Vestibular Oculomotor Screening (VOMS) and Concussion Challenge

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Disclosures

- No disclosures to report

2

Objectives

- Describe Vestibular Ocular Motor Screening test and be able to perform test
- Identify abnormal results of VOMS
- Recognize six clinical subtypes of concussion and appropriate referral
- Discuss Concussion Challenge and exertional testing for return to play

3

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Vestibular/Ocular Motor Screening

- Brief five to ten minute screen for vestibular and ocular motor impairments and symptoms
- Results are consistent to patient response on post concussion symptom scale but does not replace VOMS
- Previous standardized concussion tests (SCAT, SAC, BESS) include assessment of vestibular spinal reflex, but not vestibular ocular reflex
- Good internal consistency, low rate of false positives
- Can be used as predictor of recovery time
- Should not be used as a stand alone for diagnosis

4

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Vestibular/Ocular Motor Screening

- Dizziness reported in 50% of concussed athletes and is associated with 6.4 times greater risk of protracted recovery (>21 days)[3]
- Athletes diagnosed with learning disabilities perform below average on baseline neurocognitive testing[1]
- Athletes with history of ankle injuries perform worse on the Balance Error Scoring System (BESS) at baseline[2]
- Different than oculomotor assessment which is looking more at function of oculomotor system versus symptom provocation
  - Different distance, oculomotor assessment assumes that the patient has normal near point convergence

5

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Vestibular and Ocular-Motor Screen (VOMS)

- Standardized Assessment of
  - Horizontal and Vertical Pursuits
  - Horizontal and Vertical Saccades
  - Near Point Convergence
  - Horizontal and Vertical VOR
  - Visual Motion Sensitivity

6

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VOMS Instructions

- Use with subjects ages 9-40 years old
  - When used outside this range interpretation may vary
- Provocation of symptoms can help direct further assessment or referral for further assessment
- Equipment
  - Tape measure (cm)
  - Metronome
  - Target with 14 point font
- Assess baseline symptoms
  - Record headache, dizziness, nausea, and fogginess on 0-10 scale prior to beginning screening

7

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Horizontal and Vertical Pursuit

- Assess the ability to follow a slow moving target
- Both patient and examiner are seated
- Patient is asked to visually track examiner's finger at a distance three feet from the patient, moving slowly in horizontal and vertical directions in an "+" pattern 1.5 feet in either direction (right, left, up, down) from midline, twice
- Target should be moving at a speed so it takes about 2 seconds to move from far right target to far left target
- Ask patient to rate their symptoms of headache, dizziness, nausea, and fogginess following the test

8

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Horizontal and Vertical Saccades

- Assess the ability to move quickly between two targets
- Both patient and examiner are seated
- Examiner hold two single points (fingertips) a distance of three feet apart, three feet from the patient, the patient must look 30 degrees to the left and right, then up and down, 10 reps
- Ask patient to rate their symptoms of headache, dizziness, nausea, and fogginess following the test

9

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Near Point Convergence

- Assess the ability to view a close target without double vision
- Patient is seated and wearing corrective lenses as appropriate
- Examiner is seated in front of patient observing eye movement during test
- Patient focuses on a small target (14 point font size) at arm's length and slowly moves target toward nose, patient stops when they see two distinct images or the examiner observes an outward deviation of one eye
- Examiner measures distance between the tip of the nose and the target
- Test is repeated three times
- Ask patient to rate their symptoms of headache, dizziness, nausea, and fogginess following the test
- $\geq$ 5 cm would be considered abnormal

10

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Horizontal and Vertical VOR

- Assess the ability to stabilize vision (gaze) as the head moves
- Patient and examiner are seated, examiner holds target of 14 point font at midline a distance of three feet from the patient
- Patient rotates their head horizontally, 20 degrees each direction at a speed of 180 beats/minute, for 10 repetitions, the test is then repeated with vertical head movement
- Ask patient to rate their symptoms of headache, dizziness, nausea, and fogginess following the test

