



Neuro-Optometric Rehabilitation Treatment Modalities: Introduction to a Multisensory Approach


Catherine J. Radakovic, OD, FCOVD
Inspire Vision, PLLC



Disclosures

The speaker has no financial interest in the subject matter of this presentation and is not representing any optometric community with this presentation.

The informational content of this presentation is intended to educate the audience on the visual aspects of their patients and by no means should substitute for comprehensive optometric vision care.



Outline And Objectives

Outline

- A. List common occurring visual sequelae in TBI/ABI.
- B. Discuss testing and findings that can pinpoint causes of visual sequelae.
- C. Treatment options: in-office NORT, sytonic/light therapy, and multi-sensory integration therapy.
- D. Case examples benefited from a multi-sensory integration approach and how their outcomes were quantified.
- E. Expected outcomes and course of therapy, discussion on syndromes that may not rehabilitate as quickly as expected. Common findings in these patients.

Objectives

- A. Discuss visual symptoms, visual signs, and different visual treatment paths.
- B. Define multi-sensory integration treatment.
- C. Be able to administer a tangible tool (ie, a symptom survey) to identify those patient that could benefit from Neuro-optometric rehabilitation therapy.

What does TBI have to do with Visual Dysfunction?

Studies show that **90%** of Traumatic Brain Injury patients suffer from Visual Dysfunctions such as:



BLURRED
VISION



SENSITIVITY
TO LIGHT



REDUCTION
OR
LOSS OF
VISUAL FIELD



HEADACHES
WITH
VISUAL
TASKS



READING
DIFFICULTY



DIFFICULTIES
WITH EYE
MOVEMENTS

Vision therapy/Neuro-Optometric Rehabilitation Therapy

- ⦿ Goal:
 - Re-map those neural-visual pathways to be more successful.
 - Comfortable and efficient vision
 - Ease in ability to attend and use eyes for information collection.
 - Balance in posture, focus, and attention.





Symptoms how do we identify and quantify

Brain Injury Symptom Survey (BIVSS)

- Scaled survey that evaluates symptoms of vision related behaviors.
 - Gives a score that can be compared pre and post treatment.
 - Self-administered- perception of level of deficit can be skewed.
- Eyesight clarity
 - Visual comfort
 - Doubling
 - Light sensitivity
 - Dry eyes
 - Depth perception
 - Peripheral vision
 - Reading

Quality of Life Questionnaire (COVD)

Brain Region Localization Survey

My brain injury was: ___ years ago

My age is: ___ years

today's date: _____

- I have had a medical diagnosis of brain injury (check box if true) Cause of injury: _____
- I sustained a brain injury without medical diagnosis (check box if true) _____
- I have NOT ever sustained a brain injury (check box if true)

Please check the **MOST** appropriate box, or circle the item number that best matches your observations. All information will be held in confidence. Thank you for your help!
SYMPTOM CHECKLIST *Circle a number below:*

Please rate each behavior. How often does each behavior occur? (circle a number)	Never	Seldom	Occasionally	Frequently	Always
EYESIGHT CLARITY					
Distance vision blurred and not clear -- even with lenses	0	1	2	3	4
Near vision blurred and not clear -- even with lenses	0	1	2	3	4
Clarity of vision changes or fluctuates during the day	0	1	2	3	4
Poor night vision / can't see well to drive at night	0	1	2	3	4
VISUAL COMFORT					
Eye discomfort / sore eyes / eyestrain	0	1	2	3	4
Headaches or dizziness after using eyes	0	1	2	3	4
Eye fatigue / very tired after using eyes all day	0	1	2	3	4
Feel "pulling" around the eyes	0	1	2	3	4
DOUBLING					
Double vision -- especially when tired	0	1	2	3	4
Have to close or cover one eye to see clearly	0	1	2	3	4
Print moves in and out of focus when reading	0	1	2	3	4
LIGHT SENSITIVITY					
Normal indoor lighting is uncomfortable - too much glare	0	1	2	3	4
Outdoor light too bright - have to use sunglasses	0	1	2	3	4
Indoors fluorescent lighting is bothersome or annoying	0	1	2	3	4
DRY EYES					
Eyes feel "dry" and sting	0	1	2	3	4
"Stare" into space without blinking	0	1	2	3	4
Have to rub the eyes a lot	0	1	2	3	4
DEPTH PERCEPTION					
Clumsiness / misjudge where objects really are	0	1	2	3	4
Lack of confidence walking / missing steps / stumbling	0	1	2	3	4
Poor handwriting (spacing, size, legibility)	0	1	2	3	4
PERIPHERAL VISION					
Side vision distorted / objects move or change position	0	1	2	3	4
What looks straight ahead - isn't always straight ahead	0	1	2	3	4
Avoid crowds / can't tolerate "visually-busy" places	0	1	2	3	4
READING					
Short attention span / easily distracted when reading	0	1	2	3	4
Difficulty / slowness with reading and writing	0	1	2	3	4
Poor reading comprehension / can't remember what was read	0	1	2	3	4
Confusion of words / skip words during reading	0	1	2	3	4
Lose place / have to use finger not to lose place when reading	0	1	2	3	4



Top visual signs/diagnosis resulting from TBI

Ocular Motor Dysfunction

Convergence issues

- Insufficiency
- Excess

Visual Midline Shift

Visual Motion Sensitivity

Visual Motor Coordination

Vestibular-Ocular Reflex

- These are some of the most common diagnosis I find in evaluating patients with TBIs.
- Typically, we talk about the symptoms and what they mean, for this lecture I would like to focus on the diagnosis and how to identify it and treatment options.



Ocular Motor Dysfunction/Visual Motor Coordination

- OMD-Inability for the brain to control the eye movements to move with control and efficiency.
- VMC deficits- Inability for the brain to coordinate the eye movements with the hand with control and efficiency.
- Smooth Pursuits
- Saccades
- Fixation
- Identify by:
 - NSUCO- Ability/Accuracy/Head Movement/Body Movement (scale 1-4)
 - Right eye test of ocular motor skills-employs an eye tracker to quantify eye movements and assigns a percentile compared to others in the patients age range
 - Developmental eye movement test- only tests saccades
 - King-Devick- only tests saccades
 - Beery-buktenica developmental test of visual-motor integration



Ocular Motor Dysfunction

Henry looked to the right. He looked to the left. He looked up, and he looked down. Where had Frog gone? Henry did not like being alone in the forest. "Frog, where are you?" Henry called. "Please come back!"

TABLE 1.12 NSUCO SCORING CRITERIA: DIRECT OBSERVATION OF PURSUITS

Ability

Points	Observation
1	Cannot complete 1/2 rotation in either clockwise or counterclockwise direction
2	Completes 1/2 rotation in either direction
3	Completes one rotation in either direction but not two rotations
4	Completes two rotations in one direction but less than two rotations in the other direction
5	Completes two rotations in each direction

Accuracy (Can the patient accurately and consistently fixate so that no noticeable refixation is needed when doing pursuits?)

Points	Observation
1	No attempt to follow the target or requires greater than 10 refixations
2	Refixations 5 to 10 times
3	Refixations 3 to 4 times
4	Refixations 2 times or less
5	No refixations

Head and body movement (Can the patient accomplish the pursuit without moving his or her head?)

