Glossary

Accommodation- the act of focusing the eyes to provide an image clear enough for interpretation. The stimulus to accommodation may come from blur on the retina, or perceived awareness of the proximity of a target. Accommodation is said to be “stimulated” when looking at near objects, and “relaxed” when looking further away. Accommodation is part of the “identification” system; it tells us the “what is it?” of the target.

Astigmatism- the refractive condition in which the light rays from an object are not brought to a single point focus at the back of the eye. Astigmatism is compensated for by the use of lenses with cylinder.

Autonomic Nervous System (ANS)- the part of the peripheral nervous system that acts as a control system, maintaining homeostasis in the body. These activities are generally performed without conscious control. The ANS affects heart rate, digestion, respiration rate, salivation, perspiration, diameter of the pupils, micturition (urination), and sexual arousal. Whereas most of its actions are involuntary, some, such as breathing, work in tandem with the conscious mind. The ANS can be divided by subsystems into the parasympathetic nervous system and the sympathetic nervous system. It can also be divided functionally, into its sensory and motor systems.

Balance Master-The Balance Master utilizes a fixed 18" x 60" force plate to measure the vertical forces exerted through the patient's feet to measure center of gravity position and postural control. The long force plate allows for enhanced assessment and training capabilities.

Blur Point- the point at which an object of regard becomes blurred with the introduction of increasing prism or lens power, or by varying the target’s distance. It may be measured either monocularly or binocularly. Binocularly it represents the point at which the individual maintains a target single by calling upon changes in accommodation.

Brain Tap- Brain Tap is a powerfully effective mind development tool designed to help you overcome the ill effects of the fight-or-flight response while achieving physical, mental and emotional balance. The combination helps guide you to a perfect balance of left/right brain synchronization and relaxed brainwave activity. Braintapping creates a symphony of brainwave activity, a feeling of calm focus that’s just right for learning and productivity. Each session is designed with brainwave balance in mind. BrainTap’s large selection of specialized audio-sessions can produce this symphony of brainwave activity. The calming, rejuvenating effects of 10 to 20 minutes of braintapping serves to balance your nervous system and inoculate you against the stressors of everyday life. The BrainTap headset delivers gentle pulses of light through special earphones and from within a visor. These lights synchronize with two types of sound—binaural beats and isochronic tones—to produce deep and profound relaxation and varying states of consciousness.

Break Point- during binocular fixation, the point at which diplopia (double vision) occurs with gradually increasing prism or lens power, or by varying the target’s distance.

Brock String- A Brock string (named after Frederick W. Brock) is an instrument used in vision therapy. It consists of a white string of approximately 10 feet in length with three small wooden beads of different colors. The Brock string is commonly employed during treatment of convergence insufficiency and other anomalies of binocular vision. It is used to develop skills of convergence as well as to disrupt suppression

of one of the eyes. During therapy, the one end of the Brock string is held on the tip of the nose while the other is tied to a fixed point. The three beads are spaced out at various distances. The patient is asked to focus on one of the beads, while noting the visual input of each eye and sensation of convergence. The patient can use variable techniques to make easier or more difficult by bringing the beads closer\further to the nose and by employing lenses and prisms.

CALM - The main purpose of this product is to restore deficient magnesium levels in those experiencing symptoms of deficiency (thus alleviating or lessening these symptoms), and to maintain healthy magnesium levels.

Central Nervous System (CNS)- consists of the brain and spinal cord, which serve as the main "processing center" for the entire nervous system and control all the workings of the body. The CNS is responsible for receiving and interpreting signals from the peripheral nervous system and also sends out signals to it, either consciously or unconsciously.

Cerebellum- a region of the brain that plays an important role in the integration of sensory perception, coordination, and motor control. In order to coordinate motor control, there are many neural pathways linking the cerebellum with the cerebral motor cortex (which sends information to the muscles causing them to move) and the spinocerebellar tract (which provides proprioceptive feedback on the position of the body in space). The cerebellum integrates these pathways, like a train conductor, using the constant feedback on body position to fine-tune motor movements. Because of this "updating" function of the cerebellum, lesions within it are usually not so debilitating as to cause paralysis, but rather present as feedback deficits resulting in disorders in fine movement (e.g. spasticity), equilibrium, posture, and motor learning.