11

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Visual Motion Sensitivity

- Assess visual motion sensitivity and the ability to inhibit the VOR
- Patient is standing with feet shoulder width apart facing a busy environment, with the patient's arm outstretched the patient will maintain focus on their thumb, then rotate head, eyes, and trunk as a unit, 80 degrees to the right and left at a speed of 50 beats/minute for 5 repetitions
- Ask patient to rate their symptoms of headache, dizziness, nausea, and fogginess following the test

12

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Interpretation of VOMS

- Normal control subjects report minimal to no symptoms during VOMS and have normal NPC distance (≤5 cm)
- VOMS symptom scores > 2 and NPC distance ≥ 5 cm represent clinically useful cut-offs
- Three VOMS items (VOR, VMS, NPC distance) resulted in 89% accuracy for identifying patients with concussion
- Any individual VOMS item with score ≥2 increases the probability of being concussed by at least 46%[3]
- NPC distance of ≥5 cm increases probability of concussion by at least 35%[3]

13

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Interpretation of VOMS

- Useful with other tools to identify a concussion
- For convergence insufficiency, pursuit and saccade abnormalities, refer to either a Vestibular PT (if mild) or Neuro OT/Vision specialist (if moderate to severe) to evaluate and treat
- Can indicate a vestibular and/or ocular motor issue and may indicate proceeding to additional oculomotor exam, especially beyond the acute stage

14

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Clinical Subtype for Concussion

- Cervical
  - Symptoms typically include neck pain and headaches radiating from neck, extremity numbness and tingling
  - High impact like MVA, blindsided hit, rotational component, may have history of neck pain
  - Likely can be treated by any outpatient PT by addressing neck pain
  - VOMS results: likely normal
- Vestibular
  - Symptoms typically include dizziness, imbalance, nausea, visual-spatial disorientation
  - History of motion intolerance/sickness or migraines
  - Would benefit from a referral to vestibular or concussion therapist
  - VOMS results: VOR, VMS provoking symptoms

15

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Clinical Subtype for Concussion

- Ocular
  - Symptoms typically include blurred, double vision, frontal headache with reading and computer work, pressure behind eyes, light sensitivity
  - History may include past ocular dysfunction resulting in eye patch, prisms, reading glasses
  - Would benefit from referral to OT for vision therapy
  - VOMS results: Smooth pursuit, saccades provoking symptoms, NPC ≥5cm
- Cognitive/Fatigue
  - Symptoms improve in the morning, increase during the day, worse with activity (cognitive or physical), mental fogginess, memory deficits
  - History of sleep disorders, stress, lack of structured schedule
  - Would benefit from referral to OT or SLP to address cognitive deficits
  - VOMS results: likely normal

16

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Clinical Subtype for Concussion

- Post Traumatic Migraine
  - Symptoms include variable headache, at times severe, nausea, photophobia, phonophobia, poor sleep, vision issues, numbness and tingling
  - History of migraine prior to injury, history of ice cream headaches, motion sensitivity or vestibular disorder
  - May benefit from follow up with referring provider
  - VOMS results: likely normal
- Anxiety/Mood
  - Symptoms may include sleep dysfunction, catastrophizing, hypervigilance, irritable, drowsy, foggy, difficulty concentrating
  - History of anxiety personal or family, migraine
  - May benefit from follow up with referring provider
  - VOMS results: normal or mildly provocative

17

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Concussion Challenge

- Exertional testing to assist in clearing patients for return to sport
- One piece of return to sport, should be using conjunction with results from neurocognitive testing (ImPACT) and performance in PT/OT
- No formal research has been done regarding exertional testing
- Tool has been adapted from other groups who are doing exertional testing for return to play

18

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Concussion Challenge

- Monitoring heart rate, symptoms of headache, dizziness, nausea, fogginess during activity
- Pre and post test VOMS
- Pre and post test Balance screen
- Exertional testing including 30 minutes of aerobic activity and high level movements to challenge the vestibular in all planes (rotation, forward, backward, vertical, lateral)
- Stopping test if symptoms rise >5/10 on any symptom scale, but okay to resume falls below 5/10 within 5 minutes
- Report results to MD who ultimately makes the decision regarding return to play

19

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20

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21

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