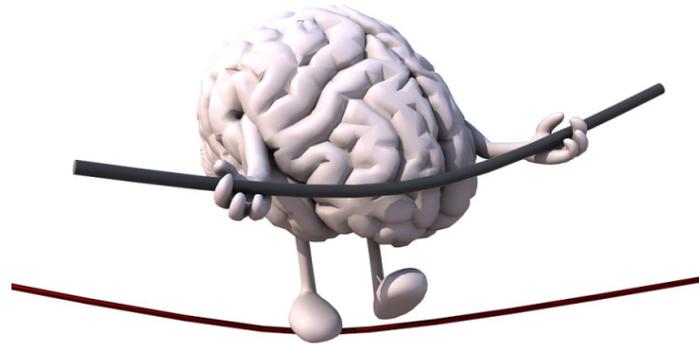


# A Journey Through Post Concussion Syndrome and Vestibular Rehabilitation



Dr. Stacey Gaven, LAT, ATC



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# Presenter Conflict

## No Conflict

- The views expressed in these slides and today's discussion are mine unless otherwise noted
- Participants must use discretion when using the information contained in this presentation



# Objectives

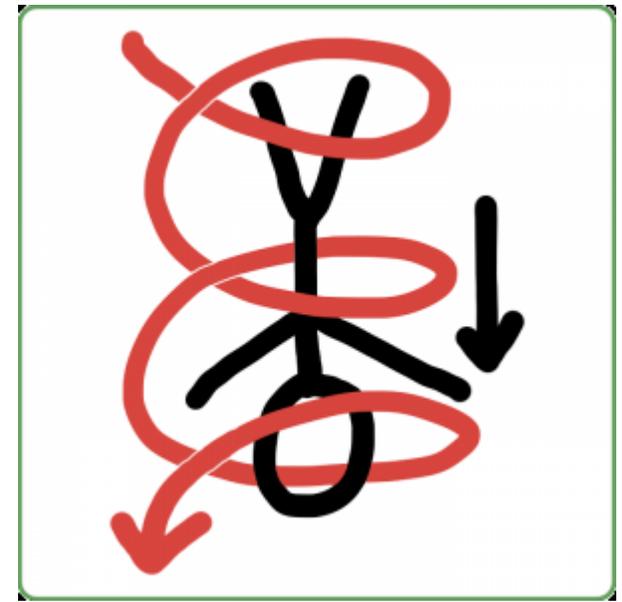
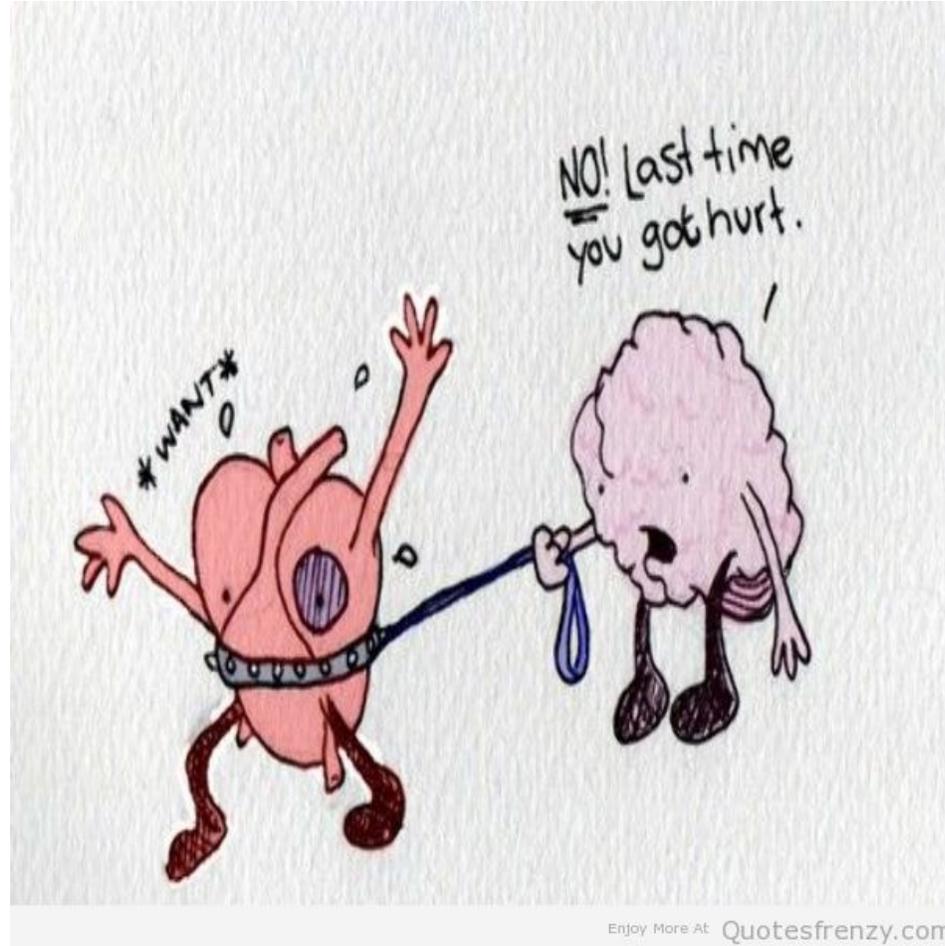
- Understand the need for further evaluation of the individuals with reports of dizziness, balance deficits, and lingering concussion symptoms
- Provide a recommendation on patients that may benefit from the integration of vestibular rehabilitation
- Describe the effectiveness of vestibular rehabilitation in the reduction of concussion symptoms in patients with prolonged symptoms of concussion
- Integrate vestibular rehabilitation techniques into clinical practice