Cheiroscope- an instrument that presents a pattern or image to one eye, which is transferred to and projected out of the other eye. It is used to probe the presence of first-degree fusion and the stability of binocular posture. The two primary types of cheiroscope are Wheatstone, which uses sphero-prisms, and the Mirror Stereoscope, which uses mirror images.

CogState- Cogstate has been used extensively as a rapid and reliable screening assessment in a range of clinical indications, including Alzheimer's Disease, depression, schizophrenia, AIDS, dementia complex and as a measure of cognitive decline following a mild traumatic brain injury or suspected concussive episode.

Convergence- the turning inward of the lines of sight to attain or maintain single vision. In the real world there is convergence unless fusion is prevented by mechanical or other reasons (such as strabismus). We use the word "divergence," but it is a relative term, meaning that the eyes are relatively less converged than they were previously.

There are 5 types of convergence:

Tonic- the normal muscle tonus present in the living eye

Proximal- a "psychological" component, based on perceived awareness of the closeness of an object

Accommodative- convergence reflexively related to accommodation

Fusional- convergence stimulated by perceived disparity to attain or maintain single vision; usually occurs at sub-conscious level

Voluntary- the aligning the two eyes with conscious effort

The various types of convergence are controlled by centers in different areas of the brain; all the components must be integrated if fusion is to be effortless. This allows conscious effort and attention to be directed elsewhere.

Convergence Insufficiency- more exo (phoria or tropia) is measured at near than at far.

Cranio-Sacral-Cranio-Sacral Massage works to release tension and reset the craniosacral rhythm. When there is increased fluid or tension around the brain or spinal cord, the craniosacral rhythm becomes disrupted. Craniosacral massage is used to relieve that tension and calm the nervous system.

DEM- The Developmental Eye Movement Test provides an objective method of assessing fixational and saccadic activity during reading and non-reading tasks.

Dorsal Stream- The dorsal stream (or, "where pathway") is involved with processing the object's spatial location relative to the viewer and with speech repetition.

Dynavision - The Dynavision D2 targets multiple lobes and functions of the brain. It can be utilized to improve immediate recall, frontal lobe processing, peripheral vision, and proprioception when paired with a balance activity. The DynaVision is an essential tool to train and assess an athletes' ability to react to various situations, to be proactive in tracking, decision making, peripheral awareness and cognitive processing. The D2 records all of the data and enables the athlete and trainer to quantitatively assess the results thereby creating the ability to improve on the weak areas with tailored routines.

Extra-Ocular Muscles- six striated muscles that attach to the outside of each eye (total 12) and which allow the eye to move. These muscles coordinate together to produce eye movements in the different positions of gaze:

Lateral Rectus (LR)- abduction (away from the nose), innervated by Cranial Nerve VI (the Abducens)

Medial Rectus (MR)- adduction (towards the nose), innervated by Cranial Nerve III (Oculo-Motor)

Superior Rectus (SR)- responsible for adduction, elevation and intorsion, innervated by Cranial Nerve III

Inferior Rectus (IR)- responsible for adduction, depression and extorsion, innervated by Cranial Nerve III

Inferior Oblique (IO)- responsible for abduction, elevation and extorsion, innervated by Cranial Nerve III

Superior Oblique (SO)- responsible for abduction, depression and intorsion, innervated by Cranial Nerve IV (Trochlear).

Fixation- the process, condition, or act of directing the eye towards an object of regard, causing the image of the object to be aligned on the fovea. During fixation there are small involuntary saccades, which are imperceptible to the naked eye; this means that fixation is an active process where the oculomotor system sends and receives information to the brain in order to keep the image centered on the fovea, where it will best be seen.

Fixation Disparity- exists when there is a small misalignment of the eyes when viewing an object binocularly. Since the corresponding points still fall within Panum's areas, the object is still seen as single. The misalignment may be vertical, horizontal or both. The misalignment (measured in minutes of arc) is much smaller than that of a strabismus, although it may reduce a patient's comfort and level of stereopsis. A patient may or may not have fixation disparity and a patient may have a different fixation disparity at distance than near.

Frontal Lobe- sometimes referred to as the "executive" part of the brain, the functions of the frontal lobe involve the ability to recognize future consequences resulting from current actions, to choose between good and bad actions (or better and best), override and suppress unacceptable social responses, and determine similarities and differences between things or events.

