Use of Vestibular Therapy in the Concussed Athlete

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Objectives

• To discuss vestibular history clues in the office treatment of the concussed athlete
• To discuss the vestibular physical examination clues in the office treatment of the concussed athlete
• To discuss vestibular treatment modalities and return to play criteria

Introduction

• Most common head injury in athletics.
• Fewer than 10 percent result in loss of consciousness.
• Estimated 2.25 million concussions unidentified each year.
Introduction

- At risk sports include football, boxing, hockey, wrestling, gymnastics, lacrosse, soccer, cheerleading and basketball.
- Once a concussion has occurred, a player is 4 to 6 times more likely to sustain a second concussion.

Before Exam Begins

- Watch athlete walk to exam room
- CT Scan if done
- Computerized Neurocognitive Test Baseline and any post-tests
- SCAT2 or BESS Scores
- PPE of athlete with complete concussion history
- Phone number of your ATC at your athlete’s school

Key Historical Questions

- Do they have a pressure headache and does it get worse with school or exertion?
- Do they get dizzy with movement?
- Do they get fatigued at a certain point in the day?
- Are they more sensitive to light/noise?
UPMC Symptom Categorization

- Cervicogenic
  - Dysfunction to the cervical spine

- Cognitive Symptoms
  - Attention Problems
  - Dysfunction
  - Fogginess
  - Fatigue
  - Cognitive Slowing

- Emotionality
  - More emotional
  - Sadness
  - Nervousness
  - Irritability
UPMC Symptom Categorization

• Sleep Disturbance
  – Difficulty falling asleep
  – Sleeping less than usual

• Vestibular
  – Ability of ophthalmologic and neurological systems and body (eyes, brain, and body) to work together

• Ocular
  – Ability of ophthalmologic system to work appropriately
  – Are vergence and divergence appropriate
Vestibular Examination

- Anatomy
  - Central Vestibular System
    - Vestibular Nuclei
    - Cerebellum
    - Autonomic Nervous System
    - Thalamus
    - Cerebral Cortex

- Peripheral Vestibular System
  - Semicircular Canals
  - Otoliths – Utricle and Saccule
  - Vestibular Ganglia
  - Vestibular Nerve

- 2 systems affected
  - Vestibular Ocular Reflex System (VOR)
    - Stabilizes vision while head moves
  - Vestibular Spinal Reflex (VSR)
    - Balance control
Vestibular Examination

• Aural Symptoms
  – Can occur status post concussion
  – Tinnitus, fullness or hearing changes usually have worse prognostic recovery
  – Cause may be a mixed central and peripheral vestibular disturbance that allows for slower and often incomplete recovery

Vestibular Examination

• Dizziness Status Post Concussion
  – Inner Ear
    • Benign Paroxysmal Vertigo
    • Labyrinthine Concussion
    • Perilymphatic Fistula

Vestibular Examination

• Dizziness Status Post Concussion
  – Central
    • Post Traumatic Migraine Related Dizziness
    • Brainstem Concussion
    • Autonomic Dysregulation/Postural Hypotension
    • Ocular Motor Abnormalities
    • Seizure
Vestibular Examination
• Causes of Dizziness Status Post Concussion
  – Cervicogenic Dizziness

Vestibular Examination
• Ocular Motor Testing
  – Gaze holding/fixation
  – Pursuits
  – Saccades
  – Optokinetic Nystagmus
  – Convergence
  – Alignment
  – Vestibulo Ocular Reflex (VOR)

Vestibular Examination
• Ocular Motor Testing
  – 1. Gaze Fixation
    • Maintain eye fixation on target without drift
    • Tested in neutral and up to 9 planes and in light and dark
    • Look for rebound nystagmus
      – Eye movement to direction of last movement after return to center
Vestibular Examination

• Ocular Motor Testing
  – 2. Smooth Pursuits
    • Eyes follow a target
  – 3. Saccades
    • Quick movement of eyes between targets
  – 4. Convergence
    • Ability to focus on near target
    • Watch for convergence spasm

• Ocular Motor Testing
  – 5. Ocular Alignment
    • Look for misalignment — strabismus or lazy eye
    • Testing
      – Cover/Uncover Test
      – Cross Cover Test
      – Maddox Rod

