Second Annual
“Lunch and Learn”

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The See-Sick Syndrome

Practical diagnostic and treatment applications for the Primary Care OD
What we going to cover

- The clinical presentation of SSS
- Etiology and background
- Effective treatment strategies
What is the See-Sick Syndrome?

- Neuro-Ocular Vestibular Dysfunction (NOVD)
- Visual-vestibular Dysfunction (VVD)
- “Supermarket Syndrome”
Primary Symptom: Motion Sickness

- Nausea
- Dizziness
- Fatigue
- Malaise
- Drowsiness
- Depression
- Bodily warmth pallor, and/or cold sweats
Other symptoms

- Headache
- Asthenopia associated with reading
- Photophobia
- Intermittent diplopia usually with reading
- Transient blur
- Poor adaptation to new Rx
Symptoms triggered by

- Riding in a car or plane and trying to read
- Peripheral visual movement/shadows
  - Rotating ceiling fan
  - Traveling in a car on a country road
- Walking down the isle in a supermarket
- Crowds of people
- Activities that require rapid eye movement
  - Examples: watching sports, movies, etc.
Other related factors

- Non-strabismic binocular dysfunction
- Increase in symptoms with age
- Seems to be more common in females*
  - 1 in 17 female
  - 1 in 50 male

* Roderic Gillilan, O.D.
Etiology
The Vestibular Connection
What is the Vestibular System?

- Vestibular perception of orientation tells us
  - Which way is up?
  - Where am I?
  - Where am I going?
The Vestibular System is more than balance
The Vestibular System Provides

- A **motor center** to move around three dimensionally
- An **emotional center** for self regulation
- A **perceptual center** so we are not lost in space
- A **spatial-temporal center** with which to relate to objects, people and events in our world
Multisensory Awareness…
Position in Time, Space and Gravity

- Proprioception
- Tactile
- Speed, Duration, and Differentiation of Movement - Kinesthesia
- Vision
- Sound
Vision and Vestibular is…

Vision and “Where”
Visual-Vestibular Interactions – the Vestibulo-Ocular Reflex

- **Purpose:** to maintain stable retinal images during head movement
- **Both SCCs and otoliths contribute**
  - SCCs compensate for rotation (angular VOR)
    - Primarily responsible for gaze stabilization
  - Otoliths compensate for translational movement (linear VOR)
    - Comes into play when viewing near targets and head is being moved at high frequencies
- **Cerebellum plays a regulatory role**
  - if retinal image motion is >2 deg/sec, cerebellum will modify action of the vestibular nuclei
Vision & Balance

- Vision contributes 1/3 of the sensory information used to maintain balance & equilibrium
- Any mismatch of visual information could potentially exacerbate symptoms experienced with vestibular dysfunction
- Parvocellular v. Magnocellular visual components
  - P-system: foveal vision
    - The “what”
  - M-system: spatial orientation & information
    - The “where”
    - Contributes to balance, movement, coordination & posture
Symptoms of Vestibular Dysfunction

- Dizziness
  - Disequilibrium – a loss of balance without the illusion of movement
- Vertigo – the illusion of motion (of the world or of the self) when there is none
  - Usually results from a sensory mismatch between visual, vestibular, and somatosensory inputs
Vision and Vestibular Dysfunction

- **Nystagmus**
  - Horizontal: caused by acute peripheral vestibular loss
  - Vertical/torsional: typically indicates direct injury to brainstem
    - Can be caused by medication toxicity
- Disruption of VOR → gaze instability
  - The world may appear jumpy, bouncy, jerky
  - Can create oscillopsia
  - Photosensitivity/discomfort with flickering lights
- Commonly associated with vestibular dysfunction:
  - Fixation disparity, phoria (uncompensated)
  - CI, accommodative convergence dysfunction
  - VF loss
  - Visual perceptual deficits
Visual Dysfunction can Mimic Vestibular Dysfunction