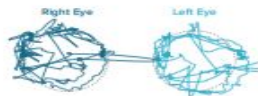
Points	Observation
1	Large movement of the head or body at any time
2	Moderate movement of the head or body at any time
3	Slight movement of the head or body (>50% of time)
4	Slight movement of the head or body (<50% of time)
5	No movement of head or body



18 Pursuits

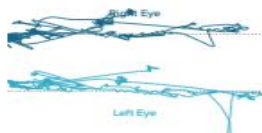
PERCENTILE: 11

Circular Smooth Pursuit



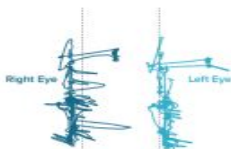
Metrics	Right	Left
SP (%)	81.94	84.76
Efficiency (mm)	59.75	60.30

Horizontal Smooth Pursuit



Metrics	Right	Left
SP (%)	77.86	88.71
Efficiency (mm)	76.03	68.19

Vertical Smooth Pursuit



Metrics	Right	Left
SP (%)	90.52	86.18
Efficiency (mm)	57.47	61.49

18 Saccades

PERCENTILE: 13

Horizontal Saccades



Metrics	Right	Left
TA (mm)	26.12	25.22
SPEED (d/s)	15.83	16.65

Vertical Saccades



Metrics	Right	Left
TA (mm)	20.04	15.76
SPEED (d/s)	20.63	20.21

Eye-Hand Reaction Time

Choice Reaction Time

558 ms	956 ms	1129 ms
Saccadic Latency	Visual Speed	Brain Processing Speed
Total Reaction Time: 2643 ms		
Target Accuracy: 87%		

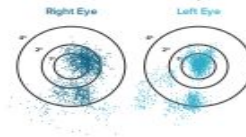
Discriminate Reaction Time

643 ms	945 ms	1173 ms
Saccadic Latency	Visual Speed	Brain Processing Speed
Total Reaction Time: 2761 ms		
Target Accuracy: 100%		

49 Fixations

PERCENTILE: 50

Fixation Stability



Metrics	Right	Left
$\leq 1^\circ$	27.66	53.51
$> 1^\circ$ and $\leq 2^\circ$	40.14	9.75
Dispersion (mm)	10.57	10.85

Reference Information



PURSUITS

Related Brain Areas
Cerebellum, Parietal Lobe



SACCADES

Related Brain Areas
Cerebellum, Brain Stem, Frontal Lobe



FIXATIONS

Related Brain Areas
Neural Integrator, Brain Stem



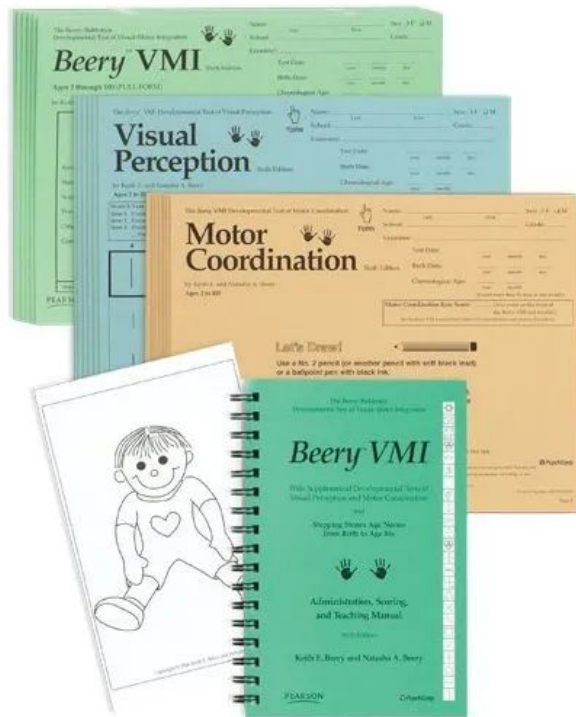
MUSCLES

(Translational View)
Imbalance of oculomotor muscles may result in eye movement issues.



NERVES

(Inferior View)
Cranial nerves III, IV and VI are involved in eye movements.





What does it mean if a patient has OMD?

1. Physically they can not get their eyes to move together in a controlled and coordinated manner- Palsy or tropia
2. They can move their eyes but it takes a lot of effort, poor stamina and eyes feel sore.
3. Visual symptoms with eye movements is too much for them to sustain the movement.

Treatment Plan-----

- A. Start with one eye and always go in order:
 - a. Fixations
 - b. Pursuits
 - c. Saccades
- B. Add hand movements.
- C. Binocular slowly until the eye movements become more natural and integrated.- follow the same order, eyes first then hands..
- D. Load the ocular motor task:
 - a. Add movement
 - b. Add distractors
 - c. Add cognition



Vergence difficulties- Double vision or eyes pulling

Problems at near

1. Convergence insufficiency
2. Convergence excess

How to test it?

- Near point of convergence
- Cover test

Problems at distance

3. Divergence insufficiency
4. Divergence excess

- Brock string
- Phoria and Vergence testing

Gold Standard

Problems at both near and far

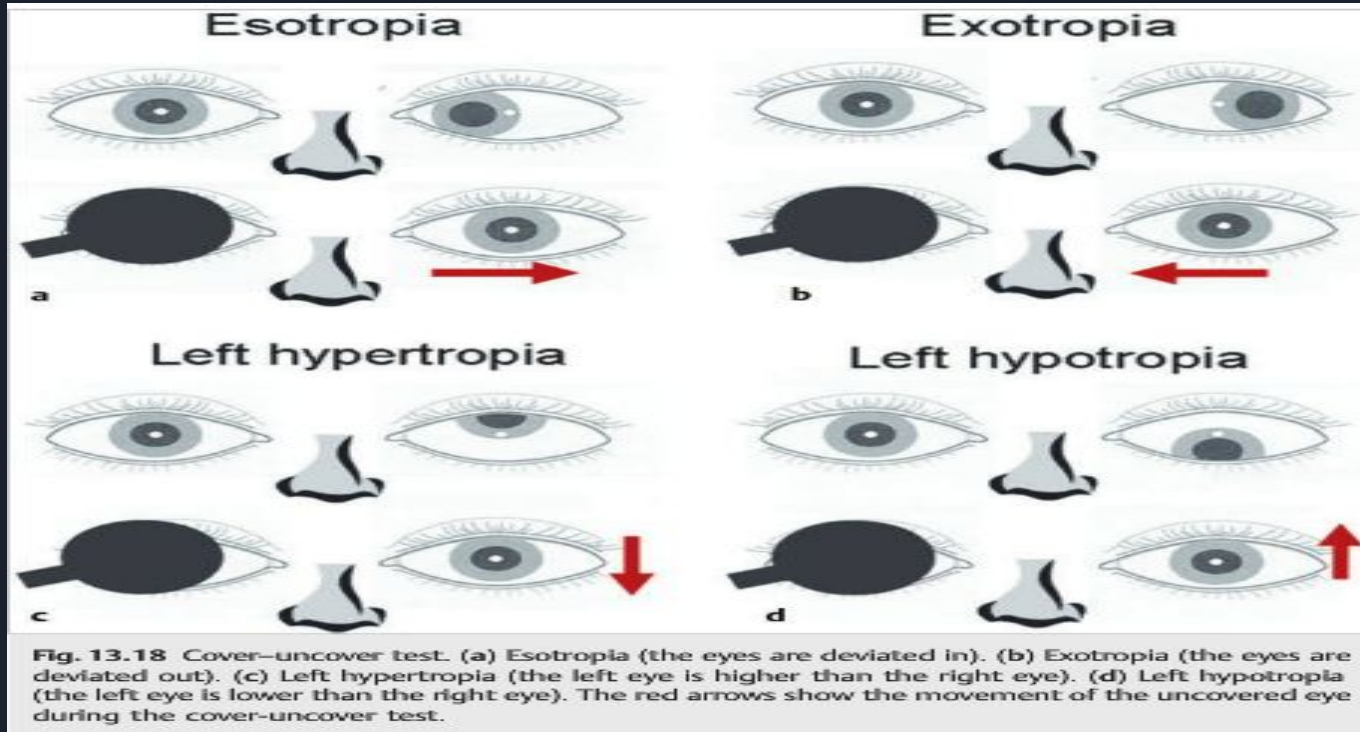
5. Vergence infacility

*You have to not just identify if the patient can do it but how the patient is doing it. Increase in symptoms, decrease in efficiency, etc.

The consumption of soft drinks by American youth is increasing. National dietary surveys show that carbonated soft drink consumption more than doubled in youths aged 6 to 17 from about 5 ounces per day in 1977-78 to 12 ounces in 1994-98, the most recent years for which national data is available. Adolescent boys' soft drink consumption more than tripled during those years.