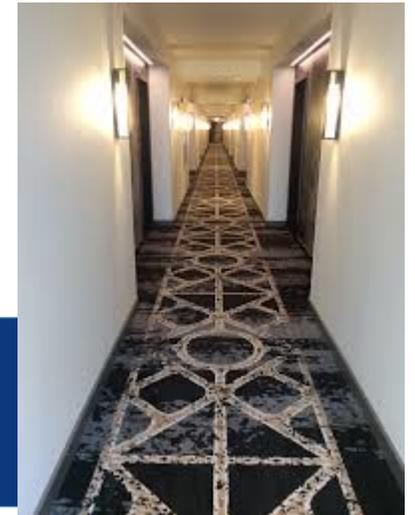
# My journey in dealing with post concussion syndrome

- Suffered 3 Concussions Freshmen Year in HS
  - One in soccer, basketball, and softball
- Suffered 4<sup>th</sup> Concussion Senior Year in HS
  - Significant Short-Term Memory Loss
- No Concussions during Collegiate Soccer Career
- Suffered 4 Concussions during Semi-Pro Career
  - 5<sup>th</sup> Concussion was accompanied by bulging discs of C4 and C5
  - 7<sup>th</sup> Concussion was accompanied by a Fx of Superior Orbital Rim: took around 6 months to recover
  - 8<sup>th</sup> Concussion: Ended Soccer Career
    - Had symptoms for over 2 years post concussion

# The Struggle.....



# Beyond the playing field....



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- Medical professionals need to address the functional capacity of systems affected by concussion to ensure safe return to play. (Ingriselli et al., 2014, Johnston et al., 2004)
- Best practices suggest that the assessment of vestibular function through cranial nerve, oculomotor and balance assessments are an important aspect of concussion management. (Valovich-McLeod & Hall, 2015)
- Sports related concussions are heterogeneous and require an individualized clinical approach. (Collins et al., 2014)



# Tools in the Toolbox...Initial Assessment



Name: \_\_\_\_\_ Date / Time of Injury: \_\_\_\_\_ Date of Assessment: \_\_\_\_\_ Examiner: \_\_\_\_\_

**What is the SCAT3?**  
The SCAT3 is a standardized tool for evaluating/assessing athletes for concussion and can be used in settings apart from 1:1 cases and clinics. It supersedes the original SCAT and the SCAT2 published in 2008 and 2009. **Important!** For younger patients, ages 12 and under, please use the **CHILD SCAT3**. The SCAT3 is designed for use by medical professionals. If you are not qualified, please use the Sport Concussion Recognition Tool. **Practitioner baseline testing with the SCAT3 can be helpful for diagnosing post injury risk cases.**

**Specific instructions for use of the SCAT3 are provided on page 3. If you are not familiar with the SCAT3, please read through these instructions carefully. The tool may be freely reproduced for use from the distribution to individual teams, groups and organizations. Any version or any reproduction in a digital form requires approval by the Concussion in Sport Group.**

**NOTE:** The degree of a concussion is a clinical judgment, clearly made by a medical professional. The SCAT3 should not be used solely to make, or validate, the degree of concussion in the absence of clinical judgment. An athlete may have a concussion even if their SCAT3 is "normal".

**What is a concussion?**  
A concussion is a disturbance in brain functions caused by a direct or indirect blow to the head. It results in a variety of neurological signs and symptoms. Some examples listed below and most often do not involve loss of consciousness. Concussion should be suspected in the presence of any one or more of the following:

- Symptoms (e.g., headache, or physical signs (e.g., vomiting), or impaired brain function (e.g., confusion) or abnormal behavior (e.g., change in personality).

**SIDELINE ASSESSMENT**

**Indications for Emergency Management**

**NOTE:** In case of the head-injury suspicion, be associated with a severe brain injury, any of the following warrants consideration of activating emergency procedures and urgent transportation to the nearest hospital:

- Glasgow Coma Scale less than 15
- Deteriorating mental status
- Prolonged pupil injury
- Progressive, worsening symptoms or new neurological signs

**Potential signs of concussion?**

If any of the following signs are observed after a direct or indirect blow to the head, the athlete should stop participation, be evaluated by a medical professional and should not be permitted to return to sport the same day if a concussion is suspected.

