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Vestibular Rehabilitation for Athletes with Post-Concussion Syndrome

Encore Sports Medicine

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DISCLOSURE

- I am currently working with Bertec to develop a home-based portable device to deliver vestibular rehabilitation.
  - DOD phase I grant
  - UABRF IPD no U2016-0014/AIMTECH-9; PCT Patent Application No. PCT/US2017/014227. “Systems and Methods for Vestibular Rehabilitation”

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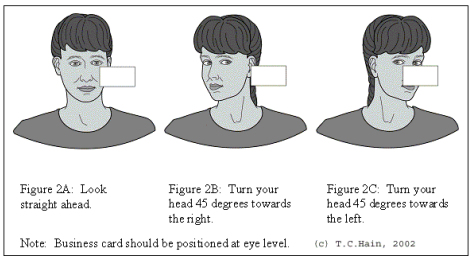
Objectives

- Recognize when a concussed athlete needs vestibular rehabilitation based on standardized outcome measures.
- Deliver and progress vestibular-based exercises in a safe and effective manner.



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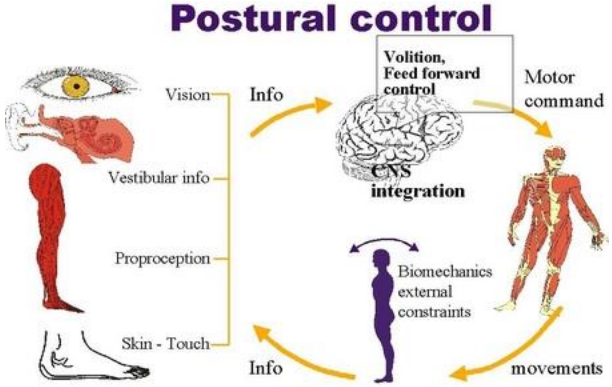
WHY VISION, OCULOMOTOR & VESTIBULAR? (Ciuffreda 2014)

- 30 areas of the brain and 7 of 12 cranial nerves deal with vision
- Balance is derived from multiple sensory inputs from vestibular end-organs, the visual system, and the somatosensory and proprioceptive systems



Vestibular-related Impairments from sport related mTBI:

- Poor Static and Dynamic Balance
- Gaze Instability
  - Convergence insufficiency vs. VOR dysfunction
- Poor perception of vertical (Christy et al. in review)
- Symptoms
  - Vertigo (head mov't induced vs. visual vertigo)
  - Off-balance
  - Motion sensitivity
  - Exacerbated with aerobic activity
- Headache - Migraine

Zhou 2015; Corwin 2015; Ellis 2015; Heinmiller 2016; Leddy 2016

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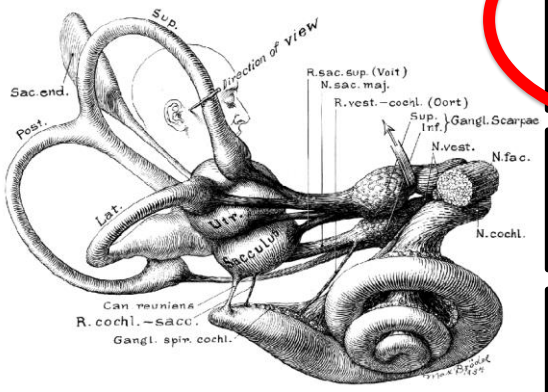
FOUR BASIC RESPONSIBILITIES OF THE VESTIBULAR SYSTEM:



1. AUTONOMIC RESPONSES & PERCEPTION OF STABILITY/MOVEMENT: Brainstem connections

2. PERCEPTION OF VERTICAL: Vestibulo-Thalamico-Cortical pathways

3. POSTURAL CONTROL: Vestibulo-spinal Reflex

4. GAZE STABILITY: Vestibulo-Ocular Reflex

Predictors of clinical recovery from concussion: a systematic review

Grant L Iverson,[1,2] Andrew J Gardner,[3] Douglas P Terry,[1,2] Jennie L Ponsford,[4] Allen K Sills,[5] Donna K Broshek,[6] Gary S Solomon[7]

Iverson GL, *et al*. *Br J Sports Med* 2017;**51**:941–948. doi:10.1136/bjsports-2017-097729

Results A to… the search stra… are major met… Many different clinical outcomes were measured, such as symptoms, cognition, balance, return to school and return to sports, although symptom outcomes were the

101 ARTICLES

"The development of subacute problems with HA or depression is likely a risk factor for persistent symptoms lasting greater than a month"

not appear to be at substantially greater risk. There is some evidence that the teenage years, particularly high school, might be the most vulnerable time period for having persistent symptoms—with greater risk for girls than boys.

Objective A systematic review of factors that might be associated with, or influence, clinical recovery from spo… fun… sch… **Des… Dat…** Coc… Wel… **Elig…** published by June of 2016 that addressed clinical recovery from concussion.

"The most constant predictor of slower recovery from concussion is the SEVERITY OF ACUTE & SUBACUTE SYMPTOMS"

Conclusion The literature on clinical recovery from sport-related concussion has grown dramatically, is mostly mixed, but some factors have emerged as being related to outcome.

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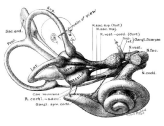
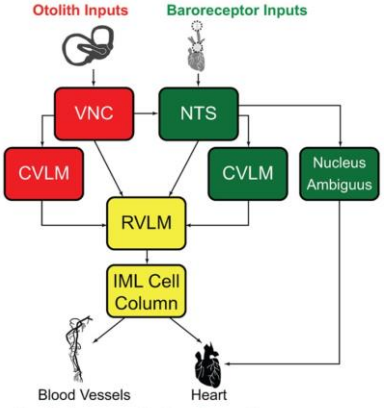
ASSESSMENT OF SYMPTOMS





Vestibulo-sympathetic reflex pathway
Baroreflex pathway
Convergent vestibular and baroreflex pathways

Holstein et al. 2012

SYMPTOMS

- SCAT5 (Sport Concussion Assessment Tool)
- CISS (Convergence Insufficiency Symptom Survey)
- VOMS (Vestibular Ocular Motor Screening)
- DHI (Dizziness Handicap Inventory)
- VVAS (Visual Vertigo Analog Scale)
- VAS (Visual Analog Scale)

SCAT5

SCAT3 SYMPTOM SCORE
ADOLESCENT
13 AND OLDER:

- Shehata 2009: mean score was 4.92 in 260 athletes aged mean=20.5 years
- Our lab: “Symptomatic” if symptom severity score > 12
- Mean + 2 SD of normative sample in our lab

STEP 2: SYMPTOM EVALUATION

The athlete should be given the symptom form and asked to read this instruction paragraph out loud then complete the symptom scale. For the baseline assessment, the athlete should rate his/her symptoms based on how he/she typically feels and for the post injury assessment the athlete should rate their symptoms at this point in time.

Please Check: ☐ **Baseline** ☐ **Post-Injury**

Please hand the form to the athlete

	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 vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "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
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
Trouble falling asleep (if applicable)	0	1	2	3	4	5	6
Total number of symptoms:							of 22
Symptom severity score:							of 132
Do your symptoms get worse with physical activity?						Y	N
Do your symptoms get worse with mental activity?						Y	N
If 100% is feeling perfectly normal, what percent of normal do you feel?							

Child report

Name: _____

	never	rarely	sometimes	often
I have trouble paying attention	0	1	2	3
I get distracted easily	0	1	2	3
I have a hard time concentrating	0	1	2	3
I have problems remembering what people tell me	0	1	2	3
I have problems following directions	0	1	2	3
I daydream too much	0	1	2	3
I get confused	0	1	2	3
I forget things	0	1	2	3
I have problems finishing things	0	1	2	3
I have trouble figuring things out	0	1	2	3
It's hard for me to learn new things	0	1	2	3
I have headaches	0	1	2	3
I feel dizzy	0	1	2	3
I feel like the room is spinning	0	1	2	3
I feel like I'm going to faint	0	1	2	3
Things are blurry when I look at them	0	1	2	3
I see double	0	1	2	3
I feel sick to my stomach	0	1	2	3
I get tired a lot	0	1	2	3
I get tired easily	0	1	2	3

Total number of symptoms (Maximum possible 20)

Symptom severity score (Maximum possible 20 x 3 = 60)

self rated clinician interview self rated and clinician monitored

Parent report

The child	never	rarely	sometimes	often
has trouble sustaining attention	0	1	2	3
Is easily distracted	0	1	2	3
has difficulty concentrating	0	1	2	3
has problems remembering what he/she is told	0	1	2	3
has difficulty following directions	0	1	2	3
tends to daydream	0	1	2	3
gets confused	0	1	2	3
is forgetful	0	1	2	3
has difficulty completeing tasks	0	1	2	3
has poor problem solving skills	0	1	2	3
has problems learning	0	1	2	3
has headaches	0	1	2	3
feels dizzy	0	1	2	3
has a feeling that the room is spinning	0	1	2	3
feels faint	0	1	2	3
has blurred vision	0	1	2	3
has double vision	0	1	2	3
experiences nausea	0	1	2	3
gets tired a lot	0	1	2	3
gets tired easily	0	1	2	3

Total number of symptoms (Maximum possible 20)

Symptom severity score (Maximum possible 20 x 3 = 60)

Do the symptoms get worse with physical activity? Y N

Do the symptoms get worse with mental activity? Y N

parent self rated clinician interview parent self rated and clinician monitored

Overall rating for parent/teacher/coach/carer to answer.
How different is the child acting compared to his/her usual self?

