another*
- *Spatial Disorganization*
- *Tracking dysfunction*

Cognitive Challenges

Information Processing

- *Perception of information may be inaccurate, leading to erroneous data comprehension.*
- *Inaccurate encoding of information*
- *Slow information processing*
- *Illogical or inarticulate processing of information.*
- *Memory Retrieval*

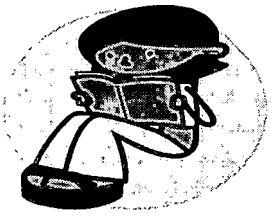
  Short or long term memory may be incomplete or inaccurate.

- *Executive Functions*
  - *Prioritizing, Decision Making, or Judging,*
  - *Evaluating or Assessing may be challenging.*

Emotional Symptoms

- *Frustration*
- *Irritability, Anger or Rage (seemingly unprovoked)*
- *Discouragement*
- *Depression*
- *Hopelessness*
- *Sadness*
- *Social Isolation*
- *Tearfulness*

Academic Challenges



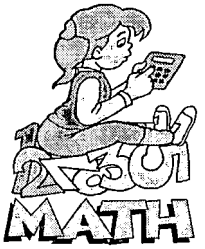
Reading Challenges

- *Letters or Words may be indistinguishable*
- *Letters or words may be reversed*
- *Letter perception may be confused, i.e., b" for "d", "u" for "n", "w" for "m"*
- *Letters or words may appear to be "moving"*
- *May confuse directionality of print*
- *Spatial indiscrimination*
- *Information sequencing may be inaccurate*
- *Ability to follow instructions or directions may be impaired*
- *Memory, Short and long term may be impaired*
- *Comprehension of text may be incomplete and inaccurate*
- *May misinterpret graphics*
- *Visual imagery may be minimal, inaccurate or. confusing*

Writing Challenges

- *Writing may be large, sloppy and illegible*
- *Copying written text may be challenging and confusing*
- *Writing may cause confusion, fatigue and frustration*
- *Student may be reluctant to write at all or for short periods of time*
- *Written text may be disorganized and inarticulate*

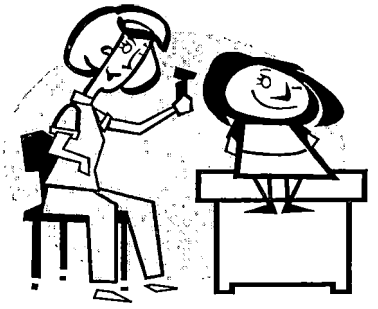
Math Challenges



- *May confuse numbers or words representing numbers*
- *May be unable to accurately identify numbers or manipulatives when calculating, measurements, sizes and relationships*
- *May misinterpret mathematical signs, +, -, as well as others*
- *May be unable to organize math operations*
- *May find operations of fractions difficult to perform*
- *May confuse sequencing*
- *May be unable to correctly read graphs or maps*
- *May be unable to distinguish numbers in vertical or horizontal alignment*
- *May confuse instructions or be unable to recall them*

Lists of Academic Challenges compiled from
Palm Springs Unified School District
Department of Special Education

ASSESSMENTS



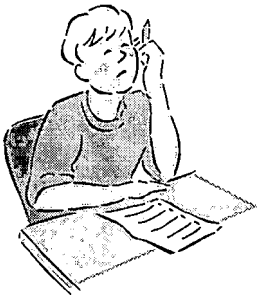
Medical

- *Comprehensive medical examination to determine presence and extent of injuries*

- *Neuro-Opthamalogical: A comprehensive brain and ocular motor systems assessment that may determine the precise location and severity of the impairments*

- *Scans, CT, MRI, PET and other indicated tests that may be able to detect the location and extent of brain and ocular motor injury*

Neuropsychological Assessments



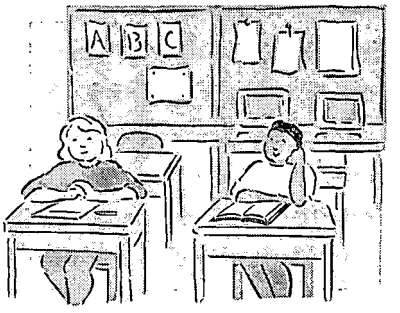
Neuropsychological assessments explore the cognitive and functional skills of the student with suspected brain and ocular motor damage. Included in the assessments are the following:

- *Complex Attention, i.e., selective, alternating, sustained or divided*
- *Memory skills, new learning and perspective memory*
- *Verbal and written communication skills, i.e., word retrieval, thought formulation and expression*
- *Written information processing skills, reading comprehension and retention*
- *Executive functioning skills, i.e. initiating, planning and self monitoring*
- *Reasoning skills i.e., concrete, abstract, decision making, problem solving*

Mathematical skills

Neuropsychologists compile and analyze the assessment findings and recommend strategies that will enhance the student's ability to function more effectively in his environment.

