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Physical Therapy Management of Concussion

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Evaluation

- Balance
- Outcome Measures
- Oculomotor
- Cervical
- Exertion
- Reaction time and Divided attention

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Balance

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Balance

- There are two types of balance: static and dynamic
- Balance is composed of three main systems:
  - Visual
  - Proprioception
  - Vestibular

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Balance

- mCTSIB
  - Traditional versus computerized
- Bertec Cobalt
  - Assessment of balance with Head Shaking and Visual Motion Sensitivity
    - Performed on a force plate which measures sway with and without compliant surface
- Functional Gait Assessment

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Balance

- BESS test
- Sharpened Romberg
  - Eyes open and eyes closed
- Single leg stance
  - Eyes open and eyes closed

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Outcome Measures

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Outcome Measures

- Dizziness
  - Dizziness Handicap Inventory (DHI)
    - Adult
    - Youth
    - Pediatric
  - Patients answer 25 questions, subgrouped into functional, emotional, and physical components

- Headache
  - HIT-6
  - Headache Disability Index (HDI)

- Cervical
  - Neck Disability Index (NDI)

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Outcome Measures

- Anxiety
  - Hospital Anxiety and Depression Scale (HADS)
- Vision
  - Developmental Eye Movement (Adult –ADEM)
  - King Devick
- Migraine
  - Migraine Disability Assessment (MIDAS)

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Oculomotor

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Major Oculomotor Gaze Systems

- Eye movements are controlled by 4 major systems
  - **Saccadic**- for rapid eye movements to bring new objects being viewed on to the fovea
  - **Smooth Pursuit**- for eye movements to keep a moving image centered on fovea
    - CN III. Oculomotor: eye movement (dilation of pupils, follow the target)
    - CN IV. Trochlear: eye movement (look down)
    - VI. Abducens: eye movement (look lateral)
  - **Vestibulo-ocular Reflex**- keeps image steady on fovea during head movements
  - **Vergence**- to keep image on fovea predominately when the viewed object is moved near

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Spontaneous/ Fixed Nystagmus

SPONTANEOUS-

- Simple test! Hold patients head still while they look at you. Will not see unless in the acute stage
- Observe for nystagmus

FIXED GAZE NYSTAGMUS

- Hold patient's head stationary
- Use your finger or pen and take patient to 30 degrees left, right, up and down from center and hold gaze
- Observe for any nystagmus at 30 degrees angle
- DO NOT TAKE TO END RANGE!!!

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Smooth Pursuits

- Holds images of a moving target on the retina
- Simultaneously performed with OMROM testing
- Keep target between 2-3 feet from patient
- 60 degree total arc to avoid end range nystagmus
- Do not move finger too fast (maximum 60 degrees per seconds)

- **Positive findings: Saccadic intrusion**

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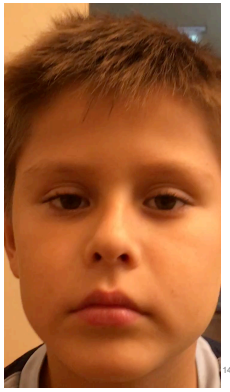
Horizontal Smooth Pursuit



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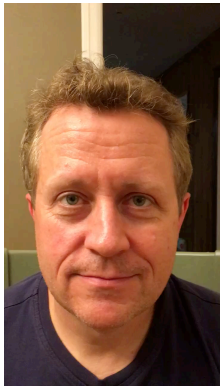
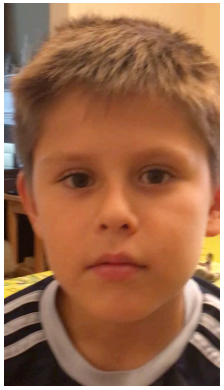
Vertical Smooth Pursuit





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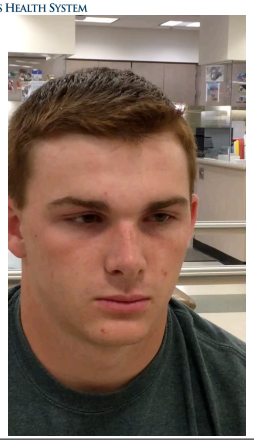

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Saccades

- Rapid conjugate movements of the eyes to pace the object of interest on the fovea
- Have patient look between 2 targets approximately 15 degrees apart
- Nose, pen, nose, pen in left right and up and down
- Looking for number of eye movements it takes for patient's eyes to reach target

- **Positive findings: hypometric and hypermetric (cerebellar) or inability to increase speed**