Please circle one response:

no different | very different | unsure | N/A

CHILD VERSION (5-12 YRS)
SYMPTOMATIC IF PARENT SCORE > 18 (Porter et al. 2015)

CONVERGENCE INSUFFICIENCY SYMPTOM SURVEY (CISS)

	Never	(not very often) Infrequently	Sometimes	Fairly Often	Always
1. Do your eyes feel tired when reading or doing close work?					
2. Do your eyes feel uncomfortable when reading or doing close work?					
3. Do you have headaches when reading or doing close work?					
4. Do you feel sleepy when reading or doing close work?					
5. Do you lose concentration when reading or doing close work?					
6. Do you have trouble remembering what you have read?					
7. Do you have double vision when reading or doing close work?					
8. Do you see the words move, jump, swim or appear to float on the page when reading or doing close work?					
9. Do you feel like you read slowly?					
10. Do your eyes ever hurt when reading or doing close work?					
11. Do your eyes ever feel sore when reading or doing close work?					
12. Do you feel a "pulling" feeling around your eyes when reading or doing close work?					
13. Do you notice the words blurring or coming in and out of focus when reading or doing close work? 14. Do you lose your place while reading or doing close work?					
15. Do you have to re-read the same line of words when reading?					
	__ X 0	__ X 1	__ X 2	__ X 3	__ X 4

For a score of 16 or greater, vision therapy may be indicated.[1,2,3]

Capo-Aponte 2012

Scheiman 2017.

Vestibular/Ocular Motor Screening (VOMS)

VOMS SCORING SHEET

Symptoms on a 0-10 point scale

Vestibular/ Oculomotor	Type	Not Tested	Headache	Dizziness	Nausea	Fogginess	Comments
Baseline Symptoms							
Smooth Pursuit							
Saccades (Horizontal)							
Saccades (Vertical)							
Convergence (Near Point)							Score#1_____cm Score#2_____cm Score#3_____cm
VOR Horizontal							
VOR Vertical							
Visual Motion Sensitivity							

A change from baseline of ≥ 2 is considered abnormal

Mucha, 2014

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VOMS Evidence

- VOMS had good internal consistency (r_s= 0.25-0.66, p<0.02) and did not correlate with BESS or K-D (Yorke, 2017)
- Good internal consistency (Cronbach α = 0.97) and 89% of athletes without concussion scored below cut-off levels (Kontos, 2016)
- Did not provoke symptoms in healthy adolescents
- Symptoms in all but NPC and ACCOM is associated with delayed recovery after concussion (Anzalone, 2017)
- Females with concussion had higher VOMS scores than males (Sufrinko, 2017)

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NPC > 6 cm – refer to optometry

NEAR POINT OF CONVERGENCE:

1. Ask the child to focus on a small picture (5cm sticker).

2. Ask the child to “keep it as 1 sticker” as you move it toward the bridge of the nose.

3. Ask the child to say “now” when he/she sees the picture as two.

4. Measure the distance between bridge of the nose and point at which the picture becomes double.

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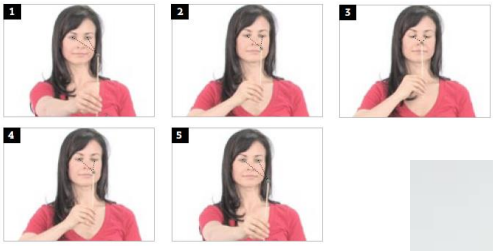
Treatment of Convergence Insufficiency



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Dizziness Handicap Inventory

	Yes	No	Sometimes
P1. Does looking up increase your problem?			
E2. Because of your problem, do you feel frustrated?			
F3. Because of your problem, do you restrict travel for business or recreation?			
F5. Because of your problem, do you have difficulty getting into or out of bed?			
F6. Does your problem significantly restrict your participation in social activities such as going out to dinner, the movies, dancing, or to parties?			
F7. Because of your problem, do you have difficulty reading?			
P8. Does performing more ambitious activities like sports or dancing or household chores such as sweeping or putting dishes away increase your problem?			

	Yes	No	Sometimes
E9. Because of your problem, are you afraid to leave your home without having someone accompany you?			
E10. Because of your problem, are you embarrassed in front of others?			
P11. Do quick movements of your head increase your problem?			
F12. Because of your problem, do you avoid heights?			
P13. Does turning over in bed increase your problem?			
F14. Because of your problem, is it difficult for you to do strenuous housework or yardwork?			
E15. Because of your problem, are you afraid people may think you are intoxicated?			
F16. Because of your problem, is it difficult for you to walk by yourself?			
P17. Does walking down a sidewalk increase your problem?			

	Yes	No	Sometimes
E18. Because of your problem, is it difficult for you to concentrate?			
F19. Because of your problem, is it difficult for you to walk around the house in the dark?			
E20. Because of your problem, are you afraid to stay home alone?			
E21. Because of your problem, do you feel handicapped?			
E22. Has your problem placed stress on your relationships with members of your family or friends?			
E23. Because of your problem, are you depressed?			
F24. Does your problem interfere with your job or household responsibilities?			
P25. Does bending over increase your problem?			

5-item BPPV Subscale from DHI

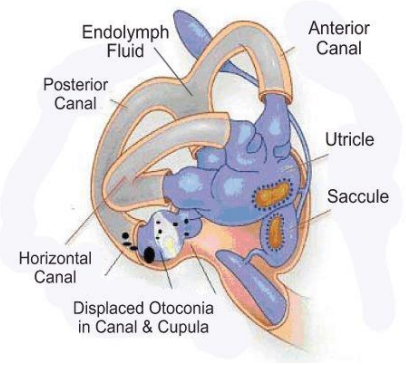
- Combined items of rolling over and getting into/out of bed area significant predictor of the likelihood for BPPV
- Scores of 4 on combination are approximately 2.7 times more likely to have BPPV than a score of 0
- Scores of 8 are approximately 4.3 times more likely to have BPPV

DHI: 5-item BPPV subscale: Whitney et al. 2005

	Questions	Yes	Sometimes	No
P1	Does looking up increase your problem?			
F5	**Because of your problem, do you have difficulty getting into or out of bed**			
P11	Do quick movements of your head increase your problem?			
P13	**Does turning over in bed increase your problem?**			
P25	Does bending over increase your problem?			

- Odds in favor of BPPV are increased approximately 15% for every 2 point increase in the BPPV sub-score
- If you suspect BPPV: refer if you haven't been trained
- Clinical Practice Guidelines for BPPV