The frontal lobes also play an important part in retaining longer term memories which are not task-based. These are often memories associated with emotions derived from input from the brain's limbic system. The frontal lobe modifies those emotions to generally fit socially acceptable norms.

Fusion- the unification of the individual images from each eye into a unified percept. Fusion has 2 components: sensory and motor.

> Sensory fusion refers to the single, unified percept that results when corresponding retinal areas are stimulated by images of the same object or images of compatible content. It is the ability to appreciate two similar or compatible images, one with each eye and interpret them as one. For sensory fusion to occur, the images not only must be located on corresponding retinal areas but also must be sufficiently similar in size, brightness and sharpness. Unequal images present a severe obstacle to fusion.
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> Motor fusion differs in that it is the physical movement of the eyes to achieve a single image when presented with different retinal images to result in or to maintain sensory fusion. It is the ability to align the eyes in such a manner that sensory fusion can be maintained. The stimulus for these fusional eye movements is retinal disparity outside of Panum's area and the eyes moving in opposite directions (vergence).

Thus, sensory-motor fusion refers to the quality and quantity of the binocular response.

Grades of Fusion- Worth divided binocular vision into grades, relative to the type of demand presented by a target.

> First-Degree Fusion, or Superimposition refers to the common localization of dissimilar but compatible images presented separately to each eye. An example of a first-degree fusion target might be the Fish and the Bowl targets from the Mirror Stereoscope. One eye sees the fish, the other eye sees the bowl. When fusion occurs, the patient will see a fish in a fishbowl.

Second-Degree Fusion, or Flat Fusion refers to the single simultaneous perception of identical targets, one presented to each eye. Upon examination of a second-degree fusion target, the distance between all corresponding (homologous) points will be found to be the same. An example of a second-degree fusion target might be the AN 1 card used in the Brewster stereoscope.

Most second-degree fusion targets include a first-degree fusion component that acts as a suppression control. An example of this might be the AN 2 stereoscopic card. In this target, each eye sees an identical star, but the right eye sees the odd numbers and the left eye sees the even numbers. When fusion occurs a single star with ALL of the numbers should be seen. The star, or second-degree fusion component, may act as a "fusion lock," enhancing or guiding binocular posture, and providing a "framework" for the simultaneous perception of the first-degree fusion components.

Third-Degree Fusion, or Stereopsis refers to the perception of depth when viewing targets that are designed with retinal disparity. Stereopsis per se is defined as the binocular appreciation of depth due to retinal disparity. Upon examination of a third-degree fusion target, the distance between corresponding (homologous) points will vary, resulting in the perception of depth when fusion occurs. Although the distance between corresponding points varies, the differences are not great enough to prevent the entire target from being seen as single. An example of a third-degree fusion target might be the Clown Vectogram. When the two films are super-imposed, the objects do not coincide exactly. This disparity is what gives rise to the perception of 3-D when the appropriate fusion response is made.

Hippocampus- a brain structure located inside the medial temporal lobe of the cerebral cortex. It belongs to the limbic system and plays a major role in short term memory and spatial navigation. In Alzheimer's disease the hippocampus is one of the first regions of the brain to suffer damage; memory problems and disorientation appear among the first symptoms. Damage to the hippocampus can also result from oxygen starvation (anoxia), encephalitis, or medial temporal lobe epilepsy. People with extensive hippocampal damage may experience amnesia, that is, inability to form or retain new memories.

HRV- The Dinamika HRV is a digital analyzer designed to study the functional state of a person based on neurodynamic HRV (Heart Rate Variability) analysis. With the help of this system you will be able to monitor your patient's functional status and to determine the effectiveness of treatment. This technology is designed to analyze the human heart and brain rhythms extracted from an electrocardio signal in the broad range frequency band and is based on the new science of Fractal Neurodynamics.

Hyperopia- also called farsightedness, the condition in which in the uncorrected eye, light rays come to point focus behind the retina. Hyperopia is compensated for by the used of plus lenses.

ImPACT- ImPACT (Immediate Post-Concussion Assessment and Cognitive Testing) is a neurocognitive assessment administered online in a controlled environment. ImPACT has two components: baseline testing and post-injury testing which are used in conjunction to determine if a patient can safely return to an activity.

King-Devick-The King-Devick Test is a two-minute rapid number naming assessment in which an in individual quickly reads aloud single digit numbers and evaluates impairments of eye movements, attention and language function.