There are at least two negative results to this soft drink explosion. First, the use of soft drinks is likely related to the rise in childhood obesity. A variety of studies suggest that we don't eat fewer calories from other sources when we increase calories from beverages. If a child drinks 9 to 10 ounces of a soft drink, that's equivalent to almost 120 calories.

Example of Convergence issues and how to test for it...



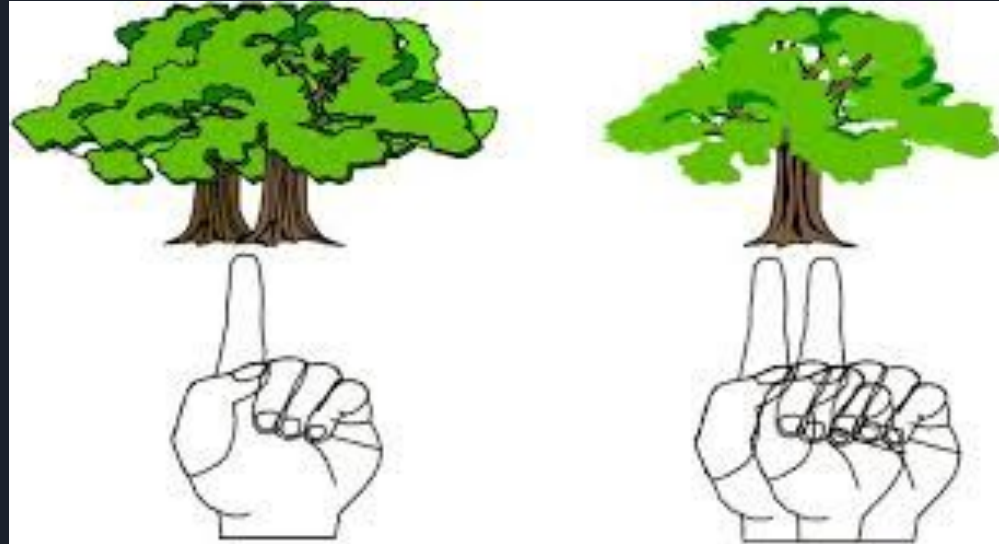
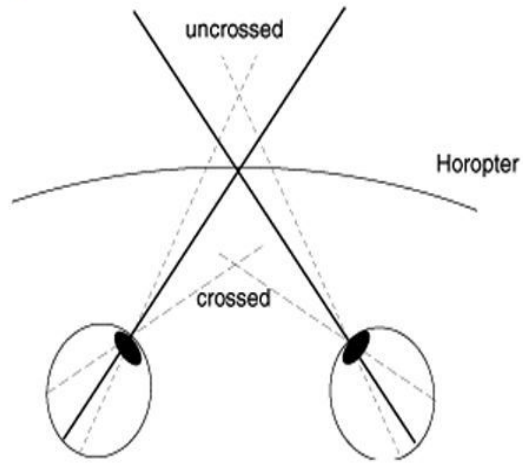


Vergence training

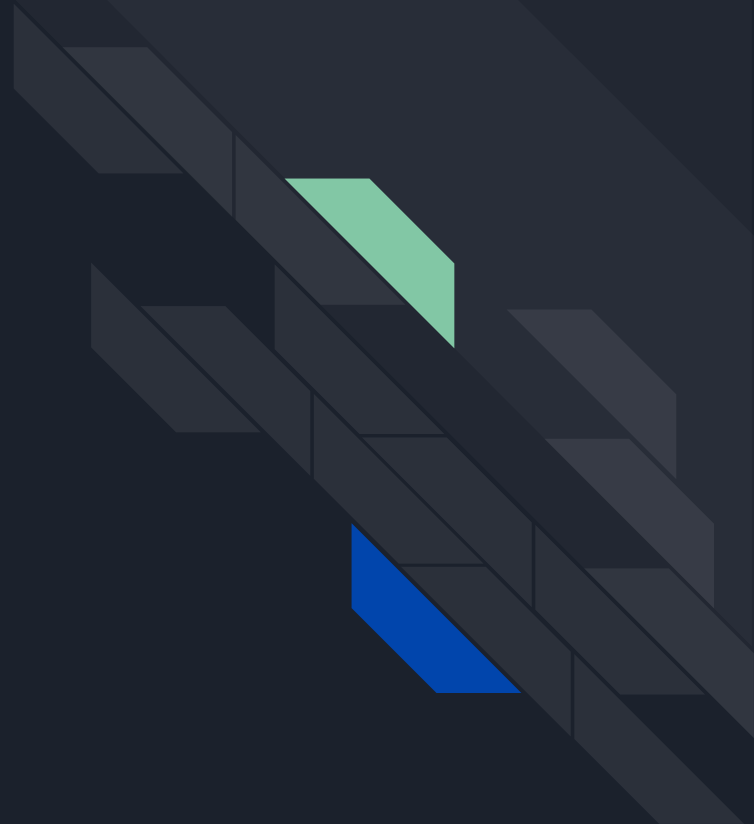
1. Always train both convergence and divergence equally
2. Constantly monitor for suppression
3. Always train at near and at far distances
4. Confirm that the patient is aware of their periphery

One example of Convergence/Divergence ability

Horoceptor, crossed and uncrossed disparity

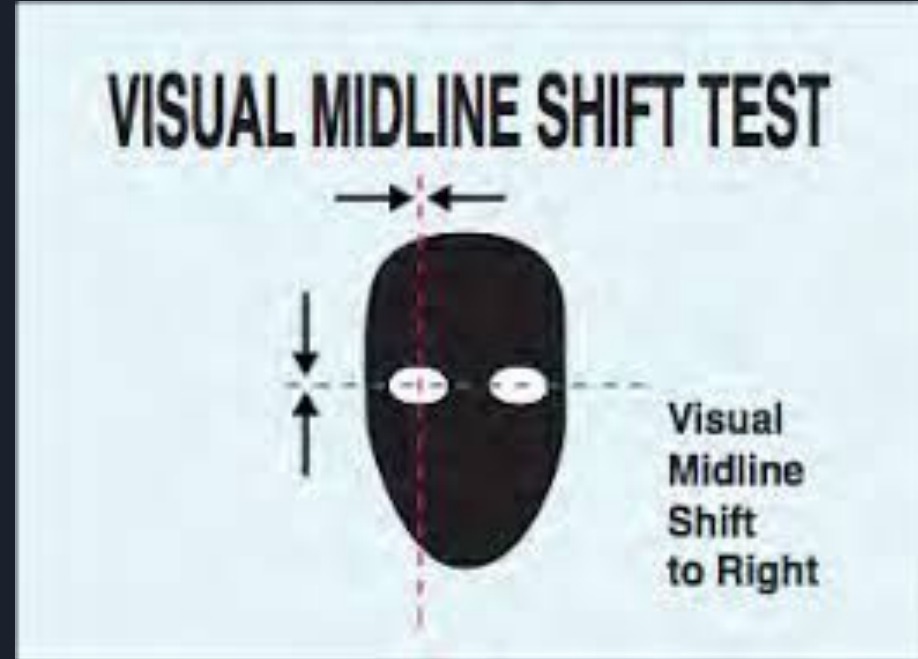


Now You Try....



Visual midline shift

- Where you think the center of his body to be.
- “The body will resolve this mismatch by leaning either toward the affected side, (uncompensated state) or away from the affected side (compensated state).” (W. Padula)
- This can be experienced as an altered posture or altered way you move through space.
- Lean and drift during ambulation correlates statistically with shift in visual midline.





Testing and treatment

-Focal/Central testing

- standing off to one side move a straight target side to side and up and down
- patient identifies where they feel it is centered

-Ambient/Peripheral testing

- patient aligns their nose with a peripheral target and then aligns their thumb

3 main phases:

1. Get the patient to identify where they are in space- balance board, OXO, Look, ready, touch, back.
2. Have them do a physical hand eye tasks while they are maintaining alignment.
3. Add speed and efficiency.
4. Add cognitive tasks
5. Try it in a mirror-artificial depth environment.