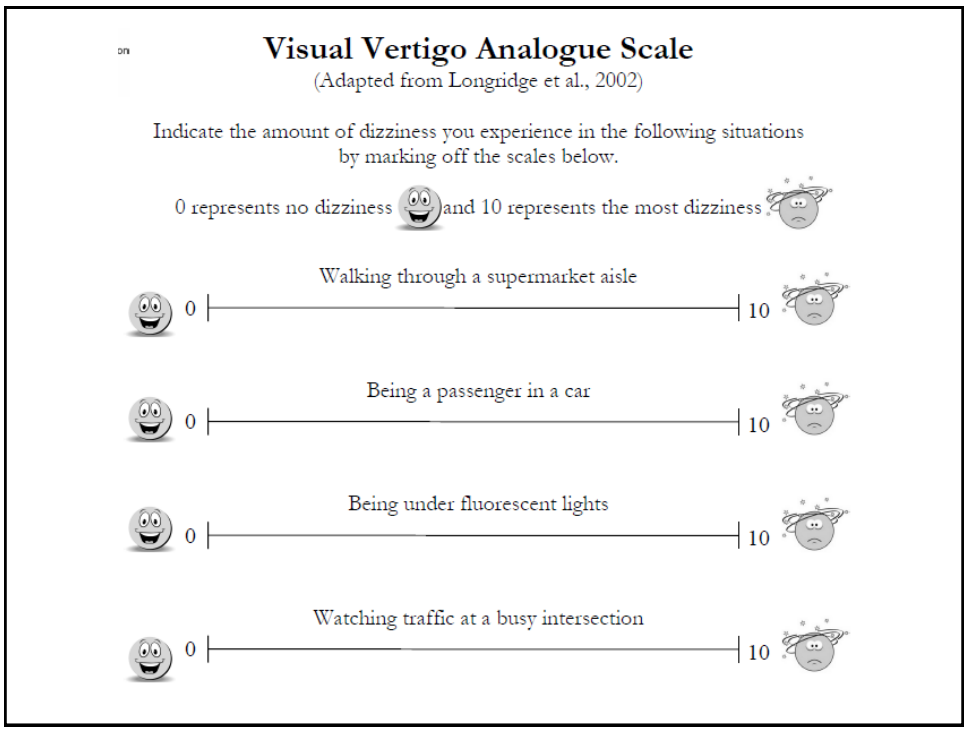
BENIGN PAROXYSMAL POSITIONAL VERTIGO

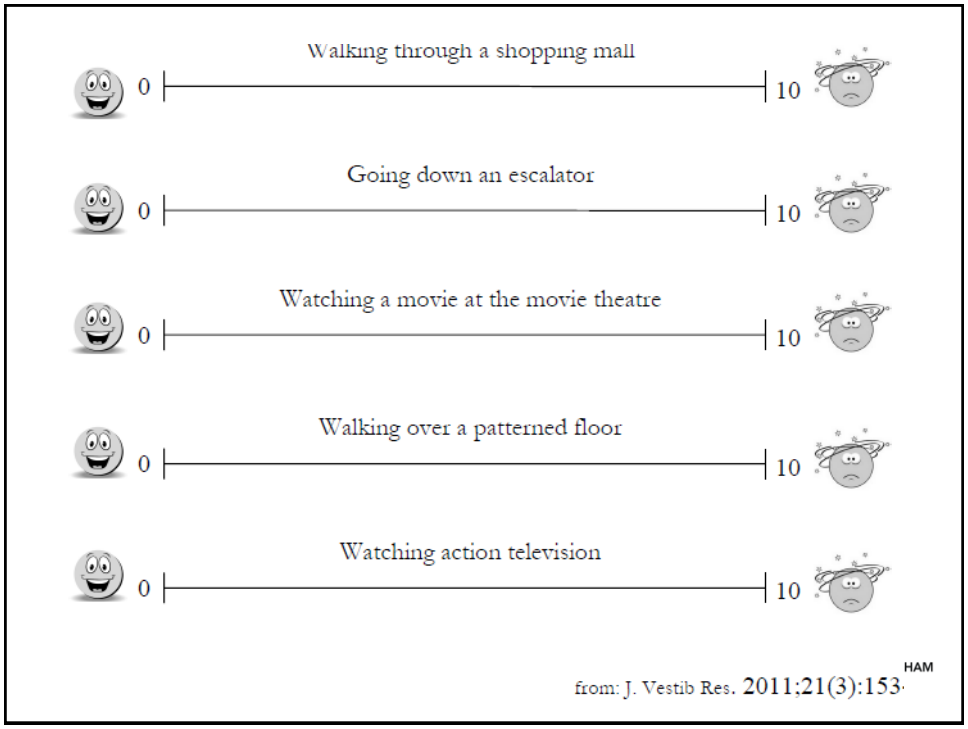


- A blow to the head may cause otoconia to become dislodged from the otoliths and fall into the semicircular canals

  Most often the posterior canal

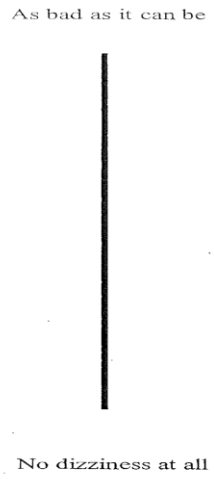
  Will cause vertigo (spinning) with changes in head position
- Thomas 2016





VAS: see handout

- 10 cm line
  - Measure in mm
- Can use at start of or end of session
- Can use after performing test or activity



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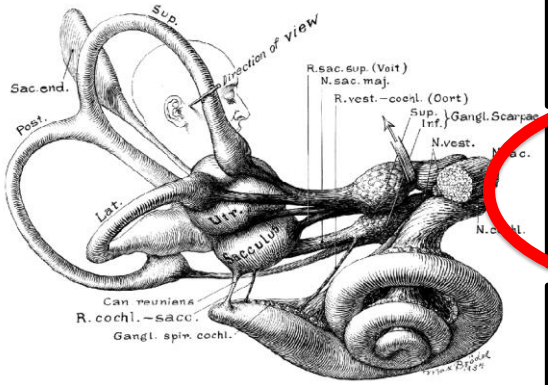
FOUR BASIC RESPONSIBILITIES OF THE VESTIBULAR SYSTEM:



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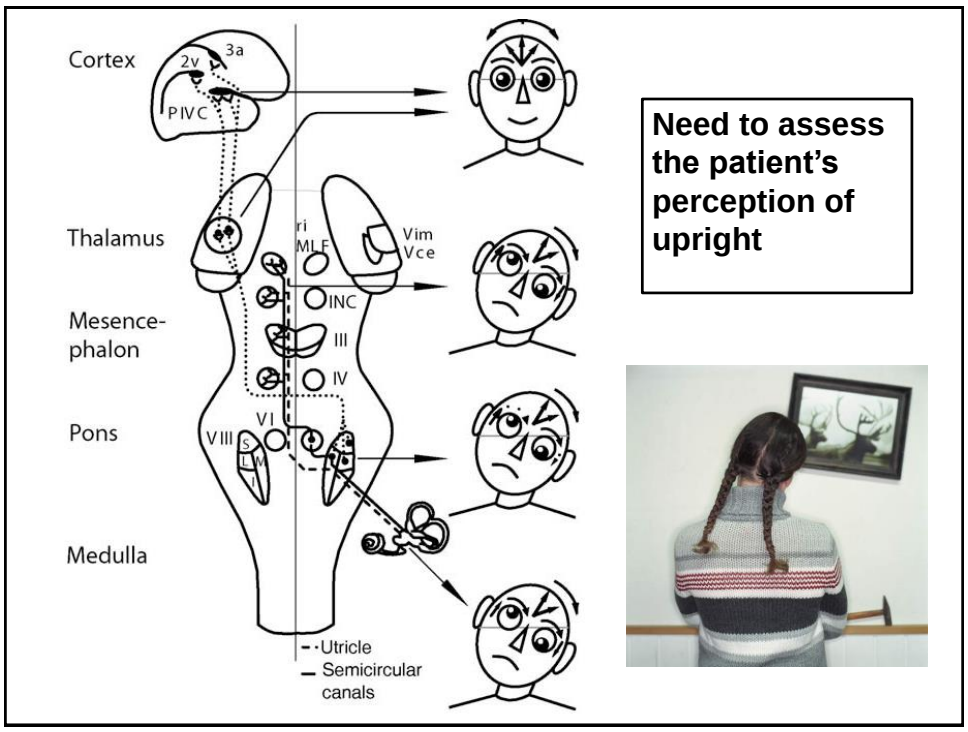

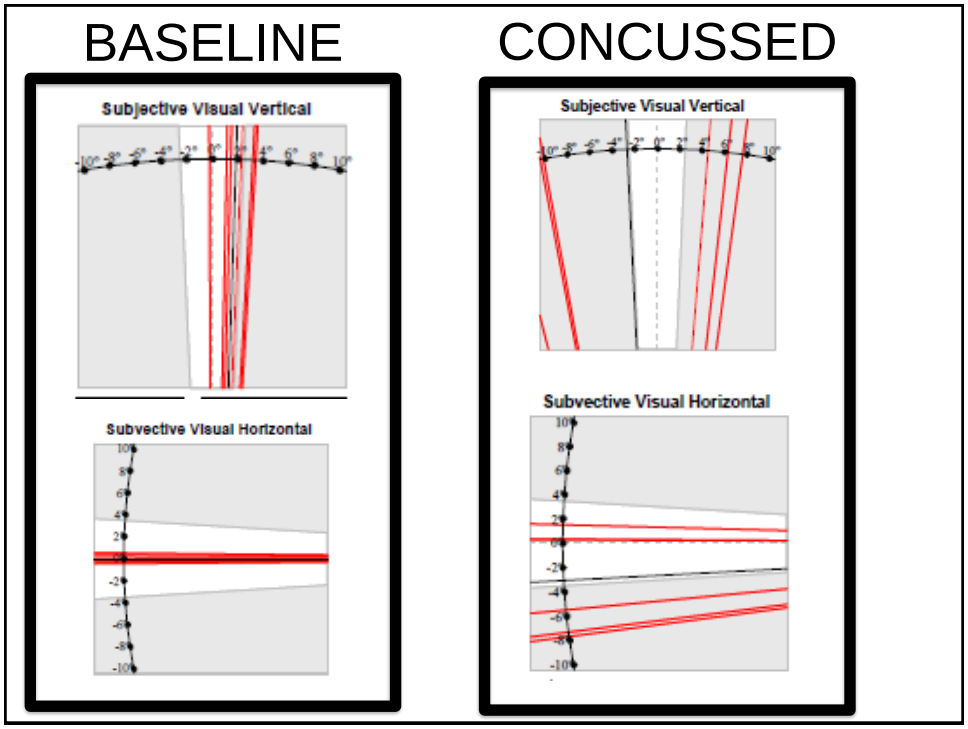

BUCKET TEST OF SVV

- Have the patient close the eyes and put the bucket over the patient's face, turn the line a random direction
- Tell patient to say "now" when the line is straight up and down
- Do 10 trials (5 to each side in random order)
- Record the degrees off for each trial and direction, then average and record the direction that the patient most often perceived.