• Ocular Motor Testing
  – 6. Vestibulo-Ocular Reflex (VOR)
    • Ability to focus on stationary object while moving head without blurriness or dizziness
    • Testing
      – Head Thrust Test
      – Clinical Dynamic Visual Acuity Test
      – Head Shake Nystagmus Test
Vestibular Examination

• Dizziness and Motion Dysfunction
  – Feeling of unease with fluid stimuli
  – Inability to seamlessly maneuver
  – Increased awareness of normal motion
  – Often coexists with migraine (migraine induced dizziness) or anxiety (migraine anxiety related dizziness)

• Testing
  • VOR Cancellation
  • DHI – Dizziness Handicap Inventory
  • CTSIB – Clinical Test of Sensory Integration on Balance (Foam and Dome)

Vestibular Examination

• Balance Dysfunction
  – Patient inability to hold self up or maintain posture voluntarily in a plane
Vestibular Examination

- Balance Dysfunction
  - Balance Testing
    - Patient self report (Activity Specific Confidence Scale or Falls Efficacy Scale)
    - BPPV Testing
    - Testing Platform (i.e. Biosway)
    - Balance Error Scoring System (BESS)
    - Computerized Dynamic Posturography

Vestibular Examination

- Balance Dysfunction
  - Balance Testing
    - Dynamic Gait Index
    - Functional Gait Assessment
    - HiMAT (High Level Mobility Assessment Tool)
    - Dual Cognitive Task Paradigms
    - Five Time Sit to Stand
    - Timed Up and Go Test (TUG)

Vestibular Physician Examination

Vestibular Testing

Vestibular Physician Examination

Vestibular Testing
2. Saccades Testing
   • Point-to-Point Discrimination in horizontal and vertical planes
     (Fingers 12 inches apart and patient looks between them for 15 seconds.)
   • Look for latency of onset, speed, accuracy and conjugate movement. Test failure is delayed, inaccurate saccades or disconjugate eye movement.

Vestibular Physician Examination

Vestibular Testing
3. Vestibulo-Ocular Reflex (VOR) – Gaze Stability
   • Ability to focus on stationary object while moving head without blurriness or dizziness
   • Do with examiner finger stationary and patient moving head side to side while fixing on stationary finger
   • Test in horizontal and vertical plane for 15 seconds
   • Look for inability to hold focus

Vestibular Physician Examination

Vestibular Testing
4. Fixation Suppression Test
   – Response to optokinetic stimulation
   – Patient focus on thumb as moves side to side following own thumb
   – Look for inability to follow fixated object
Vestibular Physician Examination
Vestibular Testing
5. Near Point Convergence Dysfunction Test
   – Focus on writing on pen 6 cm from nose bridge
   – Look for diplopia at greater than 6 cm

Vestibular Physician Examination
Vestibular Testing
6. Test of Near Point Accommodation
   - Cover one eye
   - Bring object to face
   - Should accommodate – see clear at 15 cm
   - Can fatigue system by bringing closer

Balance Assessment
• BESS
  – 3 Tests 6 different balance conditions lasting 20 seconds
  – Score determined by amount of errors recorded during different balance conditions – one point for each error
  – Increased error reflect increased problems with balance and coordination post concussion
Vestibular Therapy

- Helps with dizziness, vertigo, balance, and vision/visual discrimination associated with concussion
- Uses current PT and OT maneuvers
- May be used alone or as adjunct therapy

Vestibular Therapy

- Mean duration of vestibular therapy in significant concussions can be as long as 33 days

Vestibular Therapy

- 5 Main Categories of Exercise
  - Eye-Head Coordination
    - Involve movement of head and/or eyes for purpose of VOR gain adaptation, symptom habituation or oculomotor re-education
Vestibular Therapy

• 5 Main Categories of Exercise
  – Eye-Head Coordination
    • Exercises
      □ VOR x 1
      □ VOR Cancellation
      □ Smooth Pursuits
      □ Anticipatory Gaze Shifts
      □ Imagined Target
      □ Saccades

Vestibular Therapy

• 5 Main Categories of Exercise
  – Sitting Balance Exercises
    • Maintain balance while sitting upright, weight shifting side to side or bouncing

Vestibular Therapy

• 5 Main Categories of Exercise
  – Standing Static Balance Exercises
    • Patient stands with feet in place while upright or weight shifting
    • Can be asked to stand on one leg, stand on a rocker board, or stand with one foot on a step
    • Includes the sit to stand exercise
Vestibular Therapy