- Just as flawed vestibular input can create sensory conflict, so too can unreliable visual input
  - Dizziness, photophobia, motion sickness, reading difficulties, and trouble with peripheral motion can all be present with faulty visual input
The Vestibular System: Structure

3 Main Components:
1. Peripheral Sensory Apparatus
2. Central Processor
3. Motor Output Mechanism
Outer, Middle, & Inner Ear
Peripheral Sensory Apparatus

- Resides within the inner ear
- Consists of membranous and bony labyrinths and the hair cells
Bony Labyrinth

- Made up of semicircular canals (SCCs), cochlea, and vestibule
- Contains perilymphatic fluid
Semicircular Canals

- Provide sensory input about velocity of head movement, which plays a role in stabilization of retinal images during head movement
  - The basis for the vestibulo-ocular reflex (VOR)
- 3 sets of canals within each ear that form coplanar pairs on the left and right:
  - Lateral
  - Anterior
  - Posterior
- Differing planes allows canals to sense motion along all axes
- Planes of the canals are close to the planes of the extraocular muscles (EOMs), allowing connections between sensory & motor neurons
Membranous Labyrinth

- Suspended within the bony labyrinth by perilymphatic fluid & connective tissue
- Contains sensory organs:
  - Membranous portions of SCCs
  - Utricle, Saccule (otolith organs)
- Filled with endolymphatic fluid
Otolith Organs

- Utricle & Saccule
- Respond to tilt and acceleration of linear head motion
- Like the SCCs, can respond to motion in all 3 dimensions
Hair Cells

- Sensory cells of the vestibular system
- Reside in the SCCs, utricle, and saccule
- Displacement of hair cells due to head movement $\rightarrow$ neural firing via the vestibular nerve
Central Vestibular Processing

- Two main areas to which afferent vestibular information is directed:
  - Vestibular Nuclear Complex (VNC)
    - Primary processor; responsible for fast, direct connections between afferent info and motor output
  - Cerebellum
    - Receives output from and sends input to the VNC
    - Adaptive in function; adjusts central vestibular processing as required
- At both locations, visual and somatosensory inputs are processed along with vestibular information
Vestibular Motor Output

- After extensive communication between VNC, cerebellum, ocular motor nuclei and brainstem, motor signals are generated for the extraocular and skeletal muscles, resulting in both eye and positional movements.
- The Neural Integrator, located just below the medial vestibular nucleus in the brainstem, converts velocity and acceleration signals into neural signals encoding eye position.
Vestibulo-Cochlear Labyrinth

Diagram showing the anatomy of the inner ear, including the sacculum, utriculus, and various nerves and structures.
Clinically Relevant Vestibular Function

- Linear acceleration/deceleration
  - Sacculus - vertical
  - Utricle - horizontal
- Rotary acceleration/deceleration
  - 3 semi-circular canals
    - Peri- & post-rotary nystagmus
Neurological Considerations:

System supported by many reflexes which subserve volitional behavior

Vestibulo-ocular  Vestibulo-cervical  Vestibulo-spinal
Vestibular Sensory-Motor Bridge Triads

- Vestibular-cochlear-oculomotor triad (of the head)
  - Cervical control for spatial-temporal orientation of the head supports looking and listening

- Vestibular-proprioceptive-tactile triad (of the body)
  - Cervical integration of the head and body in time and space enables static positioning and purposeful movement for meaningful, adaptive engagement in life’s activities
Vestibular Disorders

- Prevalent for all ages
- 90 million Americans (42%) will report dizziness to MD’s once in life (National Institute of Health)
- Over 1 billion spent per year in US for medical care related to balance disorders (5+ million visits per year)
- One of 25 most common reasons to seek medical care
Etiologies of Dizziness

- Peripheral vestibular problems resulting from dysfunction or injury along the vestibular pathways
- CNS disorders – seizures, traumatic brain injury (TBI), stroke, tumors
- Vascular problems – orthostatic hypotension, transient ischemic attack (TIA), migraines
- Vision related problems – spectacle adaptation, anisometropia, aniseikonia, diplopia, visual field loss, horizontal/vertical misalignments