Trial	Report degrees off zero and direction (in relation to patient) the top of the line was tilted when vertical was perceived.			
	Initial line position: top of line to patient's left		Initial line position: top of line to patient's right	
	Degrees off zero	Direction tilted R/L/S	Degrees off zero	Direction tilted R/L/S
1				
2				
3				
4				
5				
Mean/Mode	Mean & SD:	# Right: # Left: # Straight:	Mean & SD:	# Right: # Left: # Straight:
Totals	Total # off to Right: Left: Straight:			

RELIABILITY

ICC= 0.74

- Kids 6-12

ICC=0.92

- adults

ALL SCORES

< 2 DEGREES OFF

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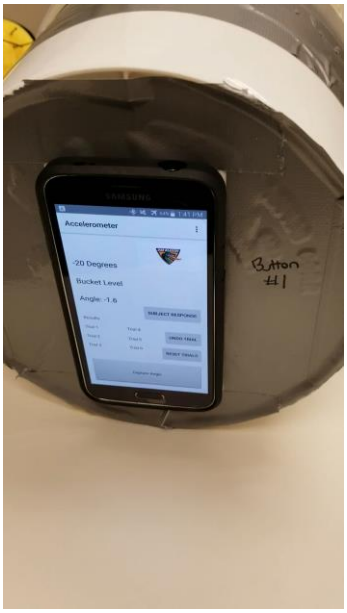
Christy 2014; Zwergal 2009

Graham Cochrane (MD/PhD student) says "There's an app for that!!!"



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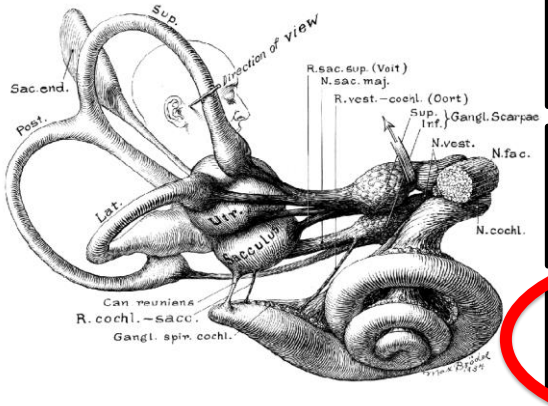

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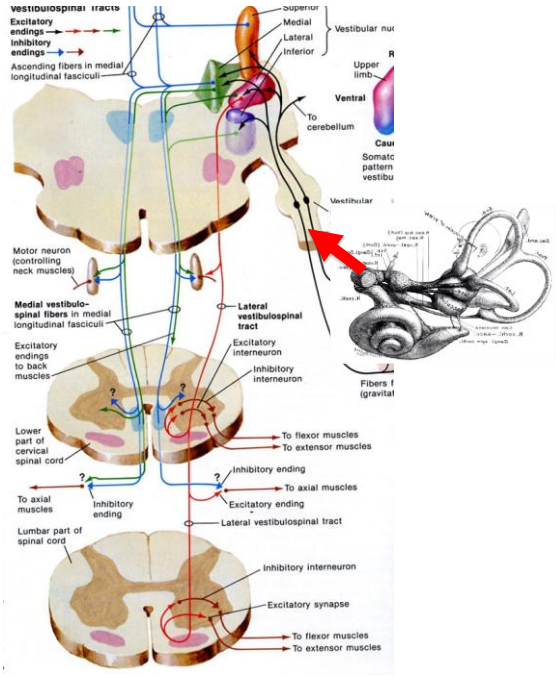
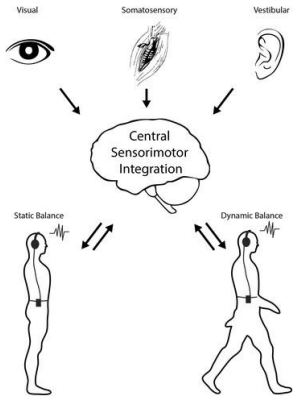




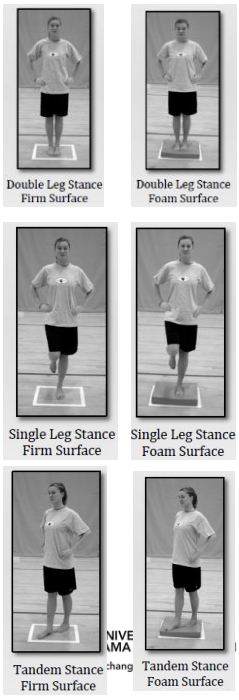
Fino et al. 2017

PUBMED 07.05.2018: "CONCUSSION AND BALANCE" (n=538 articles)

- And "Balance Error Scoring System"
  - N=130 articles
- And "Sensory Organization Test"
  - N=38 articles
- And "Functional Gait Assessment"
  - N=8 articles
- And "Virtual Reality"
  - N=16 articles

Balance Error Scoring System (BESS)

- Shoes off & hands on iliac crests for all tests
- Use Airex Foam
- Establish leg dominance
  - The leg with which they kick a ball
- Double leg stance: Feet together
- Single leg stance
  - Stand on non-dominant leg
  - 20 deg hip flexion, 45 deg knee flexion, neutral frontal plane
- Tandem stance
  - Non-dominant leg in back
  - Back of anterior foot must touch front of posterior foot
- Each trial is 20 seconds



Errors:

- Moving the hands off the hips
- Opening the eyes
- Step, stumble or fall
- Abduction or flexion of the hip beyond 30°
- Lifting the forefoot or heel off of the testing surface
- Remaining out of the proper testing position for greater than 5 seconds

The maximum total number of errors for any single condition is 10.

If a subject commits multiple errors simultaneously, only one error is recorded.

B.E.S.S. SCORECARD		
Count Number of Errors max of 10 each stance/surface	FIRM Surface	FOAM Surface
Double Leg Stance (feet together)		
Single Leg Stance (non-dominant foot)		
Tandem Stance (non-dominant foot in back)		
TOTAL SCORES: total each column		
B.E.S.S. TOTAL: (Firm+Foam total)		

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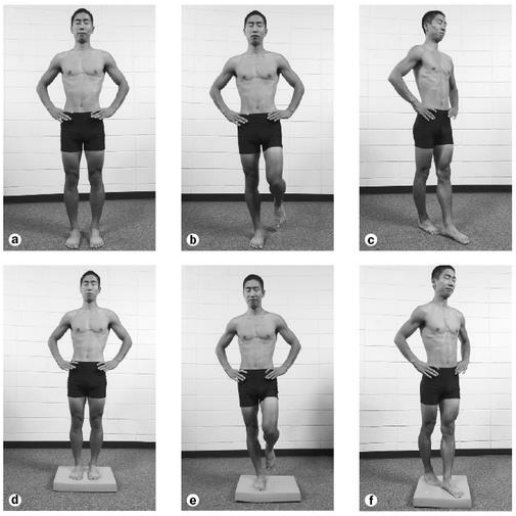

Hansen, 2017:

N=373 healthy children aged 5-14 yrs
Interrater ICC = 0.93
Intrarater ICC=0.96
Test-retest ICC=0.90
MDCs = 9.6, 4.6, 7.3 based on ICC

Alsahaleen, 2015:
N=36 (aged 15.9 +/- 1.5 yrs)
ICC for instrumented or clinical test was 0.74

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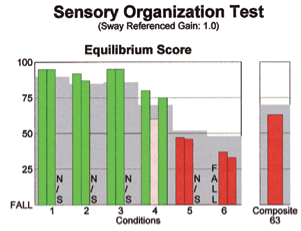
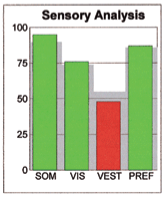
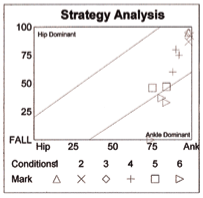
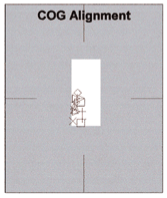
Sensory Organization Test: SOT



- Is there a problem with the patient's ability to use sensory systems for balance?