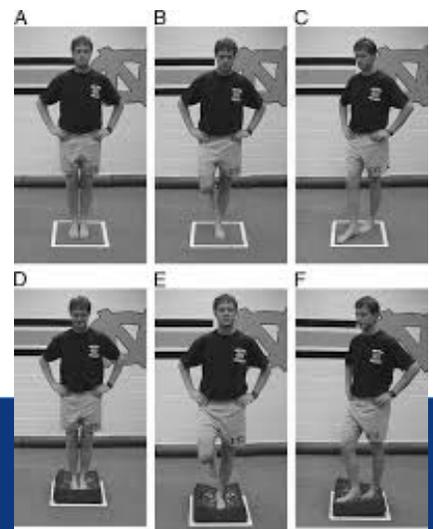
Any loss of consciousness?  Y  N  
 "Is he/she dizzy?"  Y  N  
 Balance or motor coordination is suddenly altered (swayback, etc.)?  Y  N  
 Disorientation or confusion (unable to respond to questions)?  Y  N  
 Loss of memory?  Y  N  
 "Is he/she blurry?"  Y  N  
 "Blurry or after the eyes?"  Y  N  
 Blank or vacant look  Y  N  
 Visible facial injury in combination with any of the above:  Y  N

**Any athlete with a suspected concussion should be REMOVED FROM PLAY immediately, assessed, considered for transportation to a hospital and left alone and should not drive a motor vehicle until cleared to do so by a medical professional. No athlete diagnosed with a concussion should be returned to sports participation until the day of injury.**

SCAT3 SHORT CONCUSSION ASSESSMENT TOOL 3 | PAGE 1 © 2013 Concussion in Sport Group

**Demonstration card**

**Test 1**



Nerve	Classification	Major functions	Assessment
<b>I Olfactory</b>	Sensory	Smell	Have patient identify a familiar scent with eyes closed (usually deferred).
<b>II Optic</b>	Sensory	Vision (acuity and field of vision); pupil reactivity to light and accommodation (afferent impulse)	Have patient read from a card or newspaper, one eye at a time. Test visual fields by having patient cover one eye, focus on your nose, and identify the number of fingers you're holding up in each of four visual quadrants.
<b>III Oculomotor</b>	Motor	Eyelid elevation; most EOMs; pupil size and reactivity (efferent impulse)	Check pupillary responses by shining a bright light on one pupil; both pupils should constrict. Do the same for other eye. To check accommodation, move your finger toward the patient's nose; the pupils should constrict and converge. Check EOMs by having patient look up, down, laterally, and diagonally.
<b>IV Trochlear</b>	Motor	EOM (turns eye downward and laterally)	Have patient look down and in.
<b>V Trigeminal</b>	Both	Chewing; facial and mouth sensation; corneal reflex (sensory)	Ask patient to hold the mouth open while you try to close it and to move the jaw laterally against your hand. With patient's eyes closed, touch her face with cotton and have her identify the area touched. In comatose patients, brush the cornea with a wisp of cotton; the patient should blink.
<b>VI Abducens</b>	Motor	EOM (turns eye laterally)	Have patient move the eyes from side to side.
<b>VII Facial</b>	Both	Facial expression; taste; corneal reflex (motor); eyelid and lip closure	Ask patient to smile, raise eyebrows, and keep eyes and lips closed while you try to open them. Have patient identify salt or sugar placed on the tongue (usually deferred).
<b>VIII Acoustic/Vestibulocochlear</b>	Sensory	Hearing; equilibrium	To test hearing, use tuning fork or rub your fingers, place a ticking watch, or whisper near each ear. Equilibrium testing is usually deferred.
<b>IX Glossopharyngeal</b>	Both	Gagging and swallowing (sensory); taste	Touch back of throat with sterile tongue depressor or cotton-tipped applicator. Have patient swallow.
<b>X Vagus</b>	Both	Gagging and swallowing (motor); speech (phonation)	Assess gag and swallowing with CN IX. Assess vocal quality.
<b>XI Spinal accessory</b>	Motor	Shoulder movement; head rotation	Have patient shrug shoulders and turn head from side to side (not routinely tested).
<b>XII Hypoglossal</b>	Motor	Tongue movement; speech (articulation)	Have patient stick out tongue and move it internally from cheek to cheek. Assess articulation.



# Tools in the Toolbox...Follow-Up Assessment



Vestibular/Ocular-Motor Screening (VOMS) for Concussion

Vestibular/Ocular Motor Test:	Not Tested	Headache 0-10	Dizziness 0-10	Nausea 0-10	Fogginess 0-10	Comments
BASELINE SYMPTOMS:	N/A					
Smooth Pursuits						
Saccades – Horizontal						
Saccades – Vertical						
Convergence (Near Point)						(Near Point in cm): Measure 1: _____ Measure 2: _____ Measure 3: _____
VOR – Horizontal						
VOR – Vertical						
Visual Motion Sensitivity Test						

**Instructions:**

**Interpretation:** This test is designed for use with subjects ages 9-40. When used with patients outside this age range, interpretation may vary. Abnormal findings or provocation of symptoms with any test may indicate dysfunction – and should trigger a referral to the appropriate health

CIRCLE ONE FOR EACH LISTED	NONE	MILD	MODERATE	SEVERE			
Headache	0	1	2	3	4	5	6
"Pressure in head"	0	1	2	3	4	5	6
Neck pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred or double vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitive to light	0	1	2	3	4	5	6
Sensitive to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
Trouble falling asleep	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or anxious	0	1	2	3	4	5	6

## Dizziness Handicap Inventory (DHI)

Evaluates Physical, Emotional, and Functional

Questions	Always	Sometimes	No
P1 Does looking up increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E2 Because of your problem, do you feel frustrated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F3 Because of your problem, do you restrict your travel for business or pleasure?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P4 Does walking down the aisle of a supermarket increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F5 Because of your problem, do you have difficulty getting into or out of bed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### The Activities-specific Balance Confidence (ABC) Scale\*

For each of the following activities, please indicate your level of self-confidence by choosing a corresponding number from the following rating scale:  
 0% 10 20 30 40 50 60 70 80 90 100%  
 no confidence completely confident

How confident are you that you will not lose your balance or become unsteady when you...