Listening Program- The Listening Program®(TLP) is a music listening method, personalized just for you to improve your brain health, at any age or level of ability. Using the highest audio quality recording technology (High Definition sound) and advanced neuroacoustic techniques, TLP music is acoustically modified to train your brain, strengthening neurological pathways to improve your ability to learn, communicate, and process information. TLP can benefit most anyone, and applications are wide ranging, from rehabilitation, to wellness and peak performance; in settings ranging from schools, hospitals, therapy clinics, assisted living facilities, companies, athletic and music programs, in homes, and on military bases.

Makoto Arena- Studies of therapies which combine cross-body movements with visual and auditory stimulus using the Makoto Arena, show significant improvement in visual, cardiovascular, and neurological performance. These improvements include the areas of memory, proprioception, cognitive processing, speech, learning disabilities, and more. The cognitive benefits from using Makoto make it useful for neurological therapies, including for: Stroke, Concussions, TBI's, SPD, Depression, ADD/ADHD. Training with it improves first-step speed, reaction time, mental focus, concentration, and hand-eye and foot-eye coordination. Its random, 360-degree, multi-planar environment provides a close approximation to real-time sports.

Marsden Ball- The typical Marsden ball looks like a plastic baseball with smallish numbers and/or letters printed over its surface. It has an attachment point for a string, and a good length of string is attached to it, perhaps 20 feet. The string is passed through an eyelet screw which is screwed into the ceiling at least 6 feet from the nearest wall – this allows the ball to swing freely in any direction and to vary the height of the ball from the floor. Marsden balls are useful in training VSA, and to some extent VSP (such as figure ground and spatial awareness). The typical activity involves the patient standing, sitting, or lying down and, with head steady, maintaining fixation on the ball as it swings about. There are many variations on this theme, and the Marsden Ball will be used frequently for VSA and VSP exercises.

Near Point of Convergence (NPC)- the closest point that an object of regard can be moved toward the nose without loss of fusion.

NeuroTracker- NeuroTracker is a cognitive training tool that challenges you to track multiple targets moving dynamically in 3D space. It adapts movement speed and complexity in a way that optimally trains your high-level mental abilities.

NSUCO- Developed at Northeastern State University College of Optometry - The NSUCO/Maples Oculomotor Test is a standardized method of scoring standard eye movement testing. It allows the optometrist to observe the patient's eye movement ability and accuracy along with head movement and body movement without requiring a subjective response.

Nystagmus- refers to rapid involuntary movements of the eyes that may be from side to side (horizontal nystagmus), up and down (vertical nystagmus) or rotary. Depending on the cause, these movements may be in both eyes or in just one eye. The involuntary eye movements of nystagmus are caused by abnormal function in the areas of the brain that control eye movements. The exact nature of these

disorders is poorly understood. Nystagmus may be either congenital (present at birth) or may be acquired (caused by disease or injury later in life). Nystagmus may occur with both eyes or may only occur when one eye is occluded. Nystagmus that occurs with one eye occluded is called latent nystagmus.

Occipital Lobe- the occipital lobe is the visual processing center of the mammalian brain and is the location of the primary visual cortex. It contains regions specialized for different visual tasks such as visuo-spatial processing, color discrimination and motion perception.

Optic Chiasm- The optic nerves from both eyes meet and cross at the optic chiasm at the base of the hypothalamus of the brain. At this point the information coming from both eyes is combined and splits according to the visual field. The corresponding halves of the field of view (right and left) are sent to the left and right halves of the brain, respectively, to be processed. That is, the right side of the primary visual cortex deals with the left half of the field of view from both eyes, and similarly or the left brain. A small region in the center of the field of view is processed redundantly by both halves of the brain.

Optic Nerve- part of the nervous system that transmits the impulses of sight from the retina along the visual pathways. There are currently 11 known branches of the optic nerve.

Optokinetic Nystagmus (OKN)- OKN is based on the principle that the eyes tend to follow or track the motion of one element at a time in a steadily moving display. As the tracked element moves out of sight, the eyes will “snap back” to fixate and follow another one. This subcortically-mediated function is termed optokinetic nystagmus (OKN) and is present at about five days after birth. This response can be sued as an objective measure of an infant’s ability to see detail in a moving stimulus, such as a bar grating or OKN drum. The absence of an OKN response suggests that the infant may not perceive the elements of the moving target as separate.