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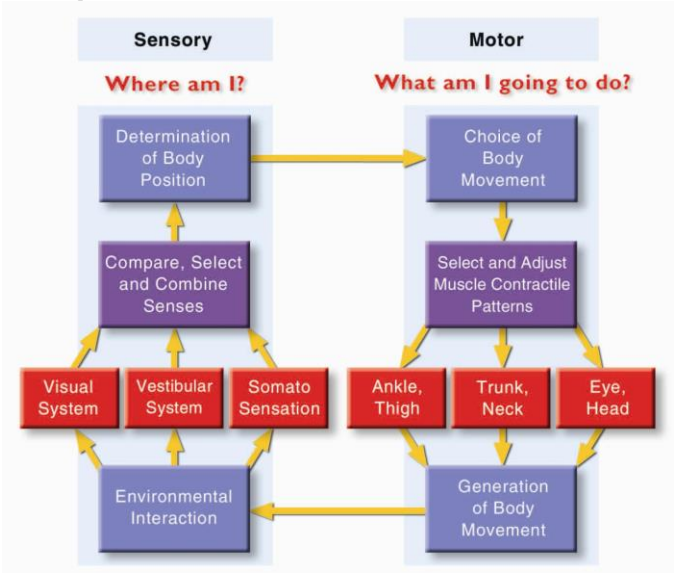
Dynamic Equilibrium Model



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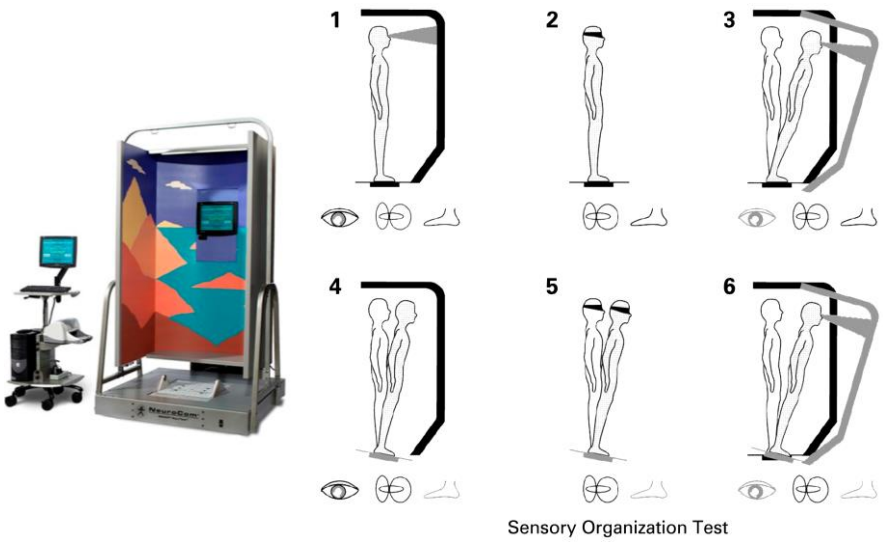
Sensory Organization Test: SOT



Sensory Organization Test

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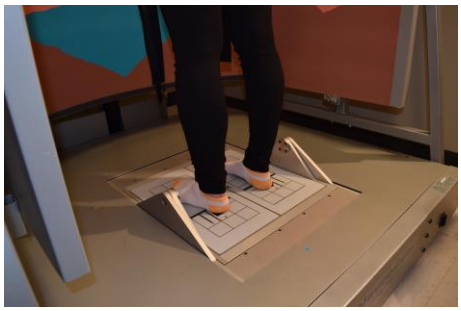

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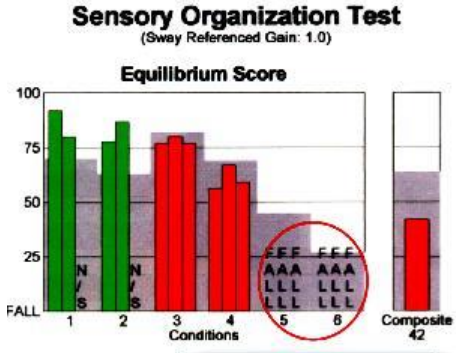
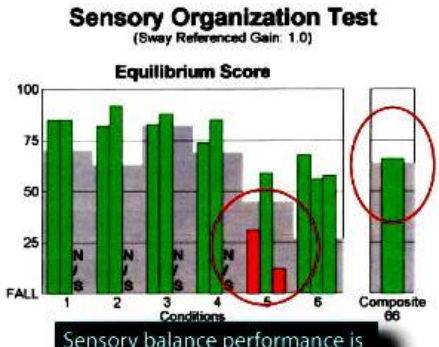
RESULTS & INTERPRETATION



The patient is unable to effectively use vestibular cues/information when on unstable surfaces.



Sensory balance performance is approaching normal range. Excellent progress so far, and good prognosis for continued improvement.

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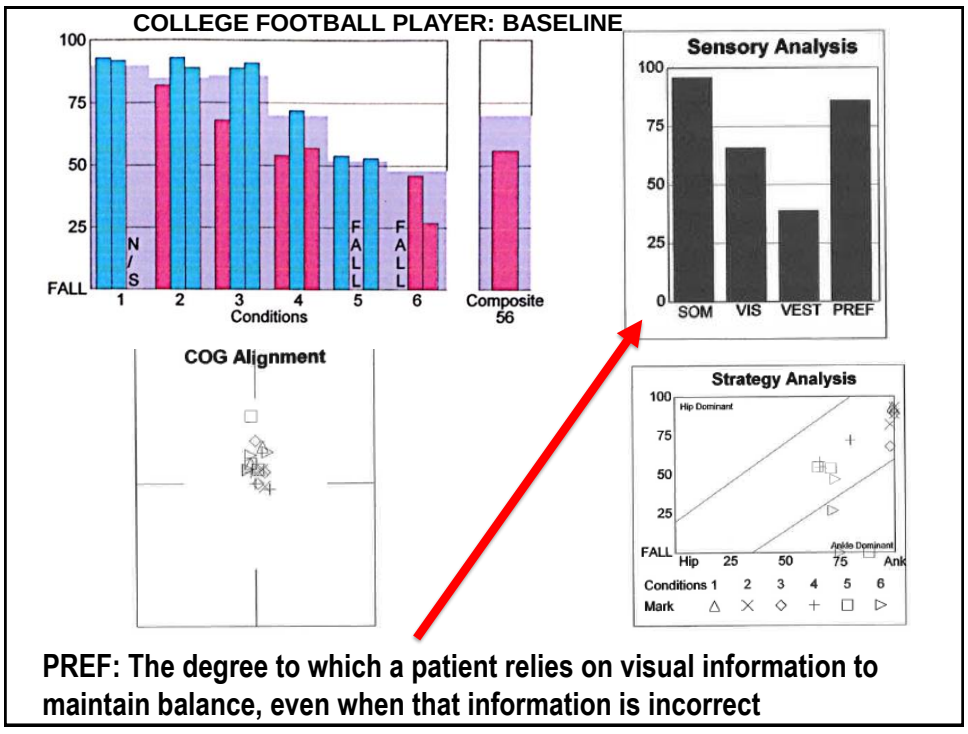
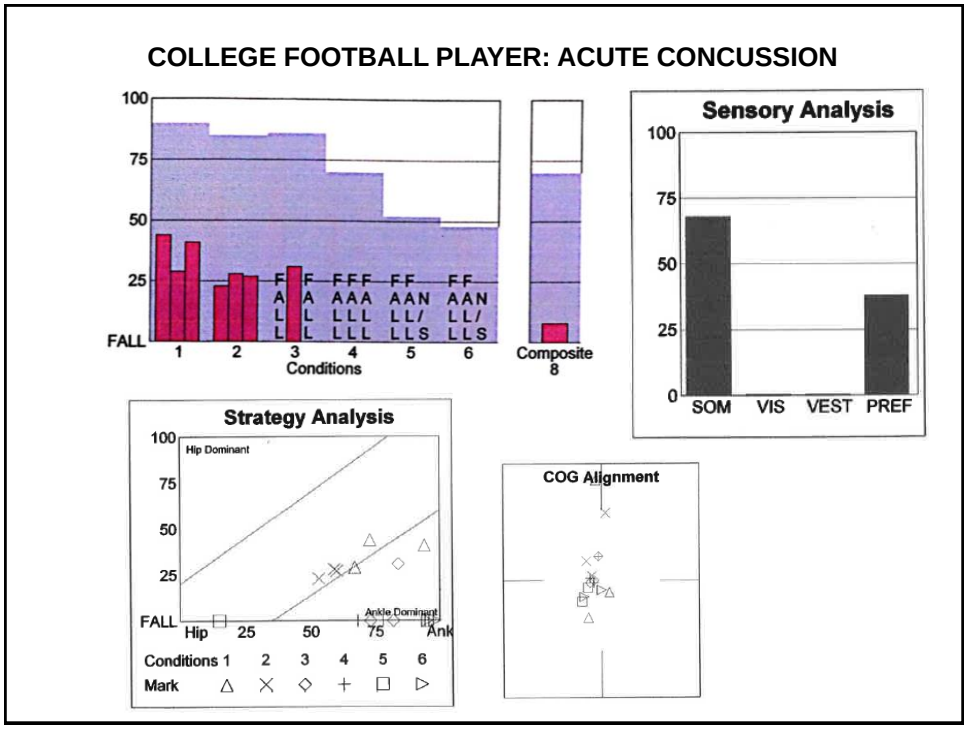
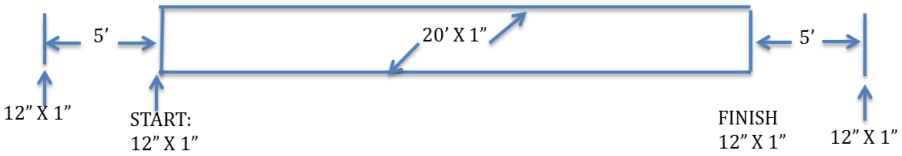


PREF: The degree to which a patient relies on visual information to maintain balance, even when that information is incorrect



Functional Gait Assessment (see handout appendix for scoring)

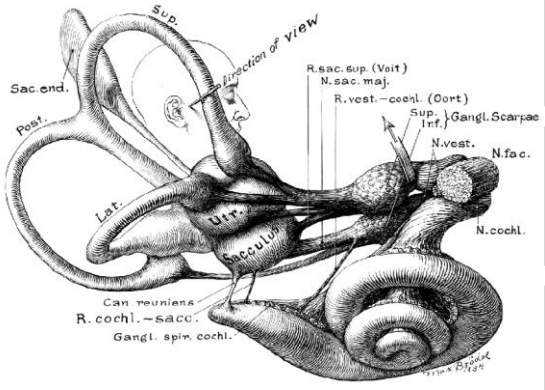
- 2 standard shoe boxes taped together.
- Stopwatch.
- Standard staircase.
- During testing, walk slightly behind the participant while preforming the item (for safety). Do not pace the participant. Demonstrate each item after reading the instructions.