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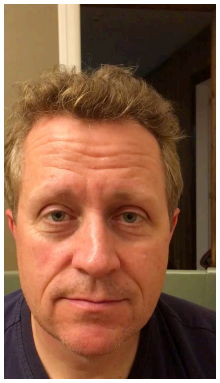
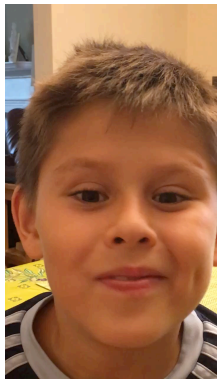
Horizontal Saccades





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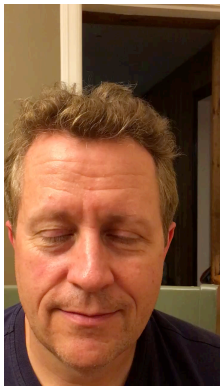
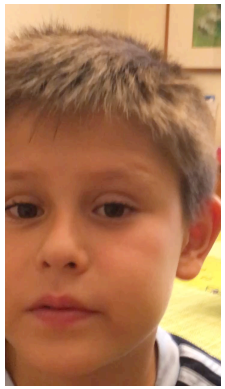
Vertical saccades





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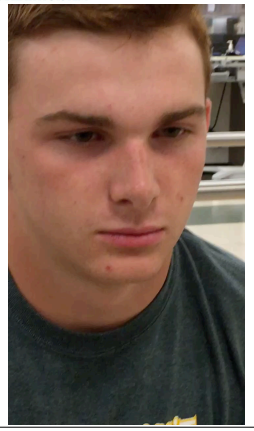

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VOR

- Tilt patient's head down 30 degrees
- Start slowly moving head side to side while they focus on your nose, gradually increasing speed
- Repeat in vertical plane
- Pace:120 bpm

- **Positive findings:Patient unable to stabilize gaze on nose**

http://www.springdaleclinic.com/wp-content/uploads/2012/11/dizzy-girl.jpg

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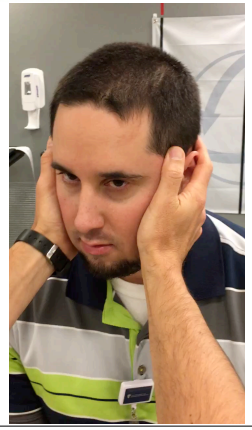

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VOR Cancellation

- Grasp patient's head and tilt forward 30 degrees (HC is in horizontal plane)
- Have patient look at your nose while you and the patient move side to side
- Repeat in vertical plane
- Pace: 60 bpm

- **Positive findings: saccadic intrusion**

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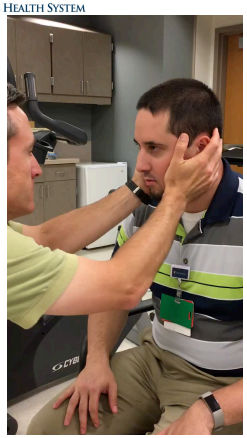

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Convergence

- Hold patient's head stable with finger 2 feet away
- Ask patient to focus on your finger while you move it towards patient's nose
- Eyes should converge and pupils should constrict
- Ask when the patient sees 2 fingers (pens) or it becomes blurry
- Convergence should be sustainable from 6 to 10 cm from forehead

- **Positive findings: Greater than 10 cm**

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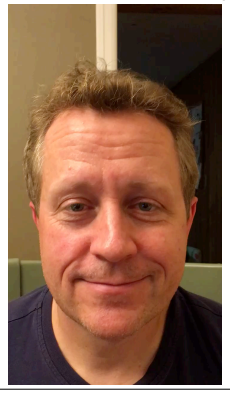
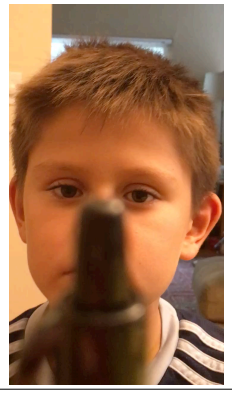
Convergence





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Accommodation

- A reflex action of the eye, response of focusing on a near object, then looking at a distant object
- In testing, the therapist will test binocular vision for convergence. Ask the patient to close one eye to check for accommodation / monocular vision
- Start close to the eye then patient move the target out until just able to read and measure the distance from target to cheek
- The reflex is dependent on CN II (optic) and CN III (oculomotor) for changes in the shape of the lens; assisting with focus on vision