OPTOS- Optos is piece of equipment used by eyecare professionals for retinal imaging to diagnose, document and treat ocular issues that may go undetected using traditional equipment.

O.D.- from the Latin Oculus Dexter, abbreviation meaning right eye.

O.S.- from the Latin Oculus Sinister, abbreviation meaning left eye.

O.U.- from the Latin Oculus Uterque, abbreviation meaning both eyes together.

Parasympathetic Nervous System- a part of the Autonomic Nervous System. The parasympathetic system returns the body functions to normal after they have been altered by sympathetic stimulation. In times of danger, the sympathetic system prepares the body for violent activity. The parasympathetic system reverses these changes when the danger is over. These parasympathetic changes include: slowing of heart beat, lowering of blood pressure, constriction of the pupils, increased blood flow to the skin and viscera, resumption of peristalsis in the GI tract.

Parietal Lobe- an area of the brain involved in the visual process. It is currently believed that the majority of the Magnocellular fibers travel to the parietal lobe via the dorsal stream. The parietal lobe deals with somatosensory information (kinesthesis and body awareness), cognition, information processing, pain and touch sensation, spatial orientation, speech, visual perception, timing and movement. It integrates sensory information from different modalities, particularly determining spatial sense and navigation.

PEMF-PEMF stands for Pulsed Electro Magnetic Field therapy; using this particular process involves directing powerful, pulsed energy waves toward damaged or injured areas of the patient's body. These waves painlessly and quickly pass through the cells in the damaged region, increasing the spin of the electrons contained within them as a result. PEMF therapy is: The induction of electricity into the cells to help stimulate or promote healing. Pulsed Electromagnetic Field (PEMF) therapy restores the energy within the cells of the body and works to reset the circadian rhythm. This allows more energy flow to the injured areas of the body, thus resulting in speeding up the healing process.

Pinnacle Program-The Pinnacle Program is designed to help adults and children meet their visual, cognitive, academic and developmental goals. Based on the principles of Mary Bolles' Sensory Learning Program model, the Pinnacle Program incorporates vision, proprioception and auditory to help re-train the brain.

Post Traumatic Vision Syndrome (PTVS)- following a TBI, a patient may develop a constellation of symptoms that may include, but are not limited to: blurry vision, diplopia, headaches, spatial disorientation, photophobia, visual hallucinations, poor attention and concentration, and poor visual memory. Conditions often associated with PTVS include convergence insufficiency, accommodative dysfunction, exotropia or exophoria, low blink rate, and poor ocular motility.

Prism- a wedge shaped lens that changes the direction of light passing through it but does not change focus. Light entering a prism is deviated toward the base (the thickest portion), and the image of the object being viewed appears to move in the direction of the apex (the point). Prisms are typically designed by the direction of their bases: Base Up, Base Down, Base Right, or Base Left. When used on a binocular basis, they are commonly referred to as Base In (both bases in toward the nose) or Base Out (both bases out towards the ears). Yoked prism refers to the application of prism when the bases of both prisms are oriented in the same direction, i.e. both Bases Up, Bases Down, Bases Right, Bases Left.

Prism can be used in a compensatory way, helping to achieve alignment of the eyes when it is not possible by other means. In the therapy room prisms are also used therapeutically on both a monocular and binocular basis to create a mismatch between the objects in the real world and where the prisms, because of the way they displace light, cause the visual system to perceive them to be. As the patient resolves these mismatches, he/she learns to use vision in a new, more efficient way. On a binocular basis, they change the demand for convergence in order to keep a target single and reflexly change accommodation.

Yoked prisms (when the bases of both prisms face in the same direction) are used in vision therapy to help disrupt the normal association between the vestibular and visual systems and create greater demands for reorientation in space to compensate for the shift of gravity, postural changes, and sense of orientation imposed by the prisms. These types of prisms can be base right (BR), base left (BL), base up (BU), or base down (BD). When the bases of the prisms are facing the same direction over each eye, the space observed is displaced towards the direction of the apex. This disruption of reality causes the patient to readjust or shift his/her center of gravity to account for the change in position of the space. In addition to the apparent shift in space, yoked prisms in the base up and base down positions can create the illusion of an increase or decrease of the volume of space. In other words, a room will appear to be longer or shorter than it really is when seen through these yoked prisms. Because the visual system is so dominant compared to other systems in the body, the patient will often change gait, head or general body posture, or recalibrate perceived spatial relationships to appropriately match the demands of the

"new" reality. Yoked prisms can also play a vital role of therapy for an ABI patient. For example, if a patient constantly perceives the world being shifted to the right, yoked prisms may help "realign" that space for that individual, thus reestablishing a sense of stability and orientation. Other applications of yoked prism include patients with autism, or cerebral palsy or attentional difficulties, etc.