- All can result in faulty input into the vestibular system
Vestibular Testing in Clinical Assessment

- Begins with a thorough history
Symptoms of Vestibular Dysfunction

- **Dizziness**
  - Disequilibrium – a loss of balance without the illusion of movement
    - Can result from a disruption in sensory-motor integration, double vision, impaired vestibular function, or peripheral neuropathy
- **Vertigo** – the illusion of motion (of the world or of the self) when there is none
  - Usually results from a sensory mismatch between visual, vestibular, and somatosensory inputs
Symptoms Algorhythm

- Sensation of motion VERTIGO
  - Vestibular Disorders
    - "PERIPHERAL" Physiologic (motion sickness)
    - Vestibular Neuritis
    - BPPV
    - Meniere's Disorder
  - "CENTRAL" Brainstem Ischemia
    - Multiple Sclerosis
    - Posterior Fossa Tumor
    - Basilar Migraine
- Sensation of impending faint NEAR-SYNCOPE
  - Cardiovascular Disorders
    - "CARDIAC" Arrhythmias
      - Sinus Arrest
      - Aortic Stenosis
    - "VASCULAR" Orthostatic Hypertension
      - Vasodepressor Syncope
      - Volume Depletion
      - Autonomic Insufficiency

- Patient complains of DIZZINESS
  - Sensation of losing balance DIS-EQUILIBRIUM
    - Neurologic Disorders
      - Multiple Sensory Deficits
        - Cerebellar Dysfunction
        - Nonfunctioning Labyrinths
      - Extrapyramidal Disorders
        - Drug Intoxications
        - Posterior Fossa Tumors
  - ILL-DEFINED LIGHT-HEADEDNESS
    - Psychiatric Disorders
      - Hyperventilation
      - Anxiety Neurosis
      - Affective Disorders
Vestibular Disorders and the Dizzy Patient

- Assessment of the Dizzy Patient
  - [PPT] A Practical Approach to Assessment of the Dizzy Patient
  - www.creshvts.co.uk/documents/GPDizzyPatient.ppt
Vestibular Function Tests

- Rotary Acceleration
  - Sensory Integration and Praxis Test
  - Southern California Post-Rotary Nystagmus Test
- Caloric Nystagmography Test
- Optokinetic Nystagmus Test
Vestibular Function Tests

- Linear Acceleration Tests
  - SIPT Standing and Walking Balance
  - Bruininks-Oseretsky Balance
  - Foam and Dome (Nashner & Shumway-Cook)
  - Tilt and Flat Board Reach (Fisher)
  - The Rhomberg Test
    - Standing Balance - Eyes Open/Eyes Closed (excellent screening tool for children)
See-Sick Syndrome

A disruption in the visual-vestibular neural software
See-Sick Syndrome
Clinical Presentation

- History…easy **motion sickness**
  - otherwise healthy patient
- Sensitivity to eye movement testing especially saccades
- Sensitivity to binocular testing
- Co-existing non-strabismic binocular dysfunction
  - Convergence Insufficiency most common
- OKN sensitivity
  - Example of testing
Optometric Treatment… often begins with lenses

- Minimize change (at first)
  - Avoid new cylindrical Rxs
- Equal base curves
- High quality optics
- SV versus bifocal
- Tints (especially light blue or BPI Omega tint-purplish hue)
- Explore low amounts of BD yoked (2-3pd)
See-Sick Syndrome

Treatment Protocol

- Optometric Vision Therapy
  - Office-based (with home oriented reinforcement (see handout examples)
    - Binocular, accommodative, oculomotor development
    - Central/Peripheral integration
    - Visual-Vestibular Integration
      - Vision and balance
      - Vision and movement
  - Ambient/Focal Integration
3 Treatment Examples

- Gross motor and visual-vestibular Integration
  - Infinity Walk
- Oculomotor with visual-vestibular integration
  - See-Sick Protocol
- Ambient-Focal with visual-vestibular integration
  - Yoked prism applications
Sources


Sources