1. ...walk around the house? \_\_\_%
2. ...walk up or downstairs? \_\_\_%
3. ...bend over and pick up a slipper from the front of a closet floor \_\_\_%
4. ...reach for a small can off a shelf at eye level? \_\_\_%
5. ...stand on your tip toes and reach for something above your head? \_\_\_%
6. ...stand on a chair and reach for something? \_\_\_%
7. ...sweep the floor? \_\_\_%

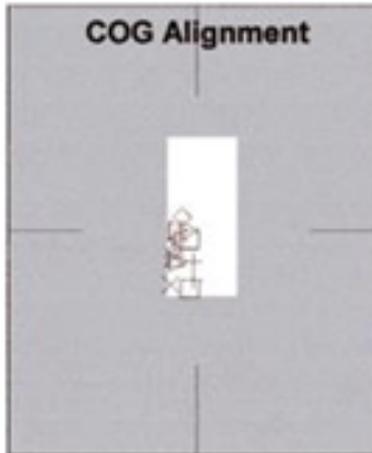
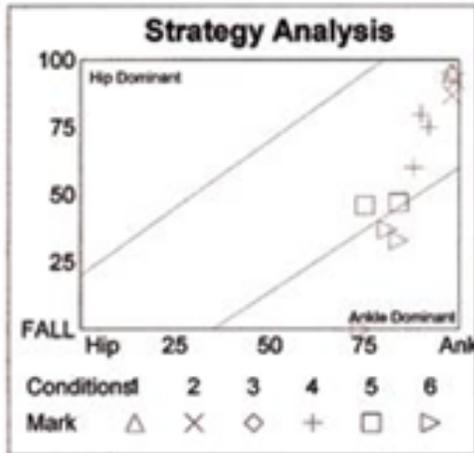
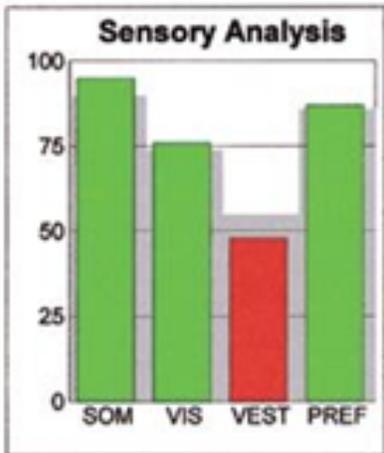
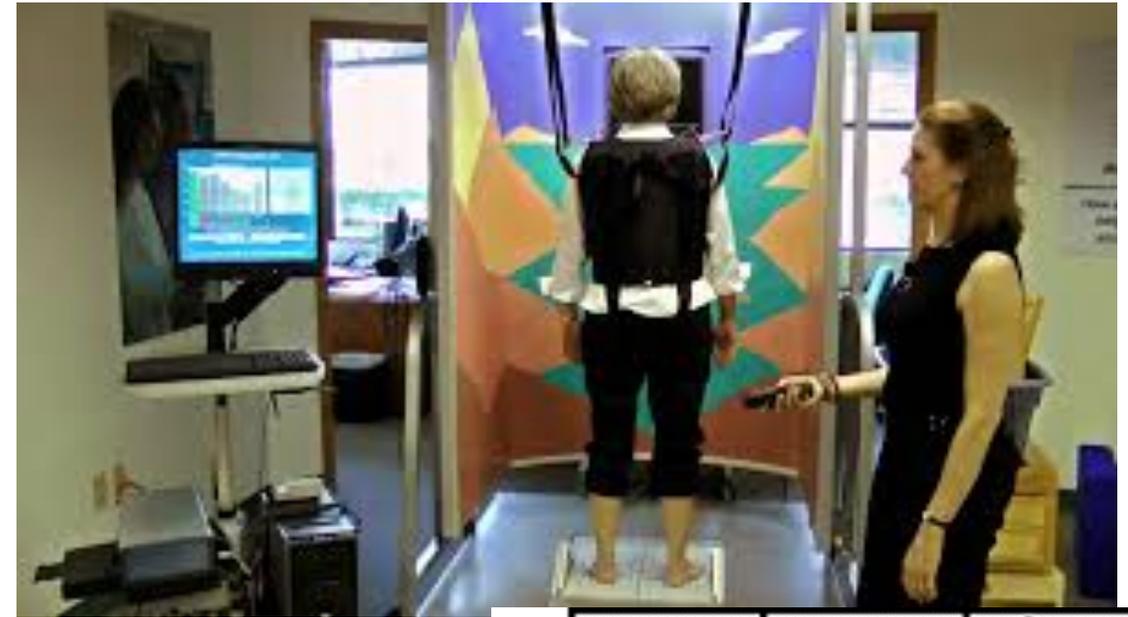
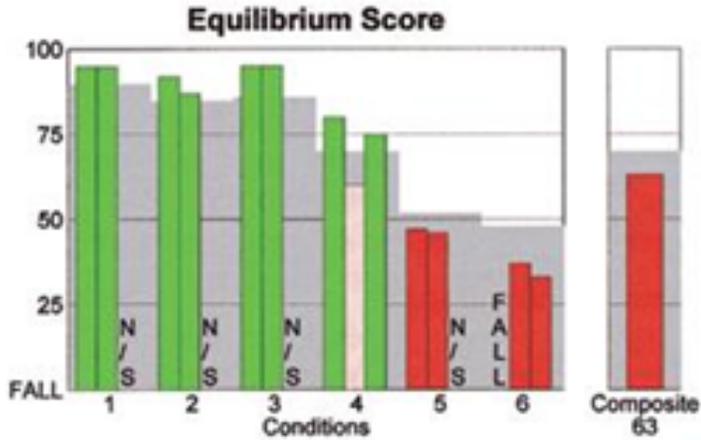
## Activities-Specific Balance Confidence (ABC) Scale