Special types of prism (called Peli prisms) can also be incorporated into spectacle lenses and used as an "alerting" mechanism for patients with visual field defects.

Proprioception- a distinct sensory modality that provides feedback solely on the status of the body internally. It is the sense that indicates whether the body is moving with required effort, as well as relative position of parts of the body and where they are located in relation to each other.

Pursuit- the type of eye movement used when following a moving target, to keep the image of the object of regard on the fovea. Pursuits are believed to be mediated in the occipital lobe. The primary stimulus to initiate a pursuit is the speed of the object. Pursuits are relatively slow eye movements (compared to the relative speed of saccades) that involve smoothly tracking a moving target while maintaining an accurate fixation. It is often called a "holding movement" because it allows the patient to hold or maintain the desired object on the fovea. Pursuits allow the individual to extract information from a dynamic and changing environment. The patient has the ability to alter the speed or duration of a pursuit during its progression, whereas that is not possible in a saccade. Before an efficient pursuit can be achieved, one must possess the ability to make and hold a fixation.

Accurate maintenance of fixation on the moving object is accomplished by a combination of smooth pursuits and saccades. When the object is moving faster than the pursuit system can keep pace, the faster saccade system is activated to reduce retinal slip and reposition the object of regard on the fovea. Even though the image is moving, our sensory system adjusts so that we maintain the sense of straight-ahead and the visual perception of the world remains continuous and stable.

Right Eye- Right Eye is an eye-tracking system for general healthcare and wellness. It's designed to quickly, easily and accurately expose vision and brain health in ways impossible with standard eye tests.

Saccades- a saccade is a relatively quick eye movement (compared to the relative slow speed of pursuit movements) during which the eye "jumps" from one target to another. Saccadic eye movements are thought to be mediated by the parietal lobe and the eyefields in the frontal lobe. The primary stimulus for the saccadic eye movement is the location of the target. It is often called a "catching" movement because it helps the patient "catch" and bring a new target to the fovea. It is faster than all the other eye movements and always starts and ends with a fixation. Thereafter, the concept of peripheral awareness and the ability to "calculate" the size of the jump needed to arrive at the desired target play a key role in accurate and efficient saccades.

Scat3 - The SCAt3 is a standardized tool for evaluating injured athletes for concussion and can be used in athletes aged from 13 years and older.

-Child Scat The ChildSCAT3 is a standardized tool for evaluating injured children for concussion and can be used in children aged from 5 to 12 years

Senaptec- Senaptec is a program that has multiple functions. It is used to work pursuits and saccades, which are performed with different activities simultaneously as tolerated by the patient. It is also used

to target eye hand coordination, decision making skills, immediate recall, and visual processing. Senaptec vision training has a variety of benefits including helping individuals recover from brain injuries, increasing an athlete's response times and generally improving your coordination, focus, and speed.

Sonix- Sonix uses sound wave frequencies to target affected brain waves and increase their stimulation. Whole Body Vibration is a platform that vibrates while the user stands, sits, etc., on it. Exercises can be performed while on the platform, which will have a different effect on the body compared to performing these exercises while on solid ground. The biological reaction to vibration is dependent on the frequency, magnitude, duration, and type of vibration — or how often, how much, and how long the vibratory stimulus is.

Stereoscope- an instrument designed to separate the binocular field into two parts, one part for each eye. When fusion is attained, a unified image is seen. It is used to explore both binocular and monocular abilities when both eyes are open. There are two most common types of stereoscope: Brewster (which uses sphero-prisms) and Wheatstone (which uses mirrors).