Functional Visual Assessments



Functional Visual Assessments (FVA) provide the information that reflects the student's abilities and challenges, that establishes the educational implications of the impairments, and recommends a program that will address the student's needs that will allow him to optimize his visual skills to access the curriculum and content.

The functional visual assessments may include the following:

- *Lighting in which the student most effectively works throughout the day, indoors and outdoors*

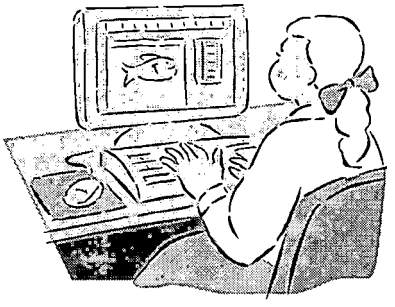
- *Seating in which the student can optimize his ability to see and comprehend his environment*

- *Positions in which the student can most effectively read and write*

- *Various activities in which the student*

engages in the classroom, school and playground

- *Learning Media Assessments*



The Learning Media Assessments elicit information about the student's ability to effectively acquire information through his senses, i.e., visual, auditory and tactile It also determines data about the type of media considered most effective in supplementing the student's abilities to read, write and perform assignments

The Learning Media Assessments may include the evaluation and effectiveness of the following:

- *Generic instructional materials i.e., real objects, enhanced texts, graphics, worksheets*
- *Instructional methods, i.e., pointing, demonstrating, prompting, lecturing*
- *Assistive technology*

What is Vision Therapy

A Vision Therapy Program is based on the theory that stimulating the specific areas of the brain and ocular motor system that have been traumatized will facilitate regenesis of those motor structures, thereby, re-establishing effective visual skills.

A Vision Therapy Program may include the following:

- *Lens with refractive correction*
- *Ocular motor occlusion*
- *Prism correction*
- *Ocular motor exercises*
- *Biofeedback*
- *Color Overlays*

What role can teachers play in the management of PTVS?

- *Maintain an awareness of the signs and symptoms of TBI and associated PTVS*

- *Observe a student closely following a reported head injury for indications of PTVS*

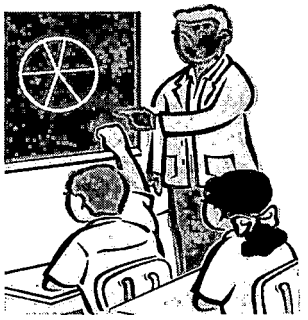
- *Suspect and investigate TBI and PTVS in students who may not have reported having had a head injury, yet, demonstrate a change of behavior and exhibit signs and symptoms of the trauma*

- *Suspect PTVS in students who may have a sudden, unexplained decrease in academic skills and abilities or drop in grades*

- *Refer student to appropriate professional when suspecting PTVS, i.e., nurse or psychologist*

- *Diagnose challenges in curricular areas, modify environment and instruction as needed*

- *Develop an awareness of various therapies which may provide PTVS management skills and techniques, i.e., vision therapy*



ACCOMMODATIONS

Physical Environment

- *Solicit student and parental input into the environments and strategies most effective in the student's ability to work*

  Collaborate with the student and parent to determine the most effective classroom seating position to maximize the student's visual abilities

- *Position student in as quiet environment as possible, away from excessive stimuli, visual, auditory as well as other stimuli*

- *Desk/Working Surface: Consider various methods of surfaces, flat to tilted, to determine that most effective and comfortable for the student to work. The recommended tilted position of working surface is between 20 - 40 degrees*

- *Maintain an environment that is well organized, minimize articles on desk at one time, minimize clutter*

Instructional Strategies and Materials Management

- *Alternate types of activities, near work and distant work*

- *Allow student visual and physical rest when needed*

- *Construct sequential instructions in achievable components*

- *Alternate modes of instruction:*

  Auditory instruction, lectures, and books on tapes.

  Kinesthetic instruction.

  Visual.

- *Cognitive Learning Strategies*

- *Color code curricular subjects, i.e., history-blue, science-green.*

- *Organizers*

  Calendars and planners

  Electronic organizers

  Notebooks

- *Provide structure for student's work in class as well as homework. (Consider on line instructional strategies for student use, Inspiration, Kidspiration as well as others)*

- *Outline formats*

- *Checklists*

- *Graphic Organizers*

- *Visual Accommodations*
- *Large print when available*
- *Enlarge assignments, worksheets, and other information when possible*

- *Color overlays if effective*

- *Line keeper, a ruler or other appropriate straight edge*

- *Text Box, a cardboard cutout which allows a student to see only the information intended*