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# Sensory Organization Test

(Sway Referenced Gain: 1.0)



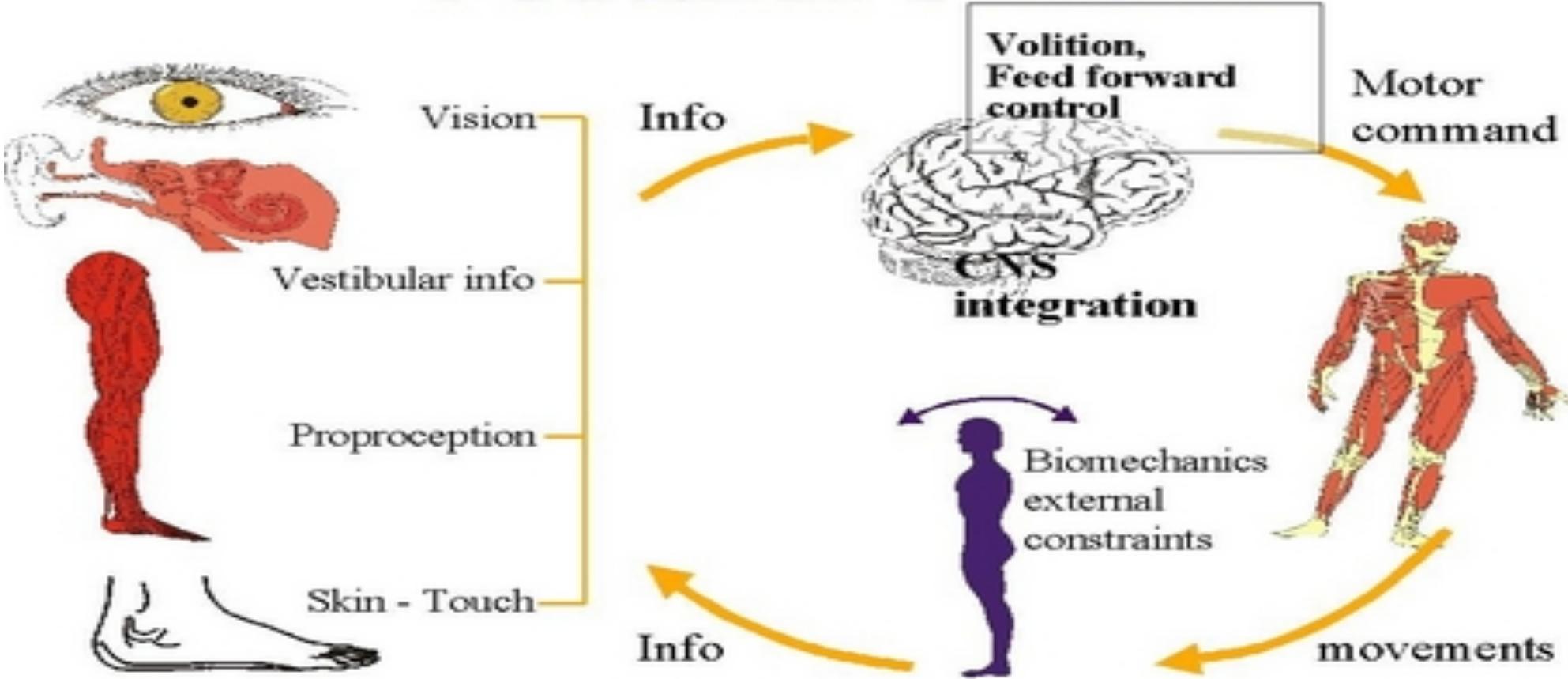
	Normal Vision	Eyes Closed	Sway-Referenced Vision
Fixed Surface	 1	 2	 3
Sway-Referenced Surface	 4	 5	 6

[www.orthobalancept.com](http://www.orthobalancept.com)



