

Vestibular Rehabilitation Exercises

1. Gaze stability exercises for oscillopsia
2. Habituation exercises for motion sensitivity
3. Balance and postural control exercises - both static and dynamic
4. Sensory integration exercises to facilitate improved brain processing of sensory input
5. Optokinetic stimulation to improve Visual-Vestibular Mismatch symptoms

Vestibular Rehabilitation as an Early Intervention in Athletes Who are Post-concussion: A Systematic Review

Babula et. al. 2023 (352)

- Beginning vestibular rehabilitation therapy as early as 10 to 14 days post-concussion does not appear to be detrimental to an athlete's healing and may help to reduce recovery time and time to return to sports.
- However, more data collection is needed to further determine the effectiveness of VRT as an early intervention in reducing post-concussion symptoms and decreasing recovery time before return to sport.
- Leaving vestibular symptoms untreated is shown to have long term effects and a prolonged return to play interval.
- Therefore, incorporating vestibular rehabilitation therapy into concussion recovery protocols is beneficial for the athlete's long-term health
- Early vestibular rehabilitation initiation is associated with faster recovery after sport related concussion Anderson et al, 2024

Altered Somatosensory Input from the Cervical Spine (Neck)

Multisensory Mismatch Hypothesis

- Abnormal cervical spine proprioceptive input to the CNS causes a mismatch among vestibular, visual and cervical somatosensory input
- Result is the symptoms of cervicogenic dizziness
- **Disrupted head neck position sense, impaired neck movement control, impaired balance and disturbances of the visual system**
- Can use a head mounted laser pointer to assess head relocation and head movement awareness

Adverse effects of disturbed neck proprioceptive information

- **Altered head-neck awareness**
Laser pointer head relocation test
- **Altered neck movement control**
Laser pointer head/neck movement control
- **Altered postural stability**
Cervical spine torsion test
- **Altered oculomotor control**
Smooth pursuit torsion test

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Cervicovestibular Rehab in concussion²⁶⁸

- 31 participants (12-30 yrs) with persistent symptoms of neck pain, dizziness and/or headaches
- Randomly allocated to **treatment** (8 weekly sessions)
- Both groups – postural education, ROM ex, rest until asymptomatic, graded exertion
- Experimental group: vestibular rehab and cervical spine treatment (manual therapy, exercise)
- **Results:** 1/14 (7%) in the control group and 11/15 (73%) in the treatment group returned to sport at 8 weeks

Vision Dysfunctions Post mTBI Goodrich 2013

Vision dysfunctions in patients with traumatic brain injury (TBI) from recent studies.

Study	Dysfunction (%)				
	Reading	Convergence	Accommodation	Strabismus	Pursuit/Saccades
Goodrich et al., 2007 [39]	61	30	22	~	20
Brahm et al., 2009 [10] [*]	87	48	49	7	23
Stelmack et al., 2009 [11]	50	28	47	8	6
Ciuffreda et al., 2007 [12]	~	42	41	25	39
Cap?/Aponte et al., 2012 [40]	65	55	65	0	60

^{*}Only mild TBI patient data included.

Vision Screening

- Fixation in primary and ecentric gaze
- Smooth pursuit or tracking
- VOR cancellation
- Saccades

Additional or Enhanced Vision Screening

- Many individuals, both with head trauma (concussion) or with non-traumatic vestibular impairment will benefit from an 'enhanced' vision assessment
- Strabismus – tropias and phorias
- Cover test and the Cover - uncover test
- Vergence – binocular function
- (convergence – divergence)
- Accommodation
- Ability to focus near and far quickly and accurately

Additional or Enhanced Vision Screening

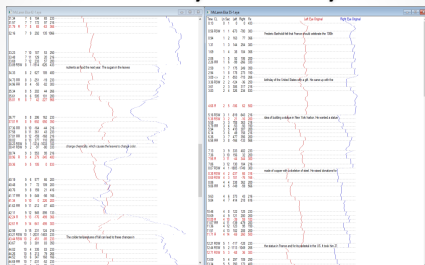
- Coloured overlays
- Perceptual visual midline shift
- Optokinetic stimulation
- Binasal visual occlusion (BNO)
- Peripheral vision is often compromised
- Need to watch how effortful the tasks are



Case Study: 12 year old female

- Referred for primarily HA associated with reading and later in the day (afternoon)
- Possible concussion in Grade 1, now in Grade 7
- No vestibular dysfunction identified
- Vision – strabismus, convergence insufficiency, accommodative infacility, symptomatic with smooth pursuit testing and to a lesser extent saccades
- Referred for neuro-optometry consult
- Engaged in vision therapy program

Case Study: ReadAlyzer



Post Trauma Vision Syndrome (PTVS)

- Constellation of problems after brain injury
- Signs and symptoms may include:
 - Eyes drifting outward
 - Eyes not working together
 - Double vision
 - Blurred vision
 - Light sensitivity
 - Visual field loss
 - Concentration difficulties
 - Reading problems
 - Poor spatial judgement/depth perception
 - Sense of midline is off



Post Trauma Vision Syndrome

- **Over focalization is relatively common**
- Results in detail first and spatial second or spatial is lost all together in severe cases
- Patients try to use their focal system for spatial relationships
- Movements in periphery become detail
- Have trouble releasing fixation
- Have trouble switching between focal and spatial systems or using the 2 systems simultaneously

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Binasal Visual Occlusion (BNO)



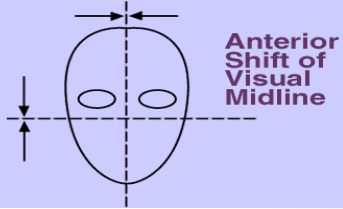
- Width of tape depends on what is comfortable for the patient
- Patients should not see the tape when the glasses are on
- Can be used for tabletop activities, moving in the environment, exercises or all of these

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Figure-Ground: How many horses do you see?



VISUAL MIDLINE SHIFT TEST



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Sensory Integration Dysfunctions

Visual-Vestibular Mismatch

- Refers to visual – vestibular integration/processing impairment
- May be present in PCS & vestibular dysfunctions
- Visual disturbances after a brain injury can be covert
- “I have frequent headaches”
- I can’t read, watch TV or work on computers for very long without symptoms
- “I don’t like being in busy environments (shopping)”
- “I keep bumping into walls/furniture”
- “I am nervous when I walk down the stairs”
- “I just just feel off a lot of the time”
- “I don’t go: to the movies, out with my friends, to restaurants or the theatre/concerts”

Visual-Vestibular Mismatch



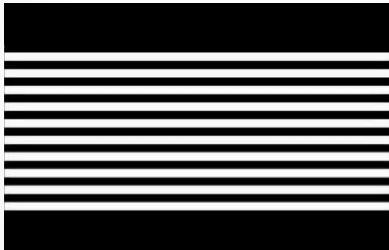
Optokinetic Stimulation

- The **optokinetic response** - combination of saccadic and smooth pursuit eye movements.
- Seen when an individual follows a moving object with their eyes, which then moves out of the field of vision at which point their eye moves back to the position it was in when it first saw the object
- **Optokinetic nystagmus (OKN)** is nystagmus that occurs in response to a rotation movement. It is present normally. The optokinetic response allows the eye to follow objects in motion when the head remains stationary (e.g., observing individual telephone poles on the side of the road as one travels by them in a car)

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Optokinetic Stimulation: Test Video



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References

- Ontario Neurotrauma Foundation
- Concussion Awareness Training Tool (CATT)
- BC Government website
- Concussion recognition tool CRT6

Thank you

www.vestibular-rehab.com