- Other strategies as deemed effective

Assistive Technology

- *Magnifying lenses, handheld or freestanding.*
- *Computers*

  Alternate keyboard with large symbols

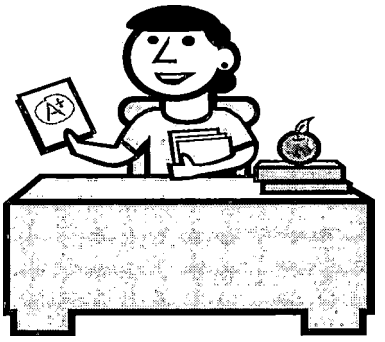
  Learning Software with enhanced graphics and multimedia programs

  Consider a laptop with indicated adaptations
- *Note Takers, electronic*
- *Calculators with large display*
- *Audio Technology, tape, DC, mini CD players*

  Voice Recorders

Accommodations compiled from the following sources:

www.pavevision.org
www.covd.edu



Teachers, test your knowledge about PTVS!

True or False

1. ___ *Accommodations for students with PTVS may include sophisticated electronic technology and software as well as simple items such as a text box or handheld magnifying lenses.*

2. ___ *Students with PTVS may describe text as "Coming off the page" or "Jumping around on the page".*

3. ___ *Only ocular motor functions are effected during traumatic brain injury.*

4. ___ *The student with PTVS may not be able to accurately describe his subjective symptoms of ocular motor dysfunction or related academic challenges.*

5. ___ *Vision therapy is a cure for post traumatic vision syndrome.*

6. ___ *The student with PTVS may demonstrate challenges emotionally, physically, socially and academically.*

7. ___ *The costs and implications of students with PTVS within the community are negligible.*

8. ___ *Teachers should consider PTVS in students who demonstrate academic challenges even though there is no history of injury.*

9. ___ *Light and movement may cause students with PTVS to become confused and irritable.*

10. ___ *Vertigo and nausea may be a significant component of PTVS.*

Answers. 1. T, 2. T, 3. F, 4. T, 5. F, 6. T, 7. F, 8. T, 9. T, 10. T.

Glossary

Acuity - Clarity of vision.

Near - Clear vision, seeing, inspecting, and understanding object viewed at arm's length.

Far - Clear vision, seeing, inspecting and understanding object viewed at distance.

Asthenopia - Visual weakness or fatigue accompanied by pain in and around the eye, headache- may include migraine, general fatigue, vertigo, and nausea.

Developmental/Behavioral Optometrists - Individuals with post-doctoral training and certification in near vision diagnosis and treatment and usually practice optometric vision therapy in addition to general optometry.

Diplopia -_Two images of an object seen at the same time.

Divergence - The ability to turn the eyes outward to track an object moving away from the body.

Esophoria - Tendency of the eye (s) to turn inward.

Exophoria - Tendency of the eye(s) to turn outward.

Extraocular - Muscles that are outside the eye and control eye movements.

Far Point - In a person with 20/20 eyesight, the distance beyond 10 feet.

Fixation - The ability to quickly and accurately locate and inspect a series of stationary objects, i.e., letters, text, as well as other articles.

Oculomotor Function - Muscular movements of the eye structures.

Orthoptics - Vision training and therapy.

Post-Traumatic Vision Syndrome (PTVS) - Secondary symptoms that follow traumatic brain and or ocular motor injury, including double vision, binocular dysfunction, light sensitivity, visual fatigue, as well as cognitive deficits, i.e., confusion, disorientation, short and long term memory impairments, information processing impediments, and loss of executive functions.

Saccadic Movements - The precise locating movements used when visually moving from one word to another when following text. Saccadic movements are performed with the eyes only, the head must remain stationary.

Stereopsis - Depth perception, using both eyes as a team to form a single image with depth.

Suppression - Cortical inhibition or the cancellation by the brain of the signals from an eye to avoid confusions and discomfort rising from problems of binocularity.

Vision Therapy (Orthoptics) - A comprehensive program of visual exercises and activities, which may include the use of selected lenses and prisms that are applied in an effort to explore, extend, and enhance all the visual abilities.

Visual Form Perception - A developed skill that enables a child to accurately discriminate visible likeness and unlikeness so that comprehension can be immediately followed by appropriate actions.

Visual-Motor Dysfunction - The inability of the eyes and hands to work together as a team.

Visual Perceptual - Awareness of visual data coming from specific sites and attributing significance to that information.

Web Resources

The following is a list of organizations and web resources and links that provide information on Post Traumatic Vision Syndrome

American Optometric Association
www.aoanet.org

College of Optometrists in Vision Development
www.covd.org

Irlen Institute
www.irlen.com

NeuroOptometric Rehabilitation Association
www.neuroskills.com

Parents Active for Vision Education
www.pavevision.com

Traumatic Brain Injury
Vision and Brain Injury
www.neuroskills.com/~cns/tbi/injury.html

Vision Therapy
www.Visiontherapy.com

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