Look, Ready, Touch, Back- “Do what you say and say what you do”



Visual motion sensitivity- Post Trauma Vision Syndrome



- Not grounded, very poor spatial awareness or control
- Hold on to walls when they walk
- Come in with sunglasses, baseball cap, very sensitive to light, sound, and motion
- Often times they have been suffering for an extended period of time, which suggests this is an embedded syndrome.

Post Trauma Vision Syndrome



- Syndrome that occurs when the ambient system does not work with the focal system.
- The patient is stuck with their focal system on full blast without the structure/context of the ambient system.
- The balance between vision and motor is compromised.
- Movement becomes conscious and isolates function
- This leads to **focal binding**
 - Inability to release detail, environment becomes over-stimulating because any movement is creating chaos in their visual system.
 - Movement of the eyes is projected into the field causing movement of whatever they are looking at (ground/print).
- Focal binding can lead to postural binding

Post Trauma Vision Syndrome

- Most of these patient are considered embedded- this means that they don't navigate their world with efficiency and this causes an aberrant reaction to become automatic.
 - Those patients need to be educate about their vision and their perception of the world, and that they will most likely follow a slower recovery curve.
 - Be very careful not to do anything focal with them, if they aren't already
 - No Brock string
 - No table top scanning activities
 - No smooth pursuits
 - Position them always away from busy backgrounds or windows
 - Work on balance over base of support with smooth movement while you are holding on to them. This grounds them in space and starts creating controlled stable movements. You may need to start with eyes closed.
 - Let them wear their sunglasses/wide brimmed hat or work with them in a room with low lighting.
 - You have to get them moving in a controlled way, they will only get better once vision and movement get connected.



Testing and treatment-

Constellation of visual signs-

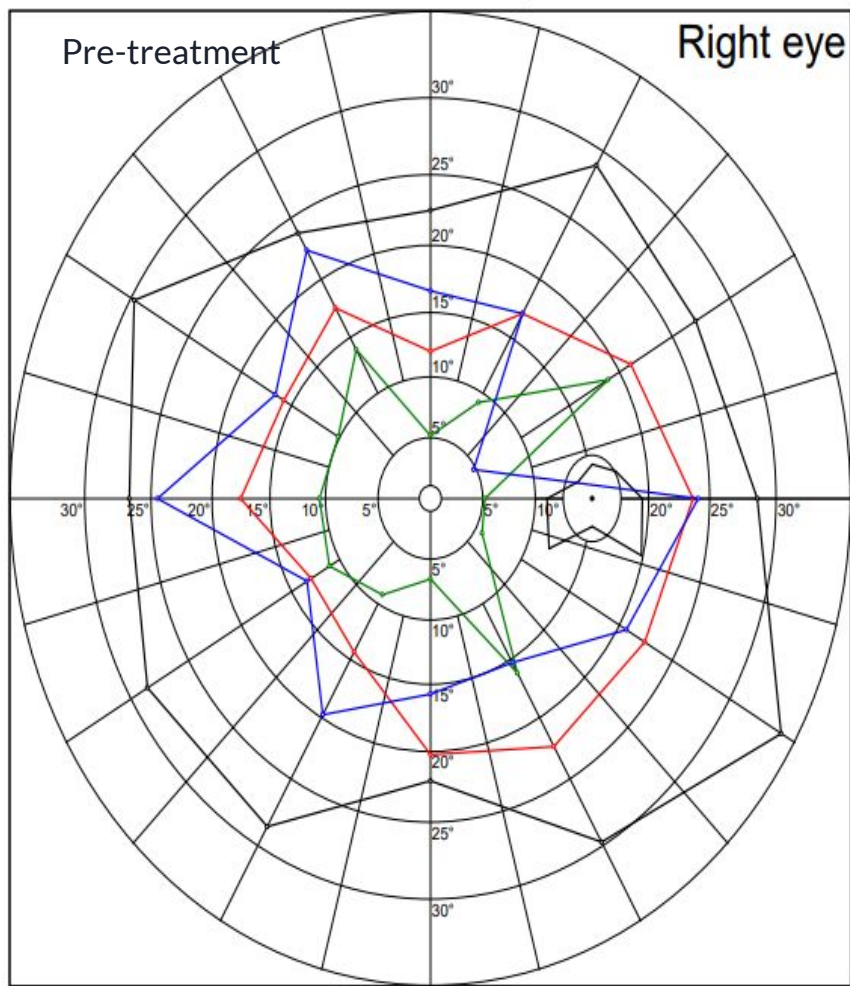
- Reduced ocular motor skills due to visual motion they perceive when tested
- Vergence component- largely an over convergence
- Visual Motion Sensitivity-THE HALLMARK
- Small Functional color fields
- Altered Visual Evoked Potential- THE HALLMARK

Treatment plan-

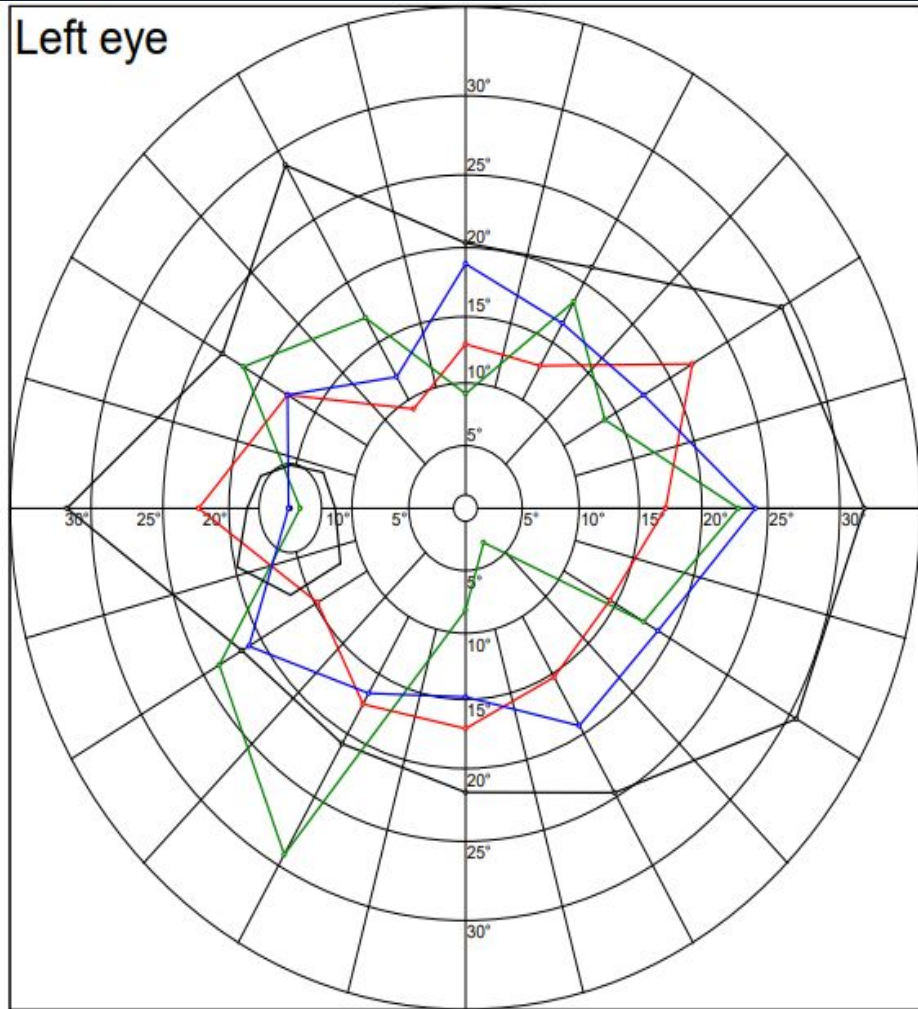
1. Stimulate peripheral motion and try interventions to improve tolerance
2. Peripheral activity without motion that they can control, to open up their periphery.
3. Hand eye coordination task to drive motor planning.