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# Postural control



[caymanechoicsservices.weebly.com](http://caymanechoicsservices.weebly.com)



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# Dizziness following concussion may also involve impairment in vestibular and ocular motor function and integration. (Collins et al., 2013)

- Symptoms of vestibular impairment may include **unstable vision, difficulty focusing, motion discomfort, difficulty in busy visual environments, and imbalance** particularly in the absence of visual input and dizziness. (Collins et al., 2013)
- Overall, balance tends to recover quickly, typically within 3 to 7 days of **injury**. (Weinberger & Briskin, 2013, Guskiewicz, 2011)
- Despite the high incidence of dizziness and balance dysfunction in people who have had a concussion, reports of vestibular and balance rehabilitation in the management of concussion are sparse. (Alsalaheen et al., 2010, Hoffer et al., 2004, Gurr et al., 2001, Herdman et al., 1990, Shepard et al., 1993)



# Can the use of vestibular rehabilitation reduce symptoms, dizziness, and improve balance function in individuals with lingering concussion symptoms?

- Studies have shown that vestibular rehabilitation reduces dizziness and improves overall balance for individuals with head injury (Herdman, 1990; Gizzi, 1995; Gurr and Moffat, 2001; Hoffer et al., 2004; Alsalaheen et al., 2010, Alsalaheen et al., 2012)
- Both adolescents and adults have demonstrated improvements from vestibular rehabilitation following a concussion (Alsalaheen et al., 2010)
- Individuals who had persistent dizziness and gait and balance dysfunction after having a concussion seem to have improved after vestibular rehabilitation. (Alsalaheen et al., 2010)



- Vestibular rehabilitation has demonstrated a positive treatment effect in individuals with peripheral vestibular disorders. (Hillier & Hollohan, 2007)
- After 6-8 weeks of vestibular rehabilitation patients demonstrated improvements in relation to symptoms of dizziness, perception of balance function, and measures of VOR function. (Hoffer et al., 2004, Broglio et al., 2015)
- Military individuals who had significant impairment in VOR and gaze stabilization at time of initial evaluation returned to normative levels after 4-12 weeks of vestibular physical therapy. (Gottshall & Hoffer, 2010, Broglio et al., 2015)
- A greater proportion of adolescents and young adults (12-30 y/o) with persistent symptoms of dizziness, neck pain and/or headache, who were **treated with** a combination of **vestibular rehabilitation** and cervical physiotherapy treatment, were nearly **4x more likely to be medically cleared to return to sport by 8 weeks following initiation of treatment** than individuals with the same kind of symptoms who continued with rest instead. (Schneider et al., 2013)

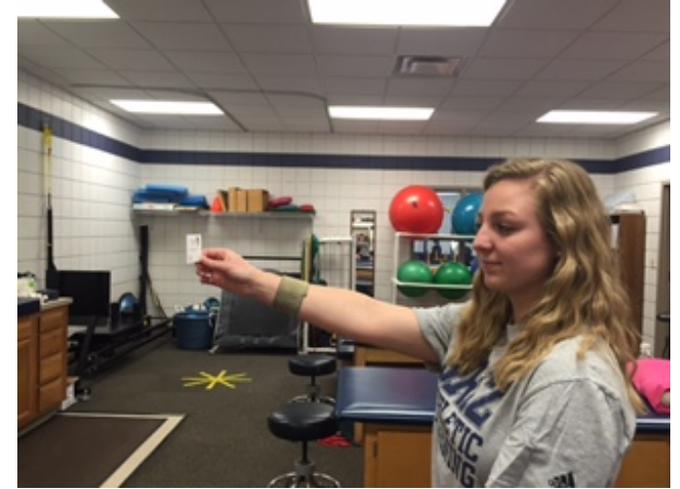


- Most of the impairments in individuals with concussion were in three domains;
  - Eye–head coordination
  - Standing static balance
  - Ambulation (Alsalaheen et al., 2012)
- The categories of exercises most frequently provided included gaze stabilization exercises in sitting and standing positions, standing balance, and walking with balance challenge (Alsalaheen et al., 2013, Alsalaheen et al., 2016)
- Additional rehabilitation strategies such as vestibular, oculomotor, and pharmacological have mounting evidence and should be incorporated by the appropriate individuals. (Broglia et al., 2015)



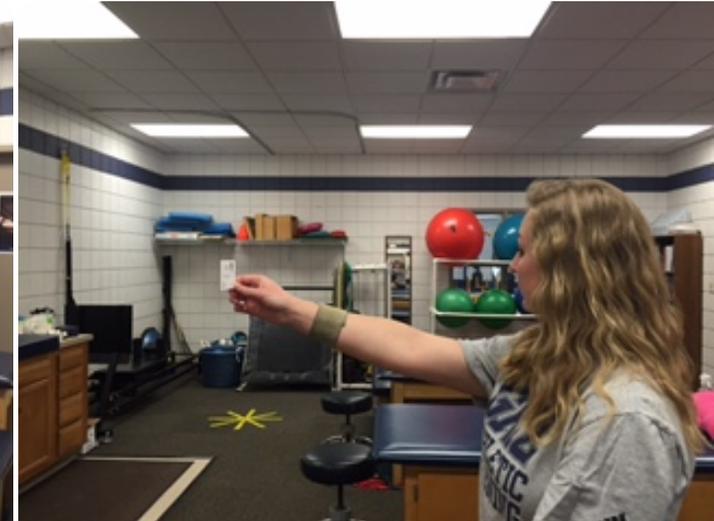
# Rehabilitation

- Card Exercises
- Gaze Stabilization
  - Keep eyes fixed on a single stationary target held in hand or placed on a wall 3-10 feet away.
  - Now **move head** side to side for 20-60 seconds.
  - Repeat 3 times.
  - Now repeat 3 times while moving head up and down for 20-60 seconds.
  - Do 3 sessions per day.