FGA (score sheet in handout)

- 10 items (max score=30)
- Concussion seems to affect the following items:
  - Walking with horizontal and vertical head turns
  - Walking tandem
  - Walking with eyes closed
  - Total score does not seem to be sensitive to concussion
    - Similar scores between concussed symptomatic, asymptomatic and controls in our lab
- Moore 2016 found improvement in FGA following a 6 month VR program in athletes with concussion

FOUR BASIC RESPONSIBILITIES OF THE VESTIBULAR SYSTEM:



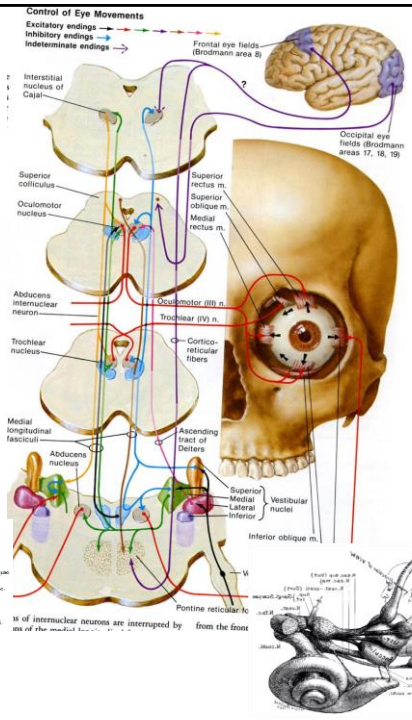
1. AUTONOMIC RESPONSES & PERCEPTION OF STABILITY/MOVEMENT:
Brainstem connections

2. PERCEPTION OF VERTICAL:
Vestibulo-Thalamico-Cortical pathways

3. POSTURAL CONTROL:
Vestibulo-spinal Reflex

4. GAZE STABILITY:
Vestibulo-Ocular Reflex

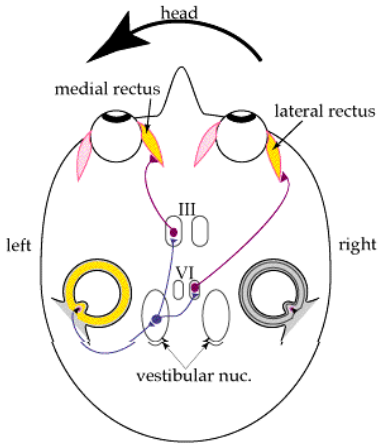
Netter, F. The Netter Collection of Medical Illustrations, Vol. 1. P. 181



GAZE STABILITY:

Vestibulo
Ocular
Reflex

VESTIBULO-OCULAR REFLEX (VOR): Eyes move opposite of the head at the same velocity and frequency

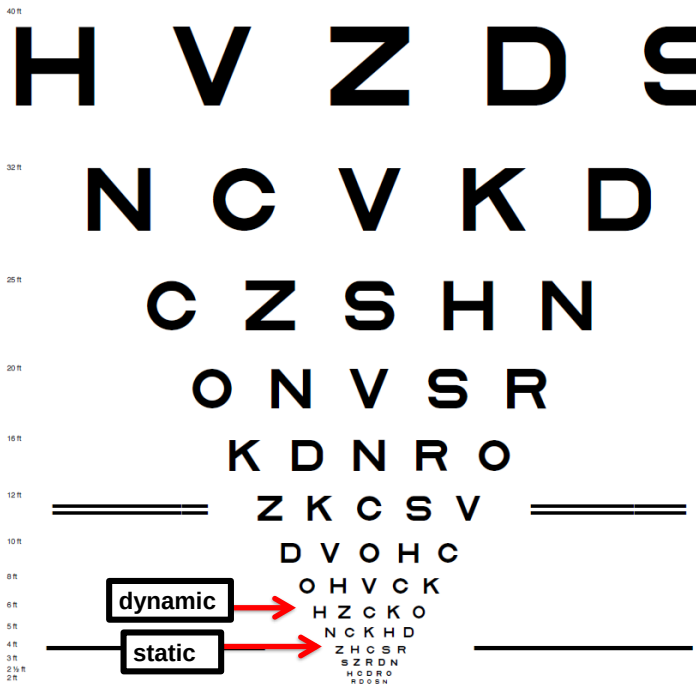


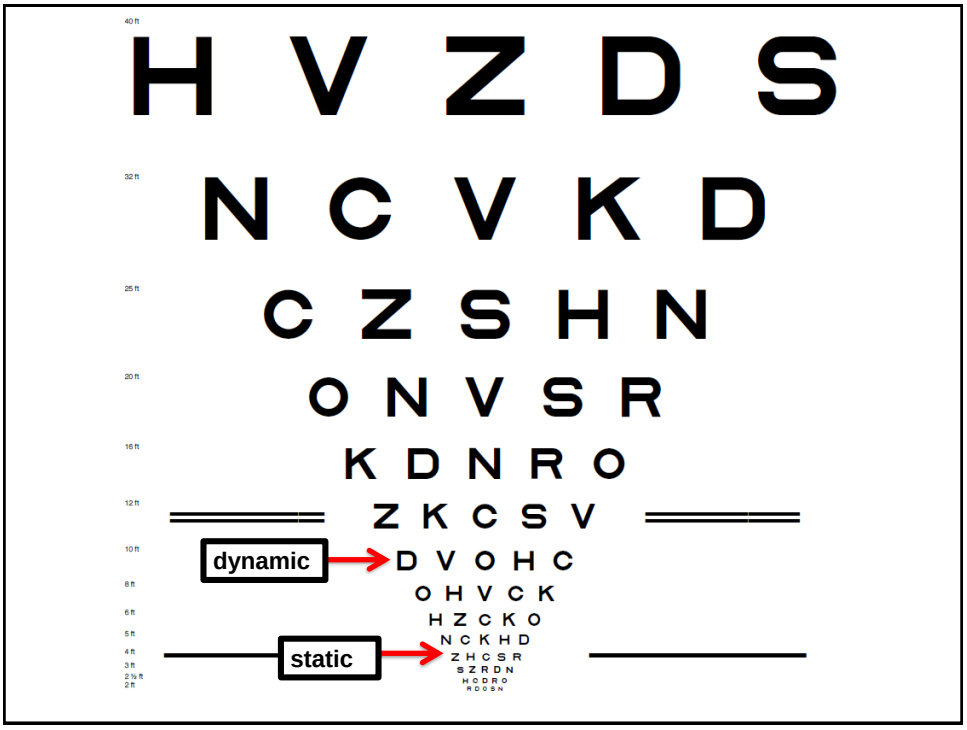
To clinically test the VOR, do the test of Dynamic Visual Acuity (DVA):

- Tests the patient's ability to USE the VOR in function (not a test of vestibular function)
- Do this test LAST in your protocol (will most likely provoke symtoms)
  - determine dizziness and headache score (VAS or 0-10)
  - If > 4 do not attempt DVA test.
    - Use clinical judgment
    - Will probably not do this with acute concussion

How to do the Clinical DVA test:

- www.i-see.org (download a ETDRS eye chart) – included in handout
  - 5 optotypes per line
- Read eye chart with head static
- Then repeat with head moving in yaw at 2 Hz (small amplitude – about 30 degrees)
  - Download metronome app (240 Hz)
- Degradation of 3 or more lines is positive for decreased VOR function
- Obtain post-DVA dizziness and headache VAS score





Computerized DVA & Gaze Stabilization Test

COMPANIES:
BERTEC (15K)
NATUS
MICROMEDICAL

DVA: Looks at the difference in visual acuity during head movement versus stationary

GST: measures the most rapid head movement velocity at which the patient can maintain visual acuity

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Computerized DVA and GST

- Therapist controls the head movement
- Practice on many people before doing it on patients
  - See if you can get consistent results on the same person
- Do GST first.
  - If abnormal, then do DVA (don't try to do both)
- Obtain baseline and post test headache and dizziness score

Computerized DVA and GST - Evidence

- Marquez 2017
  - Normative values for NeuroCom in Vision system for NCAA division I college football players.
- McDevitt 2016
  - Gaze Stabilization Test + OKN stimulation symptoms + NPC discriminated concussed from healthy controls (94.4%; AUC=0.95)
- Patterson 2017
  - DVA was not affected by physical exertion
  - NeuroCom inVision DVA had fair to good test-retest reliability (ICC=0.40-0.74)