Pre-treatment

Right eye

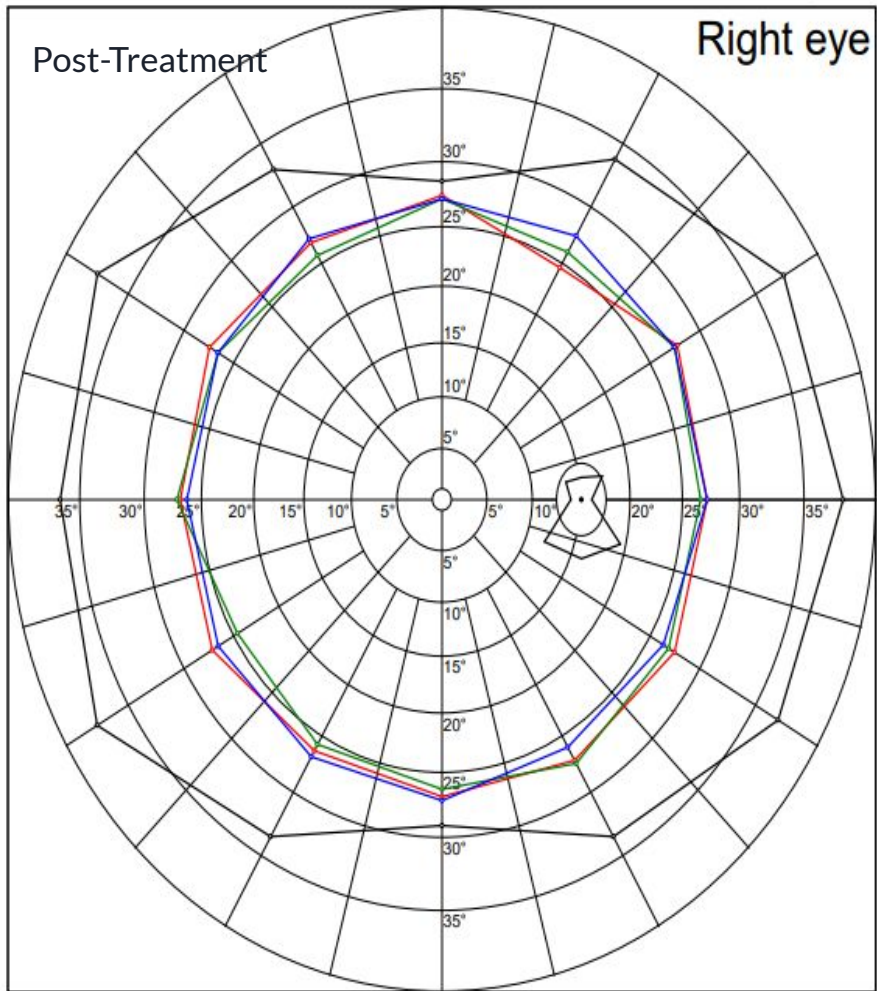


Left eye

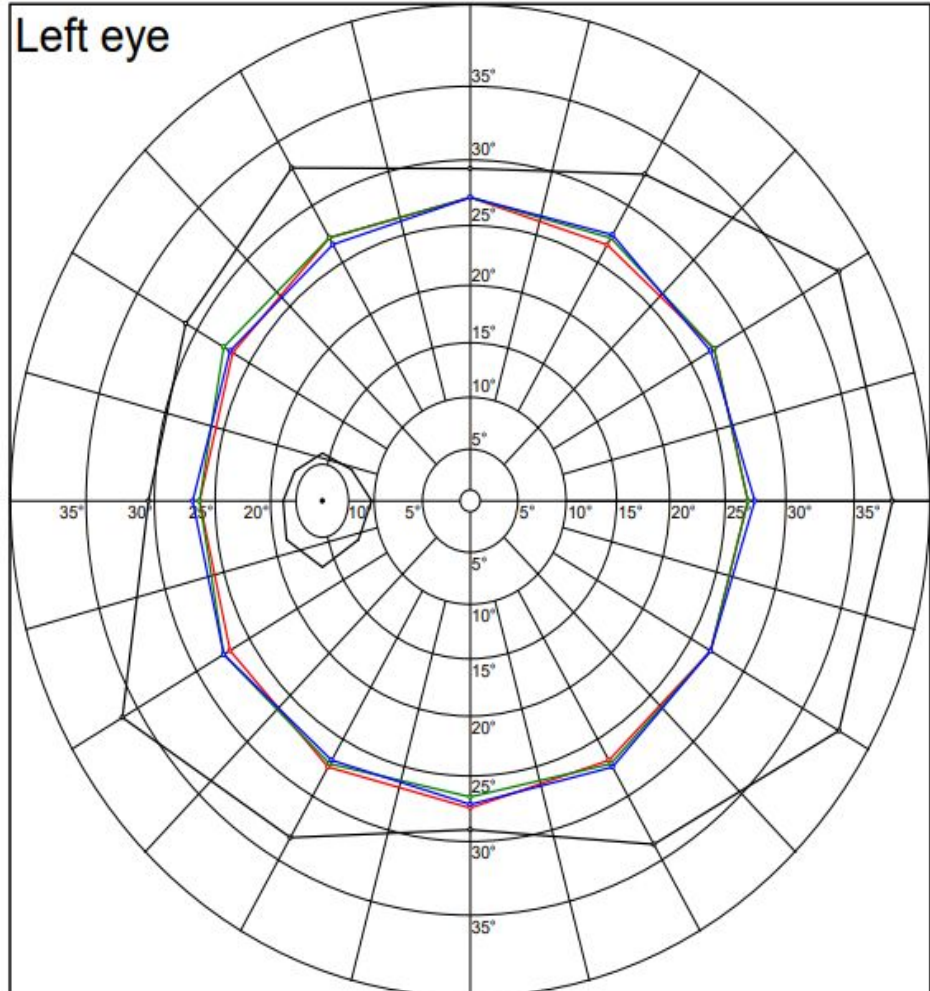


Post-Treatment

Right eye



Left eye



Neuro-Optometric Rehabilitation therapy

-Collier's Anti-gravity technique

-OKN Drum

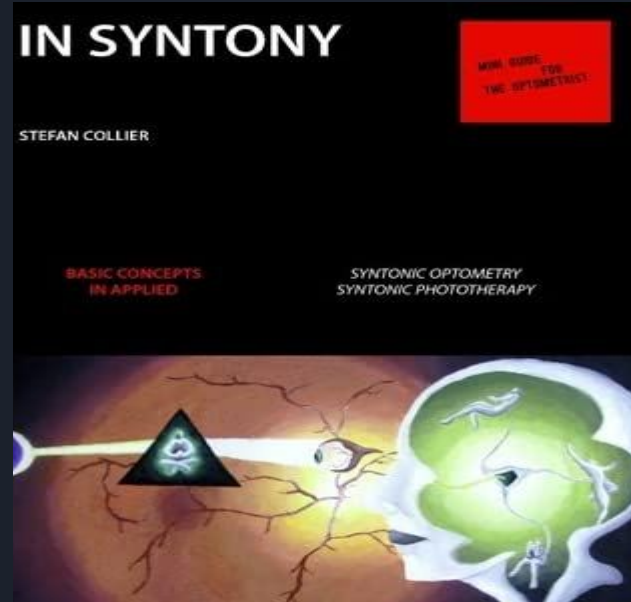
-Press Lites

-Ninja Training

-Record Player

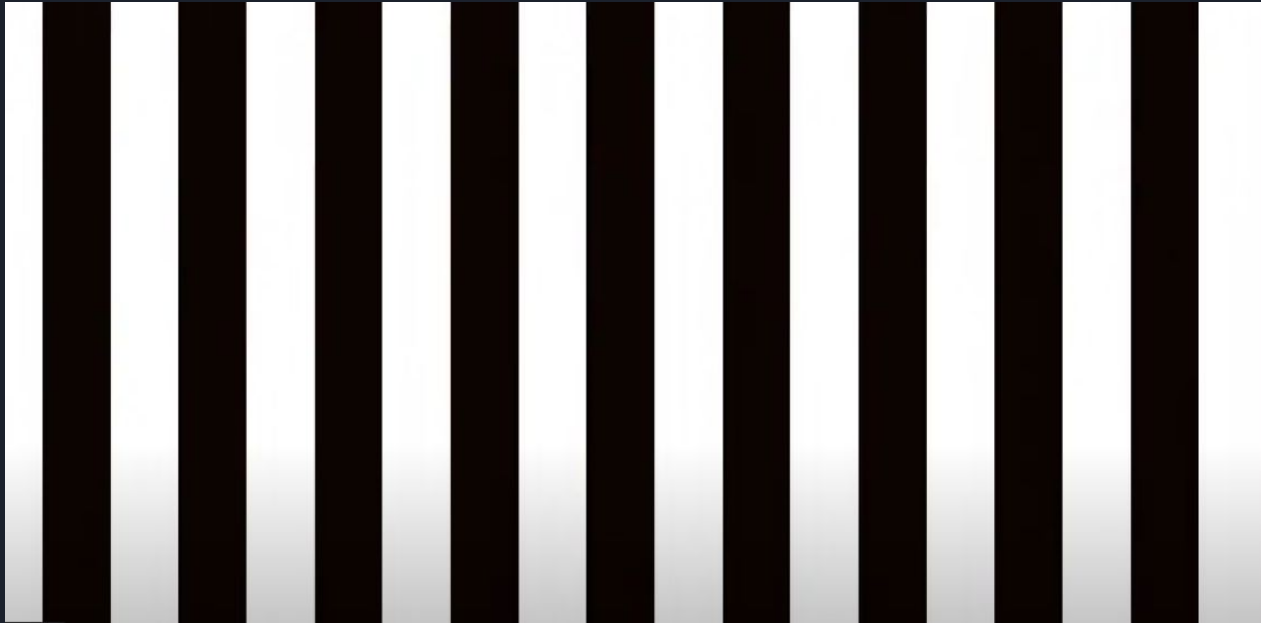
Collier's Anti-gravity technique

Combining closed eye, eye
movements with grounding.



OKN Drum

<https://youtu.be/tNqoyou1Vh4>



What this stimulates, the peripheral motion and central fixation have to be stimulated at the exact same time in order for you to see this stimulus, so this is excellent exercise for people that are focally bound, the bigger the better. Some of our therapy are trying different ways to make this stimulus more tolerable for the patient.

Press Lites example



Ninja Training example





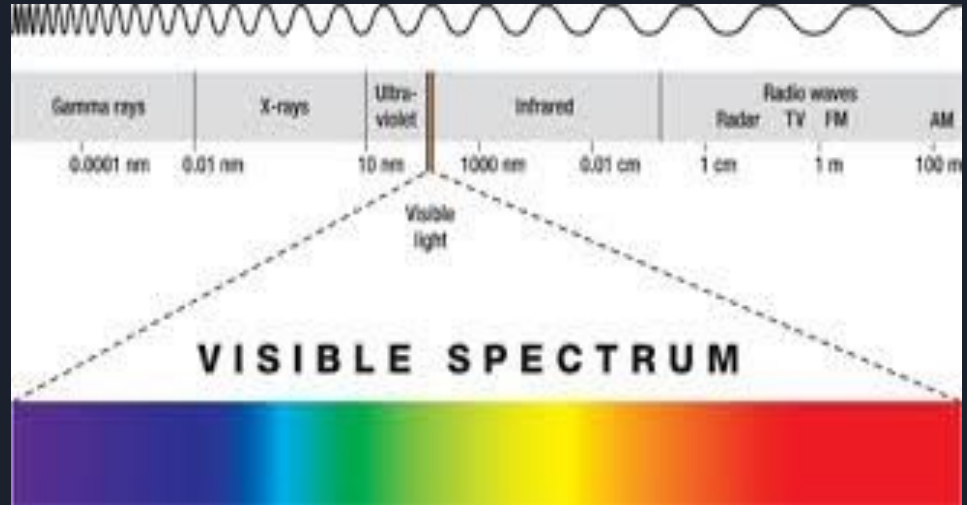
Treatment options
in addition to
Neuro-Optometric
Rehabilitation
Therapy

-Syntonics/light therapy

-Multi-sensory stimulation therapy-
“The Pinnacle”

What is Light Therapy?

- A behavioral optometric treatment in which specific visible light frequencies are shone into the eyes.
- When light enters into the eyes it travels to non-visual brain regions, namely glands such as the hypothalamus, pituitary gland, and the pineal gland.
- These glands influence chemical, electrical, and hormonal balance to the whole body, including vision.
- The goal is balance in the autonomic nervous system of the body to improve overall performance and remediate visual difficulties.



What is meant by balance in the autonomic nervous system?

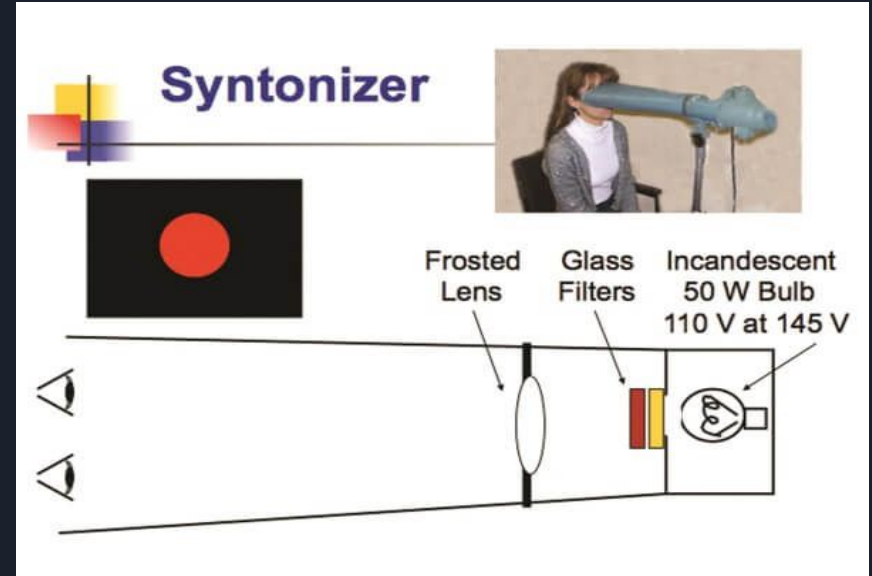
- Two separate and different pathways make up the autonomic nervous system.