- **5 Main Categories of Exercise**
  - Standing Dynamic Balance Exercises
    - Patient stands and moves without walking
    - Patient may march in place, step forward, step backward, step to the side, step up and down, or turn around
  - Ambulation Exercise
    - Patient walks forward, backward, on stairs, with turns and practices braiding, skipping, jogging, and running
- **10 modifiers to describe exercise characteristics**
  - Posture
  - Surface
  - Size of base support
  - Position of trunk
  - Position of arms
Vestibular Therapy

- 5 Main Categories of Exercise
  - 10 modifiers to describe exercise characteristics
    - Direction of head movements
    - Direction of whole body movements
    - Visual input
    - Presence or absence of a dual cognitive task
    - Special circumstances

Vestibular Therapy

- 5 Main Categories of Exercise
  - Exercises are recorded in frequency and duration

Vestibular Therapy

- Most commonly prescribed exercises
  - Eye-head coordination – 95%
    - VOR x 1
    - VOR Cancellation
    - Convergence
Vestibular Therapy

• Most commonly prescribed exercises
  – Static Balance – 88%
    • Standing upright on level and foam surfaces
    • Single leg stance
    • Weight shifting exercises in various directions
    • Sit to stand

Vestibular Therapy

• Most commonly prescribed exercises
  – Ambulation – 76%
    • Forward
    • Backward
    • Walking with turns

Vestibular Therapy

• Maneuvers
  – Gaze Stability Training
  – Eye and Head Motion Training
  – Binocular Vision Exercises
    • Dot Card
    • Brock String
    • Pencil Push Ups
    • Two Targets
  – Oculo-motor Exercises
    • Increases coordination between eyes, brain and vestibular system
Vestibular Therapy

• Maneuvers
  – Epley Maneuver
    • Treats positional vertigo
  – Balance Retraining
    • Improves balance by having brain use all systems affecting balance
  – Motion Tolerance Exercises
    • Retrains brain to adapt to specific movements without dizziness
  – Exertional Tolerance Activity
    • Bike
    • Treadmill
    • Resistance Training
    • Sports Specific Activity

Vestibular Therapy

• Maneuvers
  – Cervicogenic Rehabilitation
    • Manual Therapy
    • ROM
    • Strength Training
    • Injection
    • OMT
    • Acupuncture

Vestibular Therapy

• Maneuvers
  – Exertional Tolerance Activity
    • Bike
    • Elliptical Walker
    • Stair Stepper
    • Treadmill
    • Resistance Training
    • Sports Specific Activity
Return to Play

- Never return a player who still has concussive symptoms.
- Patient requires physical and cognitive rest.
- This includes activities that require concentration and attention:
  - School Work
  - Video Games
  - Text Messaging
- If symptoms have resolved with rest, test patient with exertion.

Return to Play

- Player should proceed stepwise.
- If post-concussive symptoms recur, the athlete should drop back to previous asymptomatic level and attempt progression again in 24 hours.
- Should not be taking any pharmacological agents that may effect or change symptoms of concussion.
- Should have neuropsychological testing return to baseline.

Return to Play

- No activity
  - Complete rest
  - Recovery Phase
- Once asymptomatic for 24 hours, proceed to step 2.
Return to Play

• Light aerobic exercise
  – Walking
  – Swimming
  – Stationary Cycling
    • All Less Than 70 % MPHR
    • No Resistance Training
  • – Increase HR

Return to Play

• Sport-specific training
  – Skating drills in ice hockey
  – Running in soccer
  – No head impact activities
  – Add movement

Return to Play

• Noncontact training drills
  – Progression to more complex training drills
    • Passing drills in football
    • Passing drills in hockey
    • May begin progressive resistance training
  – Exercise, coordination, and cognitive load
Return to Play

• Full-contact training after medical clearance
  – Restore confidence and assess functional skills by coaching staff
• Return to game play

Return to Play

• No child or adolescent athlete, including the collegiate athlete, no matter the skill level, should return to play on the same day.
• Some NFL studies have shown no risk of recurrence or sequelae with same day RTP in presence of physicians with experience and rapid neurocognitive assessment.
  – However, full clinical and cognitive recovery must occur before consideration of RTP

References