Superior Colliculus (SC)- one of the primary processing centers for visual information received from the retina of the eye. A percentage of the magnocellular fibers that leave the back of the eye do not go to the lateral geniculate nucleus (LGN). but instead to the Superior Colliculus in the mid-brain. In the SC visual information integrates with vestibular information from the semicircular canals, proprioceptive information from muscles, tendons and ligaments, tactile, auditory and other systems. It is involved in orientation, balance and postural mechanisms and keeps the world level. It is part of the process that tells us whether we are moving, the object of regard is moving, or both are moving. Using this information, along with information from other areas of the brain, we construct a personal 3-D representation of space, with ourselves placed at the center.

Suppression- refers to the condition where all or part of the visual field is not perceived. Suppression occurs upon the simultaneous stimulation of both eye, as the main “purpose” of suppression is to secure single vision where it would not be attainable otherwise. Suppression may be classified as active or passive.

> Active suppression is suppression that occurs to avoid diplopia and visual confusion when single binocular vision is not attainable.
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> Passive suppression is suppression that occurs due to gross inequalities in the visual information between the eyes, as in Anisometropia or Amblyopia. Passive suppression is generally thought to be more shallow than active suppression, as it takes less effort for the brain to ignore a blurry image than to suppress a double image. For this reason, passive suppression is often thought to be easier to eliminate.

SVI- Using a 50” touch screen monitor, the Sanet Vision Integrator is designed to improve visual abilities for a wide range of patients with visually-related learning problems, amblyopia, and traumatic brain injury. It is also very effective for sports vision enhancement work with athletes. The programmable instrument incorporates features of a saccadic trainer, virtual rotator, tachistoscope and programmable metronome. The SVI instrument actually “speaks”, instructing the patient to respond to verbal commands, improving auditory-visual integration and memory. The SVI can be used to enhance the

following visual abilities: Pursuits, saccades, fixation stability, eye-hand coordination, visual reaction time, speed and span of recognition, automaticity, and contrast sensitivity, plus visual and auditory sequencing and memory. In addition, it is extremely effective when working with visual acuity improvement in patients with amblyopia, ABI patients with visual field loss, visual-spatial neglect, and visual-vestibular integration problems, and with patients with rhythm, reading, and math problems.

Sympathetic Nervous System- part of the Autonomic Nervous System. It is always active at a basal level and becomes more active during times of stress. Its actions during the stress response comprise the "fight-or-flight" response, which includes the release of adrenaline and cortisol into the system (the stress hormones), increase in the rate of breathing, particularly in the upper lobes of the lungs (hyperventilation), increase in heart rate, rise in blood pressure, reddening of the skin, pupil dilation, stimulates the conversion of liver glycogen into glucose, shunts blood away from the skin and viscera to the skeletal muscles, brain, and heart, inhibits peristalsis in the gastrointestinal (GI) tract and inhibits contraction of the bladder and rectum.

Syntonics-Syntonics is a color light therapy that utilizes standard color filters with an incandescent light source (similar in the visible spectrum to natural sunlight). Syntonics is used to treat specific functional vision conditions. The object of the color of light is to bring the visual system into balance by activating aspects of the central nervous system. The typical treatment for syntonics requires a patient to sit in a darkened room and view a circle of colored light for 15-20 minutes over the course of a series of sessions. Visual symptoms and visual performance often improve following syntonics. The color of the light used in therapy varies based on visual diagnoses. An inward eye turn, or Esotropia, typically requires Red light, while for an outward eye turn, Exotropia, Blue light is recommended.

Temporal Lobe- An area of the brain involved in the visual process. The Parvocellular fibers travel to the temporal lobe via the ventral stream. The temporal lobe is involved with auditory processing, semantics, memory formation, object perception and recognition, naming and verbal memory, comprehension and significance and high-level visual processing of complex stimuli such as faces, scenes, etc.

Traumatic Brain Injury (TBI)- occurs when an outside force traumatically injures the brain. TBI can be classified based on severity, mechanism (closed or penetrating head injury), or other features (e.g. occurring in a specific location or over a widespread area). Head injury usually refers to TBI but is a broader category because it can involve damage to structures other than the brain, such as the scalp and skull.

Brain trauma can be caused by a direct impact or by acceleration alone. In addition to the damage caused at the moment of injury, brain trauma causes secondary injury, a variety of events that take place in the minutes and days following the injury. These processes, which include alterations in cerebral blood flow and the pressure within the skull, contribute substantially to the damage from the initial injury.