 - Parasympathetic, known as the “rest and digest” system are important in controlling homeostasis and conserving energy so the body can relax and repair.
 - Sympathetic, known as the “fight or flight” system and works to speed up and tense up the body, making the body more alert.
 - You can usually feel this system kicking in when your heart starts to race and your mouth dries up, like during a stressful situation.
 - When this system is activated the body can not rest and repair and the balance becomes dysfunctional between the two systems.

How does light therapy alter the ANS?

- Slow frequency colors like red, orange, and yellow stimulate the sympathetic nervous system.
- These are low energy long wavelengths that are used for specific systemic and visual signs and symptoms.
- Fast frequency colors like violet, indigo, and blue stimulate the parasympathetic nervous system.
- Higher energy, shorter wavelengths that influence glands to emit signals to activate the parasympathetic system pushing the body to rest and heal.

What does this therapy entail?

- At a Syntonic Conference in 1999, Dan Oren, MD, PhD, researcher for Yale University and the National Institutes of Health (NIH) explained that 50% of the entire blood volume in the body passes through the eyes in 40 minutes. He further went on to explain the biochemical mechanism of light involving hemoglobin within the blood. This explained why the eyes are an appropriate entry point for the healing power of light at specific frequencies.



How do we offer this therapy?

- Most of our patients needing light therapy will get it along with vision therapy or occupational therapy.
- They purchase goggles and are prescribed a home program, 5 days of 20 minute sessions, with a 2 day break.
- We follow up with them every 3 weeks.