- **Positive findings: Age group normative data**

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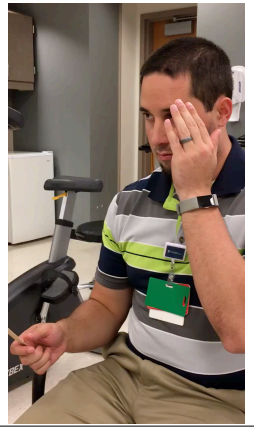

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Visual Acuity/Dynamic Visual Acuity

Visual acuity (VA) is acuteness or clearness of vision, which is dependent on the sharpness of the retinal focus within the eye and the sensitivity of the interpretative faculty of the brain.

- First ask the patient to read the eye chart until he/she can read to the lowest line possible
- Tilt the head 30 degree down and turn your patient's head side to side at 120 bpm and the patient is asked to read to the lowest line that they can.
- Repeat vertical (no need to tilt the head)

Positive findings: Greater then 2 lines difference both vertically and horizontally

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Optokinetic Reflex

- Optokinetic reflex (response) allows the eyes to follow objects in motion while the head is stationary. It is a combination of slow-phase and fast-phase eye movements

- **Positive findings: Decreased "nystagmus"**

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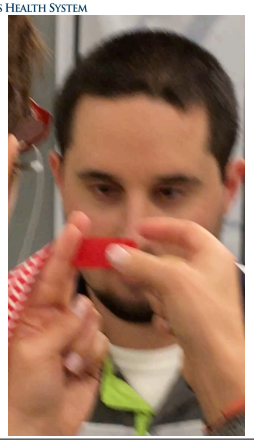

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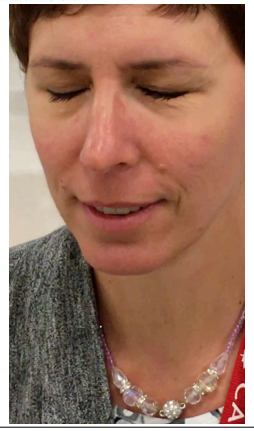

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Visual Motion Sensitivity

- Clinical technique to measure motion-provoked dizziness in patients with vestibular disturbances
- **Positive findings: Reproduction of symptoms**

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Cervical

- Assess if
  - Unilateral headaches
  - Whiplash
  - Pain
  - Stiffness
- Cervicogenic dizziness
  - Head-Neck differentiation test
  - Joint position error test
  - Smooth pursuit neck torsion test

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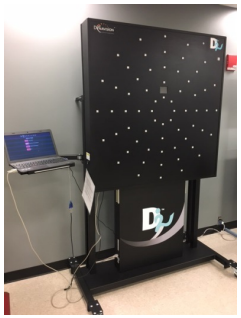
Exertion

- Exertion protocol
  - The Buffalo Treadmill Concussion Test
    - "Graded exercise on a treadmill until the participant reaches maximum exertion or experiences an exacerbation of symptoms" Leddy and Willer 2013
  - **Bike protocol to decrease motion sensitivity**
- **Positive findings: Increased symptoms from baseline**

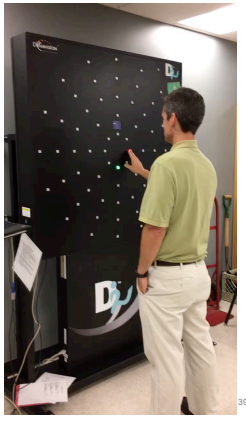
Reaction time and Divided Attention

- Dynavision
  - Concussion test



Concussion Evaluation Protocol

- Two baseline tests and three memory tests of graded complexity
  - Baseline test 1
    - Touch the target as quickly as they can
  - Baseline test 2: reaction time
    - Right and Left hand
      - 4 choice
      - 8 choice
      - 1 choice



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Graded Memory Tests

- Memory test 1
  - The patient touch the lights as fast as possible (light speed at 1 sec)
  - Call out loud the number in t-scope (1 digit number)
  - Program runs for 1 minute

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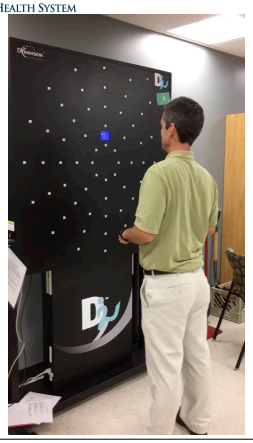