Computerized DVA and GST – More Evidence

- Wright 2017
  - The BESS, KD and computerized DVA did not distinguish post-acute concussed (n=14) from healthy controls (n=58).
- Heick 2017:
  - No relationship between the K-D, SOT, Head Shake SOT, and DVA in healthy recreational athletes aged 14-24 years.
  - These tests evaluate different aspects of visual-vestibular-oculomotor function

If DVA is abnormal, do the Head Impulse Test

- Considered a clinical test of peripheral vestibular function (VOR)
- Will most likely be negative in concussion
- Easy to do and quick, but may provoke symptoms
- Grasp the head, tell the patient to keep their eyes on your nose. Quickly and unexpectedly move the head to the right or left, stopping to observe the eye movement.
- Repeat 3 times to both sides, random order.
- Positive test = inability to keep fixation on nose for 2 or more responses
  - Moving head to R side – tests R side vestibular function
  - Moving head to L side – tests L side

NO Catch up saccades

Catch up saccades

If positive, refer to ENT for further testing

If positive, refer to ENT for further testing

VESTIBULAR AND OCULOMOTOR RESEARCH CLINIC

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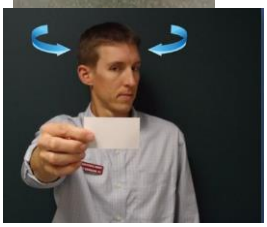

VESTIBULAR REHABILITATION:

1. Gaze instability
2. Symptoms with movement or function
3. Static/dynamic balance issues
4. Abnormal SVV

PUBMED SEARCH 07/05/2018:

- "CONCUSSION AND PHYSICAL THERAPY"
  - 423 ARTICLES
- "CONCUSSION AND VESTIBULAR REHABILITATION"
  - 72 ARTICLES
- JOURNAL OF NEUROLOGIC PT, JULY 2018 SPECIAL ISSUE ON CONCUSSION

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Storey 2018: Vestibular rehabilitation is associated with visuovestibular improvement in pediatric concussion

- Retrospective review
- 109 children (mean age 11.8 yrs), 44% with sports related concussion
- Tested using a protocol
- Completed a standard but not customized home program of VOR, balance and oculomotor exercises
- Performance on tasks improved
- BESS improved
- Did not assess DVA, SVV or SOT

Murray 2017: Can vestibular rehabilitation exercises help patients with concussion? A systematic review of efficacy, prescription and progression patterns

- 10 studies met inclusion criteria
  - 2 RCT; 3 uncontrolled studies; 5 case studies
- 1 study demonstrated increased rates (OR 3.91) of medical clearance for return to sport within 8 weeks, when VRT + cervical therapy was compared with usual care
- 8 studies used habituation + adaptation
- 9 studies used balance exercises

Makdissi 2017: Approach to investigation and treatment of persistent symptoms following sport related concussion: a systematic review

- 25 articles met inclusion criteria
  - 11 articles about assessment; 14 articles about treatment
  - 3 RCT; 1 quasi-experimental; 21 cross-sectional, retrospective, case-series
- Persistent symptoms = clinical recovery of >10-14 days for adults and >4 weeks in kids
- Symptom-limited aerobic exercise, targeted PT, cognitive behavioral therapy
- Treatment should be multidisciplinary

Schneider 2017: Rest and treatment/rehabilitation following sport-related concussion: a systematic review

- 28 studies met inclusion criteria
  - 9 on effects of rest. 19 on effects of active treatment
  - 5 RCT's
- Rest, cervical and vestibular rehabilitation, sub-symptom threshold aerobic exercise, multifaceted collaborative care
- *"A brief period (24-48 hours) of cognitive and physical rest is appropriate for most patients. Following this, patients should be encouraged to gradually increase activity."*

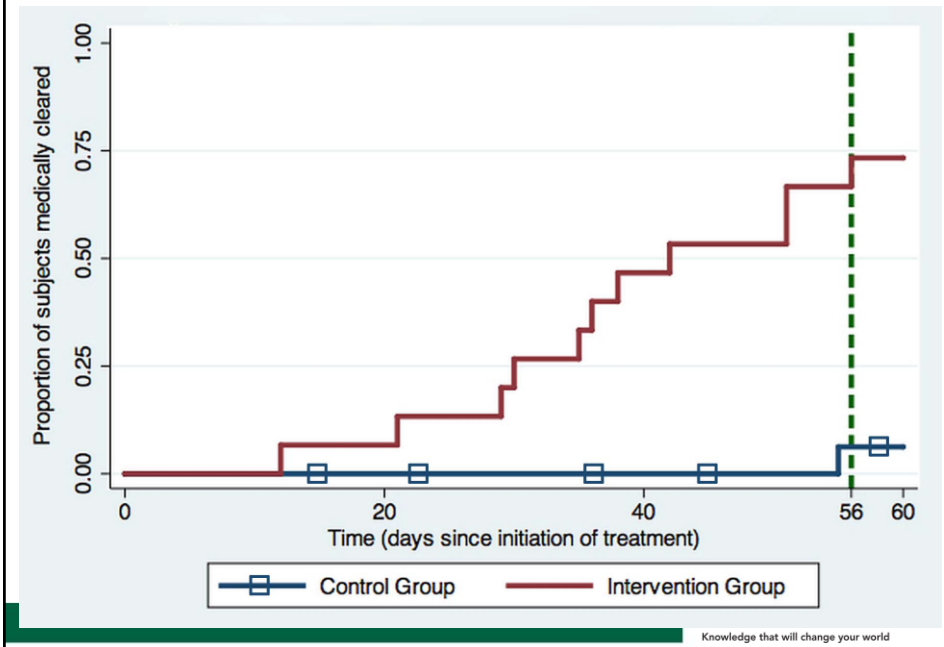
- Leddy 2016: "Absolute rest beyond the 1st few days after concussion may be detrimental to recovery." Do sub-symptom threshold exercise.
- Chrisman 2017: Sub-symptom Threshold Exercise Program (n=83)
- Grabowski 2017: Multimodal impairment based PT (n=25), retrospective (included VR)
- Moore 2016: VR and Aerobic Training Program (n=14)
- Gagnon 2016: Active rehabilitation intervention (n=10)

VESTIBULAR REHABILITATION AND CONCUSSION AND BALANCE THERAPY FOR ATHLETES WITH CONCUSSION

- Hoffer, Schubert and Balaban, 2015:
  - Review article with conclusions drawn from the literature on the military and clinical experience
- Alsahaleen et al. 2010:
  - Retrospective Chart Review
  - VR improves outcomes and shortens disability times in patients with mTBI that did not improve with rest

Schneider et al. 2014:

- Randomized Controlled Trial
- 31 individuals with concussion aged 12-30 years
  - Treatment group (standard care + Vestibular PT and cervical spine PT)
  - Control group (standard care: rest until symptom free, followed by graded exertion)
- The treatment group returned to sport significantly faster than the control group (within 8 weeks of initiating treatment).



Gottshall et al. 2010

- Pre-test/Post-test design
- N=82 military participants with mTBI who received vestibular therapy
  - SOT and Motor Control Test.
  - Dynamic Gait Index.
  - Neurocom inVision Tunnel Standardized Test:
    - SVA. DVA. Perception Time. Target acquisition. Target Following. GST.
- Vestibular therapy was provided 2X/week for 1 hour, 4-8 weeks, home program.
  - Adaptation/Substitution. Depth Perception. Static Balance. Dynamic Balance. Aerobic Activity.
- Most outcomes returned to normal after 4 weeks

- Broglio et al. 2015:
  - INVITED REVIEW ARTICLE
  - Concussion rehab: consensus based
  - Controlled exercise and cognitive activity may stimulate recovery
  - Vestibular, oculomotor and pharmacological therapies are promising if delivered by a trained professional

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VESTIBULAR REHABILITATION

Jennifer Christy, PT, PhD

VESTIBULAR REHABILITATION IS BASED ON FUNDAMENTAL THEORIES OF RECOVERY

- Adaptation:
  - Retinal slip drives VOR adaptation at the level of the vestibular nuclei
- Substitution:
  - Promote centrally pre-programmed saccades to help with gaze stability (Schubert et al.)
  - Promote use of all available sensory systems for balance
- Habituation:
  - To decrease symptoms

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Vestibular and Balance Therapy

- Goal: improve gaze stability with head movement
  - Gaze Stabilization Exercises
- Reduce Symptoms of dizziness/motion sensitivity
  - Habituation Exercises
- Improve balance
  - Static and Dynamic Balance Exercises
- VBT: do several times/day at home
- 1-2X/week clinic visits to progress
- Symptoms typically resolve in 6-12 weeks

GAZE STABILIZATION EXERCISES

1. Repetition (3X/day minimum for 6-12 weeks)
2. Error signal (ADAPTATION)
3. Voluntary head movement
   - ✓ Yaw and Pitch
   - ✓ Small Amplitude
   - ✓ Neck soreness
   - ✓ Exercises might make them dizzier
4. Active participation
5. Goal oriented and specific

Hall 2016

Gaze Stabilization Exercises

- X1 viewing
- X2 viewing
- Gaze Shifting

- IMPORTANT: These exercises should not induce a headache. If headache occurs during the exercise, the PT should adjust so that the exercise can be completed without inducing headache.