- Smooth Pursuit

- Holding a single target, keep eyes fixed on the target.
- Slowly **move the target** side to side for 20-60 seconds while head stays still.
- Perform 3 times.
- Now repeat moving head up and down.
- Do 3 sessions per day.



# Head and Eyes Same Direction

- Holding a single target, keep eyes fixed on target.
- Slowly **move the target, head, and eyes in same direction.** (up and down, side to side) for 20-60 seconds.
- Repeat 3 times per session.
- Do 3 sessions per day.



# Head and Eyes Opposite Direction

- Holding your target, keep your eyes focused on it
- Begin to slowly **move target** (up/down, side to side) while **moving your head in the opposite direction** of the target for 20- 60 seconds.
- Repeat 3 times per session.
- Do 3 sessions per day.



# Progressions

- Standing with feet apart
- Standing with feet together
- Standing heel to toe
- Marching in place, or standing on foam surface
- \*Increase difficulty by placing target on a “busy” background



# Walking Exercises

- Walking to Target with Eyes Closed
- Have the patient pick a target to walk to then have them close their eyes and walk to the target
- \*Consider the environment around them



# Heel to Toe Walking (Keep Head Up) with Eyes Open

- Progress to Eyes Closed
- Then progress to backward heel to toe walking: EO  EC



# Walking with Head Turns

- Turn the head to the Right for 3 steps
- Turn head to look forward for 3 steps
- Turn the head to the Left for 3 steps
- Turn head to look forward for 3 steps
  - Progression is for the patient to be able to turn their head while walking without pausing in the neutral position



# Walking While Looking Up and Down

- Look down (move head) for 3 steps
- Return head to neutral for 3 steps
- Look up (move head) for 3 steps
- Return head to neutral for 3 steps
  - Progression is for the patient to be able to turn their head while walking without pausing in the neutral position



# Walking Ball Toss

- Work with partner (one walks fwd./one walks backwards) while tossing a ball
  - Patient should walk both forward and backwards during exercise
  - \*may need to have patient only walk forward 1<sup>st</sup> depending on symptoms
- Patient walks while tossing a ball up to themselves
  - Patient follows the flight of the ball
- Patient walks while tossing a ball from one hand to the other
  - Patient follows the flight of the ball
  - Start with small tosses and then work on increasing height



# Balance Exercises

- DL EO Foam Surface → DL EC Firm Surface → DL EC Foam Surface
- SL EO Firm Surface → SL EC Firm Surface → SL EO Foam Surface → SL EC Foam Surface
- Tandem EC Firm Surface → Tandem EO Foam Surface → Tandem EC Foam Surface
- DL Balance on Wobble Board EO → EC



- SL Trampoline Ball Toss Firm → Unstable Surface (Foam Pad, BOSU)
- DL Balance on 2x4 EO → EC
- SL Dynamic Balance with object pick-up → Unstable surface





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# Take Home Points

- Consider all systems that may be affected by a concussion
  - Reports of dizziness, unstable vision, difficulty focusing, motion discomfort, difficulty in busy visual environments, and imbalance
- Conversation is Key!
  - Think beyond the usual.....examine different environments
- Assess all complaints
  - Keep expanding your toolbox
- Continue being AWESOME!



# Thank You!

NATIONAL  
**ATHLETIC**  
**TRAINING**  
MONTH

**YOUR PROTECTION  
IS OUR PRIORITY**

MARCH 2017



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# VOMS Evaluation

- Vestibular-Ocular Motor Screening (VOMS)
- Validated for ages 9-40
- Pre-VOMS symptom scale (0-10)
  - Headache
  - Dizziness
  - Nausea
  - Fogginess

Vestibular/Ocular-Motor Screening (VOMS) for Concussion

Vestibular/Ocular Motor Test:	Not Tested	Headache 0-10	Dizziness 0-10	Nausea 0-10	Fogginess 0-10	Comments
<b>BASELINE SYMPTOMS:</b>	N/A					
Smooth Pursuits						
Saccades – Horizontal						
Saccades – Vertical						
Convergence (Near Point)						(Near Point in cm): Measure 1: _____ Measure 2: _____ Measure 3: _____
VOR – Horizontal						
VOR – Vertical						
Visual Motion Sensitivity Test						

**Instructions:**

**Interpretation:** This test is designed for use with subjects ages 9-40. When used with patients outside this age range, interpretation may vary. Abnormal findings or provocation of symptoms with any test may indicate dysfunction – and should trigger a referral to the appropriate health