TBI can cause a host of physical, cognitive, emotional and behavioral effects and the outcome can range from complete recovery to permanent disability or death. The 20th century has seen critical developments in diagnosis and treatment which have decreased death rates and improved outcome. These include imaging techniques such as computed tomography and magnetic resonance imaging. Depending on the injury, treatment required may be minimal or may include interventions such as

medications and emergency surgery. Vision therapy, lenses, physical therapy, speech therapy and occupational therapy may be employed for rehabilitation.

Ventral Stream- The ventral stream (also known as the "what pathway") is involved with object and visual identification and recognition.

Vergences- eye movements involving both eyes in which each eye moves in opposite directions (“disjunctive” movements). Vergence movements help us to attain and maintain fusion by changing the alignment of the eyes.

Vestibular System- the sensory system that provides the dominant input about movement and equilibrium. The vestibular system comprises two components: the semicircular canals, which indicate rotational movements; and the otoliths, which indicate linear accelerations. The vestibular system sends signals primarily to the neural structures that control our eye movements and to the muscles that keep us upright. The projections to the former provide the anatomical basis of the vestibulo-ocular reflex, which is required for clear vision; and the projections to the muscles that control our posture are necessary to keep us upright.

Vestibulo-Ocular Reflex (VOR)- a reflex eye movement that stabilizes images on the retina during head movement by producing an eye movement in the direction opposite to head movement, thus preserving the image on the center of the visual field. For example, when the head moves to the right, the eyes move to the left, and vice versa. Since slight head movements are present all the time, the VOR is very important for stabilizing vision: patients whose VOR is impaired find it difficult to read using print, because they cannot stabilize the eyes during small head tremors. The VOR does not depend on visual input and works even in total darkness or when the eyes are closed.

Visual Acuity (VA)- clearness or sharpness of sight, the ability to resolve or discriminate contours and to tell when there is a separation of the contour from its background. In the US, it is usually represented as a fraction, which identifies the size of the smallest letters resolved at the testing distance used. The numerator (top number) represents the testing distance used, typically 20 feet. The denominator (bottom number) has to do with the size of the letter read. For example: 20/20 means that an individual is able to resolve the letter on the 20/20 line of the Snellen chart at 20 feet.

Visual Pathways- there are two main pathways that carry visual information from the eye to the brain: The Parvocellular/Focal pathway and Magnocellular/Ambient pathway. These are parallel processing pathways, each designed to process different types of visual information. Neither system functions in isolation of the other or without neural information from the rest of the body. Optimally, both the focal and ambient visual systems reinforce one another and function synergistically. The dichotomy of the magno/parvo pathways is referred to as the “where/what” or “action/perception” pathways by Goodale and Milner.

> M Cells (Magnocellular) are mostly found in peripheral retina and comprise approximately 20% of the retinal ganglion cells. They are large and quick to respond, sampling a large number of temporal inputs over a short period of time. As a result, they provide good temporal resolution for information regarding space and movement. As a result, we do not see space as a series of individual snapshots of space separated in time but rather it is perceived as continual and uninterrupted flow of movement.

The magnocellular visual system is involved with spatial vision: orientation (where am I?), localization (where is it?) and timing (when?).

Goodale and Milner also term the magnocellular system a “how to” system as it provides information on “how to” act on objects.

P Cells (parvocellular) are smaller, slower and most heavily concentrated in the foveal area. They comprise approximately 80% of the retinal ganglion cells. They receive input from a relatively small number of photoreceptors, allowing for good detail-oriented resolution.

The parvocellular system is involved with object vision: detail and identification (what is it?). In an undamaged and well-functioning visual system, object localization (“where?”) typically precedes object identification (“what?”).

Vital Signs- CNS Vital Signs is an assessment procedure that utilizes computerized neuropsychological tests to evaluate the neurocognitive status of patients and covers a range of mental processes from simple motor performance, attention, memory, to executive functions.

VOMS- The VOMS is a screening tool developed by the experts at UPMC to detect signs and symptoms of a concussion. It stands for Vestibular Ocular Motor Screening and looks at the systems responsible for integrating balance, vision, and movement. It also helps to determine the type of concussion a patient has suffered. When we refer to it as a simple test, we mean that the equipment you need to conduct it is very simple. The screening tests for five areas of vestibular and ocular motor impairment: Smooth pursuits, Saccadic or rapid eye movements, Near point of convergence, Vestibular ocular reflex and Visual motion sensitivity