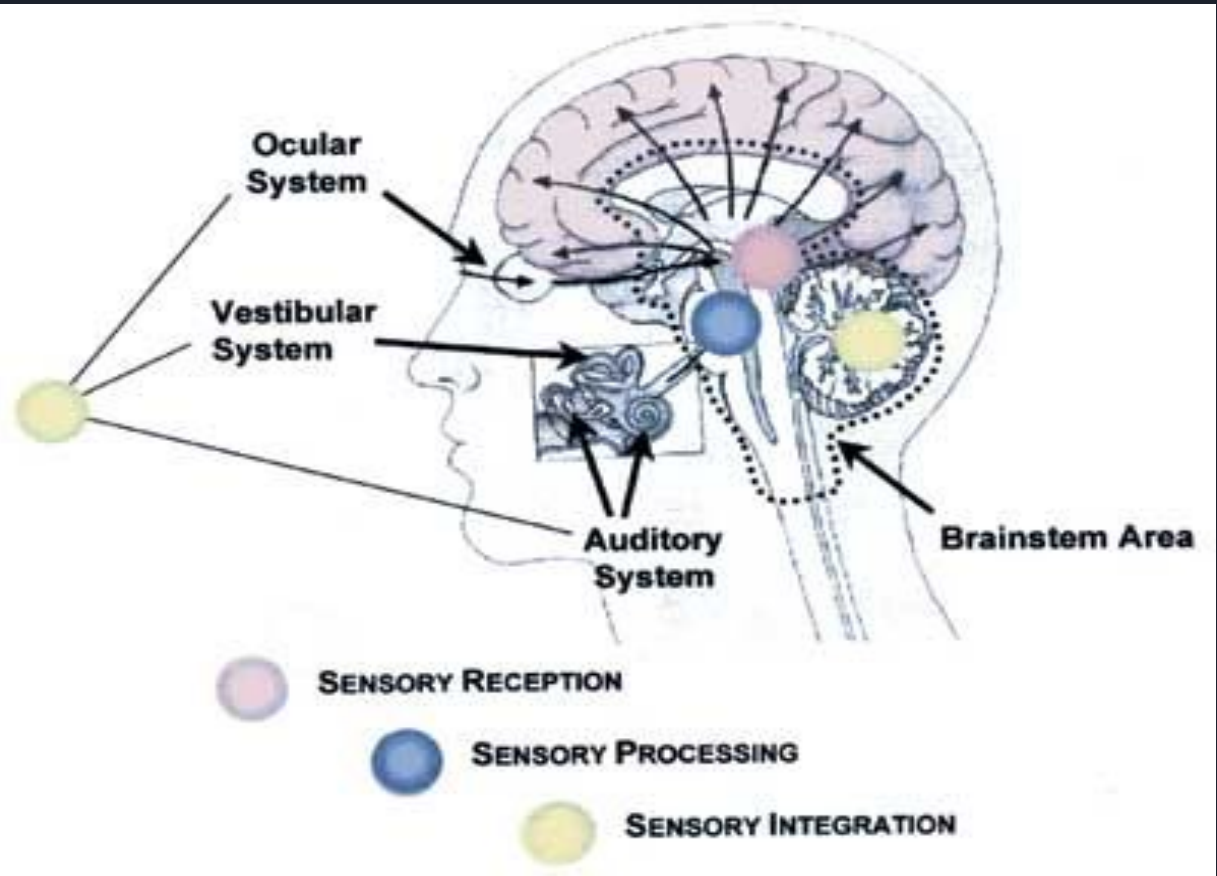
Multi-sensory Stimulation Therapy “The Pinnacle”





Bolles Sensory Learning Method- Base of our approach

“So by stimulating the senses we can enhance emergent faculties – normal subconscious sensory functioning in the brainstem area. This educational method is highly successful across a wide spectrum of populations because 'our brains are more alike than they are different.' It is a therapy that accelerates sensory integration and develops learning abilities for individuals with acquired brain injury, learning/behavioural problems, ADD/ADHD, developmental delays, autism and birth trauma. This approach re-educates emergent faculties by stimulating the participant's sensory systems to learn or relearn subconscious reception, processing and integration skills. The beneficial outcomes of the Bolles Sensory Learning Method are long lasting and continue to accrue over time. The therapy modality uses key elements of three well-established sensory stimulation therapies combined into one simultaneous sensory experience. Combining the three modalities of photo stimulation, acoustic stimulation and vestibular stimulation has remarkably accelerated sensory integration and rehabilitation processes for participants. A movement table delivering vestibular stimulation primes and unifies the nervous system arousing the brainstem area. When combined with coloured light frequencies and modulated sound frequencies, the computer-controlled instrumentation provides sessions that are at once kinaesthetic, integrative and desensitizing.”





The three principal drivers of “The Pinnacle”

- Dr. Harry Spitler- Vision

-Balancing the Autonomic nervous system and endocrine system can be obtained by a certain frequency of light administered into the eye

- Dr. Guy Berard- Auditory

- *Hearing Equals Behaviour*- “everything happens as if human behaviour is largely conditioned by the manner in which one hears.”

- Dr. Jean Ayers

-“The vestibular system is the unifying system and vestibular stimulation seems to prime the whole nervous system to function more effectively.”



What does this look like in our office?

- Program is one hour every day for 12 days.
- Continued with weekly NORT involving motion to get the newly integrated senses to work through simple motor tasks,
- Followed by 18 days of 40 minute syntonics therapy of sensory depressant to calm down the SNS and rest.
- Program of syntonics which starts with slow stimulation of the PNS and brings it into balance with the SNS.
- Program of auditory stimulation following the Berard method of auditory integration.
- Vestibular stimulation- clockwise and counterclockwise, very slowly.
- Added vibration mat that matches the auditory stimulation to integrate the proprioceptive system.
- Weighted blanket to ground the patient.



Case Examples

-SM- The firefighter that couldn't juggle

-PTVS, Focally bound, OMD, CX

-40+ sessions of NORT, CST, OT

-after Pinnacle- started reading books,
riding her bike and of course juggling!

-GD-Focally bound hiker

-Extreme light sensitivity

-20+ sessions of OT without change

-after Pinnacle- light sensitivity not
fully resolved but depth improved and
eye control improved.

Questions?