Mucha et al., 2014



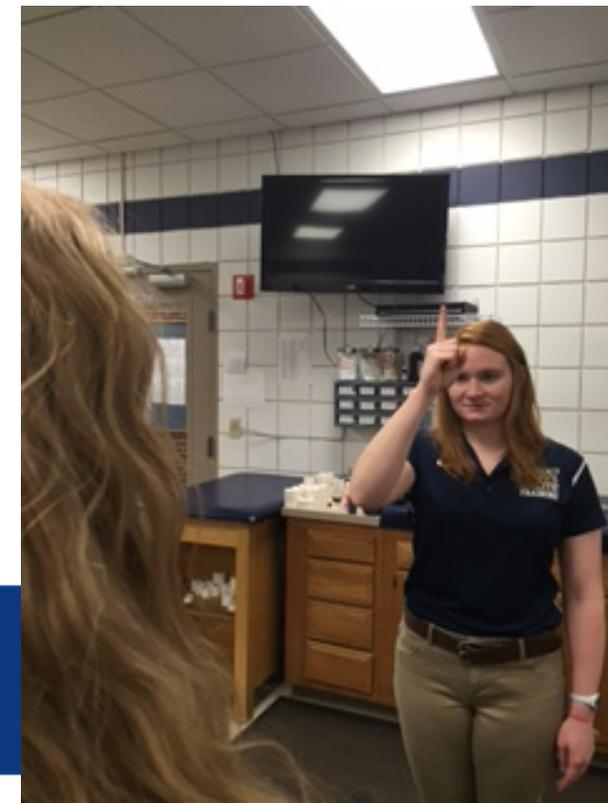
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# Smooth Pursuits

- Assesses eye tracking and oculomotor dysfunction
- Assess horizontal and vertical movement
  - 2 reps/2 seconds each direction



- Clinician is 3 ft. from patient
- Patient is instructed to maintain focus on the target as the clinician moves it smoothly



# Saccades

- Assesses for oculomotor dysfunction
- Eyes from target to target as quickly and accurately as possible
- Measure horizontally and vertically
  - 10 repetitions each
    - Want patient to gaze 30 degrees to the right and left
    - Repeat up and down with 30 degrees gaze



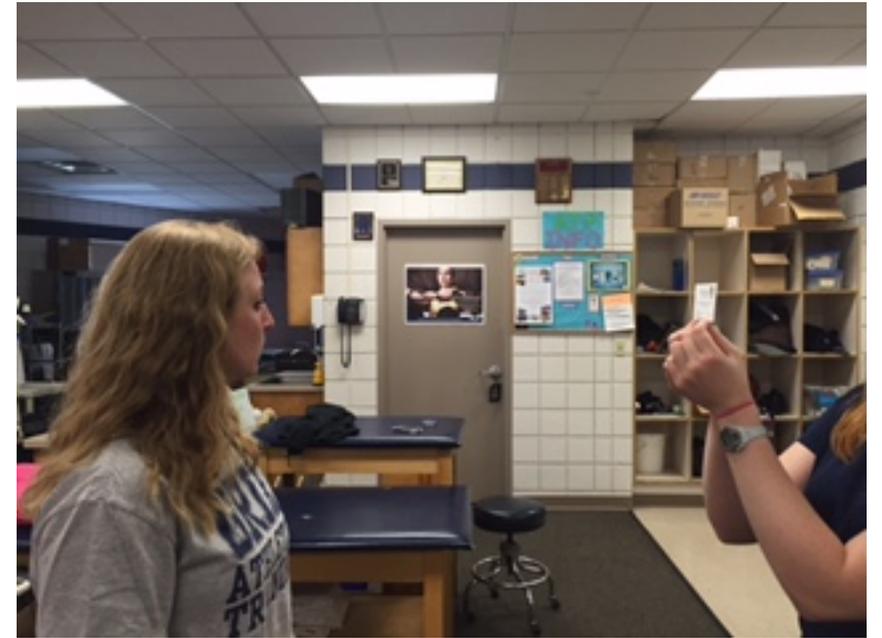
# Convergence

- Measures the ability to view a near target without double vision
- Patient focuses on a small target (14 pt. font) at arm's length and slowly brings it towards the tip of their nose
- Instruct patient to stop moving the target when they see 2 distinct images
  - Repeat 3 times
  - Abnormal  $\geq 6$  cm



# Vestibulo-Ocular Reflex (VOR)

- Assess the ability to stabilize vision as the head moves
- Clinician holds a target (14 pt. font) in front of the patient at a distance of 3 ft.
- Use a metronome (180 beats/min)
- Horizontal
  - Pt. rotates head horizontally and maintains focus on the target ( $\sim 20^\circ$ ) to each side
- Vertical
  - Pt. moves their head vertically ( $\sim 20^\circ$ )
- Perform 10 repetitions of each



# Visual Motion Sensitivity

- Test visual motion sensitivity and the ability to inhibit vestibular-induced eye movements using vision
- Patient stands with feet shoulder width apart
- Patient holds arm outstretched and focuses on their thumb
- Patient rotates 80 degrees to the right and left focusing on their thumb
- 5 revolutions (one revolution is from right to left)
- Use metronome (50 beats/min)