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Graded Memory Tests

- Memory test 2
  - The patient touch the lights as fast as possible (light speed at 1 sec)
  - Call out first number, remember the second number and call out the sum (1 digit number)
  - Program runs for 1 minute

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Graded Memory Tests

- Memory test 3
  - The patient touch the lights as fast as possible (light speed at 1 sec)
  - Call out first number, remember the second number and call out the sum
  - 20% green lights – when patient sees a green light, call out "green" but does not hit the green buttons
  - Program runs for 1 minute

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Study Proposal

- Using the Dynavision D2 "concussion protocol" to assist in determining the need for speech pathology referrals
- Compare the "concussion protocol" results with the MoCA results
- Possible limitations
  - MoCA
  - Memory tests
  - Small number of participants

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Treatment

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Treatment! Treatment! Treatment!

•**Adaptation** –Refers to the ability of the Vestibulo-ocular Reflex to undergo changes through exercises involving vision and head motion

•**Substitution** –other strategies to replace lost/impaired function (strength, ROM, proprioception, assistive device, activity modification, visual tracking)

Improve Postural Stability through vision

•**Habituation**–"based on the concept that repeated exposure to provocative stimulus will result in a reduction in the pathological response to that treatment" (Herdman & Clendaniel, 2014, p.399)

Treatment Strategies

- Treat positive findings (including symptom reproducing tests)
- Frequent symptoms check as an assessment for progression of therapy
- Always try to challenge the vestibular spinal reflex
  - Decreased base of support
    - Feet together
    - Semi-tandem
    - Tandem
  - Progress onto compliant surface
    - Close cell foam (airex)
    - Open cell foam
    - Rocker board
    - Bosu ball
  - Ambulation
    - Forward/backward

Treatment Strategies

- Include cognitive task to improve ability to perform dual task

Example of treatment progression

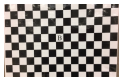
- Smooth Pursuit
  - Tracking target
    - Progression :
      - Increasing repetition or time
      - Increasing speed up to 60 degrees per second
  - Changing target
    - Plain letter on a card
    - Busy background
    - Marsden ball
    - Target on mirror
  - www.eyecanlearn.com

Example of treatment progression

- Saccades
  - Eye movement
    - Eye movement only
    - Eye /head movement
  - Time and Speed
    - Increase the speed and the duration of the exercises
  - Complexity
    - 4 panel
    - Hart chart
  - Computerized/Dynavision

Example of treatment progression

- Gaze stability
  - Speed
    - Progress to 120 bpm for general population
    - Progress to up to 150 bpm for athlete/high level patient
  - Target
    - Plain
    - Increasingly busy background
  - Complexity
    - ViewingX1
    - Viewing X2



Example of treatment progression

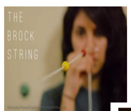
- VOR cancellation
  - Speed
    - Start 60 bpm
  - Target
    - Plain
    - Increasingly busy background

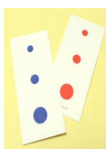
Example of treatment progression

- Motion sensitivity/Optokinetic
  - Repeating pattern ribbon
  - Motion sensitivity test as a treatment
  - Optokinetic video https://www.youtube.com/watch?v=kAPtu1WTHYc
  - Disco ball
  - YouTube videos
  - Riding escalator

Convergence Exercises

- Pencil Push Ups
- Brock String
- Dot Card
- Convergence fusion pictures





Accommodation

- Hart chart
- Poems

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Intervention after Concussion

- There as been a change in the “rest “ formula for concussion patient, from complete rest to relative/ active rest
- Evidence exist that sub-symptom-threshold and submaximal exercise have been shown to be safe and may benefit in facilitating recovery. Leddy et al. 2010

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Intervention after Concussion

- From the Consensus statement on concussion in sport -2016

“ The Berlin expert consensus is that the use of the term “persistent symptoms” following SRC should reflect failure of normal clinical recovery- that is, symptoms that persist beyond expected time frames (i.e. > 10-14 days in adults and > 4 weeks in children)”

- Preliminary evidence supporting
  - Individualized symptom-limited aerobic exercise
  - Targeted physical therapy program for cervical or vestibular dysfunction
  - Cognitive behavioral therapy for mood and behavioral issues

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Intervention after Concussion

- Reneker et al. advocates for early intervention to shorten recovery in Sport Related Concussion
  - Interventions included vestibular therapy,oculomotor, neuro-motor retraining and manual therapy
  - Intervention was as early as 10 days
  - Recovery time was shorten. The median time for medical release was 10.5 shorter than the control group

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