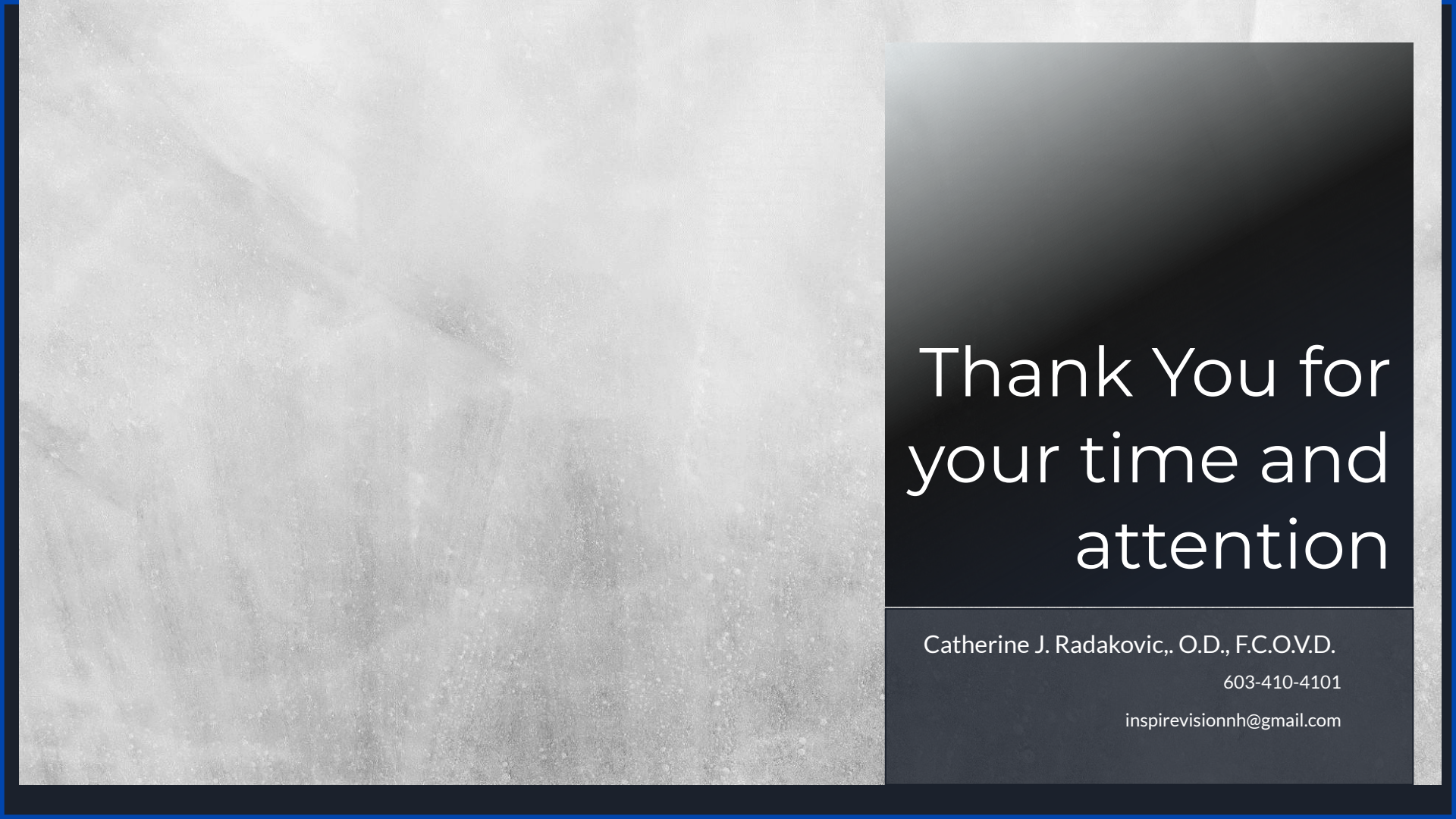


References

- Christenson GN1, Winkelstein AM. Visual skills of athletes versus nonathletes: development of a sports vision testing battery. *J Am Optom Assoc.* 1988 Sep;59(9):666-75.
- <http://www.ucalgary.ca/pip369/mod4/spatial/testingsensitivity>
- The King-Devick test is a valid and reliable tool for assessing sport-related concussion in Australian football: A prospective cohort study. *Journal of Science and Medicine in Sport* · March 2018
- Subotic, A., Ting, W., & Cusimano, M. Characteristics of the King-Devick test in the assessment of concussed patients in the subacute and later stages after injury. *PLOS.* August, 31, 2017
- K.M. Galetta, MS, J. Barrett, M. Allen, OD, F. Madda, MD, D. Delicata, MD, A.T. Tennant, EdD, C.C. Branas, PhD, M.G. Maguire, PhD, L.V. Messner, OD, S. Devick, OD, S.L. Galetta, MD, and L.J. Balcer, MD, MSCE. The King-Devick test as a determinant of head trauma and concussion in boxers and MMA fighters. *Neurology.* 2011 Apr 26; 76(17): 1456–1462. Published online 2011 Feb 2. doi: 10.1212/WNL.0b013e31821184c9
- Christina L. Master, MD, CAQSM1,2, Mitchell Scheiman, OD3 , Michael Gallaway, OD3 , Arlene Goodman, MD, CAQSM4 , Roni L. Robinson, RN, MSN, CRNP1 , Stephen R. Master, MD, PhD5 , and Matthew F. Grady, MD, CAQSM1,2 Vision Diagnoses Are Common After Concussion in Adolescents
- de Faria JML, Katsumi O, Arai M, et al Objective measurement of contrast sensitivity function using contrast sweep visual evoked responses. *British Journal of Ophthalmology* 1998;82:168-173.
- Ciuffreda et al. (2014). Proposed Objective Visual System Biomarkers for Mild Traumatic Brain Injury (mTBI). *Military Medicine.* 179.
- Craig et al. (2008). Profile of selective aspects of visually-symptomatic individuals with acquired brain injury. A retrospective study. *Journal of Behavioral Optometry.* 19(1).
- Curtis, S. (2018). Association of functional color field changes with imbalance, spatial misjudgment, and nausea in the treatment of post-concussion syndrome patients. *Journal of Optometric Phototherapy.*
- Kapoor (2002). Vision disturbances following traumatic brain injury. *Current treatment options in neurology.* (4) 271-280.
- Gallaway M¹, Scheiman M, Mitchell GL. (2017). *Optom Vis Sci.* Jan;94(1):68-73. doi: 10.1097/OPX.0000000000000935. Vision Therapy for Post-Concussion Vision Disorders.
- Groce, A., & Bansal, S. (2016). Optometric Management of Sports-related Post-concussion Visual Symptoms in Teenagers with Vision Therapy: A Case Series. *Florida Vision Development & Rehabilitation Volume 2, Issue 1*

References

- THE ADULT DEVELOPMENTAL EYE MOVEMENT TEST (ADEM) A TOOL FOR SACCADIC EVALUATION IN ADULTS A. Sampedro, J. Richman, M. Pardo. Published 2005, Psychology
- <https://www.positivehealth.com/article/learning-difficulties/bolles-sensory-learning-method#:~:text=The%20Bolles%20Sensory%20Learning%20Method,of%20an%20individual's%20emergent%20facultie>
s.
- Test-Retest Reliability of the Brain Injury Vision Symptom Survey Amber Weimer, BS1 Cory Jensen, BS1 Hannu Laukkanen, OD, MEd, FAO, FCOVD-A1 John R. Hayes, PhD, FAO1 Michael Saxerud, OD1 1 Pacific University College of Optometry, Forest Grove, Oregon
- Research Summary for Brain Injury Vision Symptom Survey: (BIVSS) COMPARISON DATA AND RASCH ANALYSIS Hannu Laukkanen, OD MEd FAO | John R Hayes, PhD | Pacific University College of Optometry| Forest Grove | Oregon | 97116
- Blog <https://visionhelp.wordpress.com/2020/04/12/look-ready-touch-back-do-what-you-say-say-what-you-do/>
- The consequence of spatial visual processing dysfunction caused by traumatic brain injury (TBI). Padula WV, Capo-Aponte JE, Padula WV, Singman EL, Jenness J. Brain Inj. 2017;31(5):589-600. doi: 10.1080/02699052.2017.1291991. Epub 2017 Apr 25. PMID: 28440687 Review.
- Modifying postural adaptation following a CVA through prismatic shift of visuo-spatial egocenter. Padula WV, Nelson CA, Padula WV, Benabib R, Yilmaz T, Krevisky S. Brain Inj. 2009 Jun;23(6):566-76. doi: 10.1080/02699050902926283. PMID: 19484630 Clinical Trial.
- Risk of fall (RoF) intervention by affecting visual egocenter through gait analysis and yoked prisms. Padula WV, Subramanian P, Spurling A, Jenness J. NeuroRehabilitation. 2015;37(2):305-14. doi: 10.3233/NRE-151263. PMID: 26484522
- Post-stroke visual midline shift syndrome. Labreche T, Wild B, Dalton K, Leat SJ. Clin Exp Optom. 2020 May;103(3):290-295. doi: 10.1111/cxo.12944. Epub 2019 Jul 18. PMID: 31321827 Review.
- Neural mechanisms underlying neurooptometric rehabilitation following traumatic brain injury.
- Hudac CM, Kota S, Nedrow JL, Molfese DL. Eye Brain. 2012 Jan 18;4:1-12. doi: 10.2147/EB.S27290. eCollection 2012. PMID: 28539777



Thank You for
your time and
attention

Catherine J. Radakovic, O.D., F.C.O.V.D.

603-410-4101

inspirevisionnh@gmail.com