Equipment for GSE:

- Two business cards, index cards or post-it notes with a single small letter or number written on them in black ink (referred to as "target" in the instructions). NOTE: the target letter or number should be small enough that keeping it in focus during head movement will be a challenge. Therefore, target size will vary between participants depending on their abilities. The goal is to make the exercise challenging without inducing headache.
- Blank wall or busier background (depending on level)
- Chair (if doing the exercises in sitting)
- A method of timing the exercises (e.g. timer, song, stopwatch)

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X1 Viewing, Distant Target:

- Assess symptoms of dizziness on a scale of 0 (no dizziness) to 10 (extremely dizzy). This will become the baseline symptom score.
- Place the card with the target onto a blank wall at eye level while the participant is standing with feet shoulder distance apart, 6-10 feet from the wall.
- The participant should be instructed to move their head in yaw (i.e. saying "no") as quickly as possible while keeping the target in focus. The head movement does not have to be very large. Cue the participant to move the head faster and faster until they feel that the target is "*just about to go out of focus*."
- Continue for 1 minute without stopping
- Rest for 1 minute or until symptoms of dizziness return to no more than 2 over baseline.
- Repeat using pitch head movements (i.e. saying "yes")
- Can also do while holding the card in front of them (simple background)

X1 yaw (far target)

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X1 pitch (busy)

CONSIDERATIONS

- Target size (larger at first)
- Start doing them facing a blank wall or less busy environment
- Have them assess headache and dizziness before and after the exercise
  - Symptoms should come down to baseline within 15 minutes.
  - If not, they need to back off

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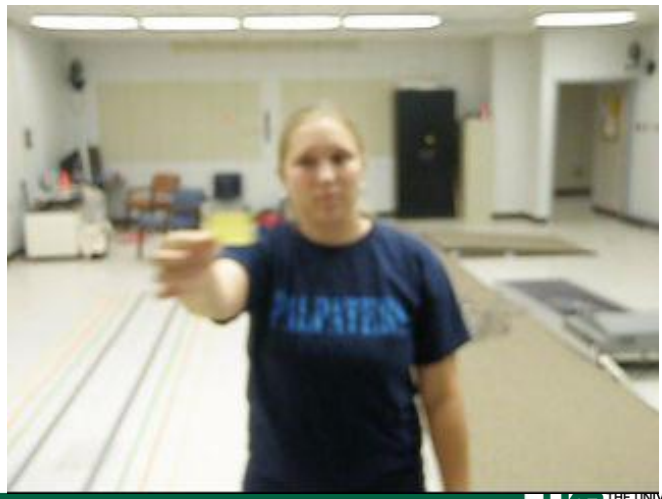
X2 Viewing (only after X1 with no symptoms)

- While sitting or standing, hold the target at arm's length.
- Instruct the participant to move the head and target in yaw (i.e. saying "no") in opposite directions, keeping the target in focus. As with X1, the head and target movement does not have to be very large. Cue the participant to move the head and target faster and faster until they feel that the target is "*just about to go out of focus*."
- Continue for 1 minute without stopping
- Rest for 1 minute or until symptoms of dizziness return to no more than 2 over baseline.
- Repeat using pitch head movements (i.e. saying "yes")

X2 yaw (takes practice!)

X2 yaw (watch her eyes)



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X2 pitch

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X2 yaw busy

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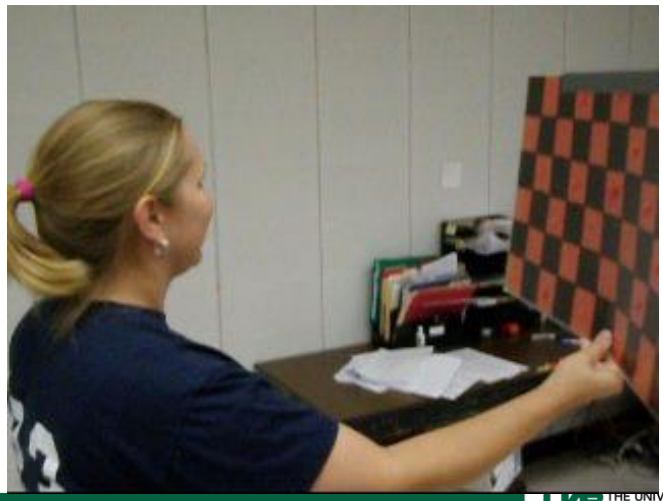
X2 yaw busy



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PROGRESSION

Levels	Background	Balance Challenges	Target Size	Speed of head movement	Time
Easy	Plain/White	Sitting or standing with feet shoulder width apart	Large (e.g. 2.5cm or larger)	Slow (1Hz)	1 minute
Medium	Busy (checkerboard or wallpaper)	Standing with feet together or in tandem Standing on foam pad Standing on 1 foot	Medium (e.g. 2cm)	Medium (1.5 Hz)	1.5 minutes
Difficult	Moving background (e.g. TV; window in front of traffic; holding card in crowded area)	Walking forward/back; jumping; standing on 1 foot on foam pad; treadmill	Small (e.g. 1 cm or smaller)	Fast (2 Hz)	2 minutes

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Gaze Shifting

- The patient should sit or stand 2 feet from a blank wall
- Place 2 targets (e.g. X and Z) on the blank wall at eye level, side by side. To achieve the correct distance between targets, place 1 target slightly to the participant's left at eye level. The participant should then turn the head to point the nose at the target. Place the 2nd letter to the participant's right so that the participant can see the target using peripheral vision. In most cases, the letters will be about 2 feet apart.
- Instruct the participant to point the nose and eyes to the X (i.e. target on the left).
- Instruct the participant to "turn the eyes to the Z" (i.e. make a saccade to the target on the right), then quickly "point the nose at the Z" (i.e. make a quick head movement while keeping the letter in focus).
- Repeat, going to the opposite side (i.e. Eyes, then Head)
- Continue for 1 minute without stopping
- Rest for 1 minute or until symptoms of dizziness return to no more than 2 over baseline.
- Repeat using pitch head movements (i.e. saying "yes")

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GAZE SHIFTING

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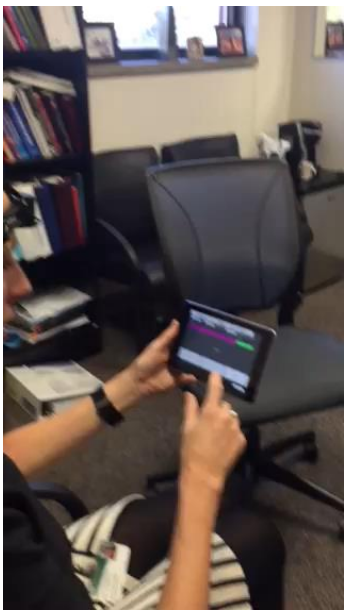
Progression

Levels	Background	Balance Challenges	Speed of head mov't	Target placement	Time
Easy	Plain/White	Sitting or standing with feet shoulder width apart	Slow	2 targets placed side by side or up/down	1 minute
Medium	Busy (checkerboard or wallpaper)	Standing with feet together or in tandem Standing on foam pad Standing on 1 foot	Medium	Several targets placed diagonally	2 minutes
Difficult	Moving: e.g. window with traffic or TV	Walking forward/back; standing on 1 foot on foam pad; treadmill	Fast	Several targets placed in functional places (e.g. simulate driving)	3 minutes



TABLET VERSION: VOR X1 VIEWING

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Habituation

1) Determine the stimulus that causes the participant to become symptomatic using an appropriate outcome measure (e.g. VOMS, VAS, VVAS)
2) Identify 2-3 specific stimuli (head movement, body movement or visual stimulus) that mildly or moderately provoke symptoms. These will be the exercises to prescribe.
3) If habituation of head or body movement is the goal, instruct the participant to complete the exacerbating movement 3-5 repetitions, 3 times per day, resting between repetitions so that the symptoms return to baseline. For example, if going from supine to sitting is moderately provoking, the participant should first rate symptoms on a scale of 0 (no symptoms) to 10 (severe symptoms), go from supine to sit, then let the symptoms return to baseline, then lie back down and repeat 3-5 times.
4) Do this 2-3 times per day with the goal of being able to go 3 days in a row without motion related symptoms.

- If habituation of visual stimuli is the goal, find a video on you tube that mildly provokes symptoms (note: if you search for "urban walking" there are many videos to choose. You can also search for "Emory Dizziness and Balance"). Instruct the patient to watch the video ONLY UNTIL SYMPTOMS BEGIN. The participant should then document the # of seconds, let the symptoms return to baseline, and repeat (i.e. 2 repetitions total).
- Do this 2-3 times per day with the goal of increasing the time of viewing the video to 2 minutes without symptoms.
- NOTE: the goal is to bring on symptoms, but they should not get sick. Following the exercises, symptoms should return to baseline within 15 minutes or you did too much. *If you give them too much, you can make them worse.*
- These exercises should not induce a headache. If headache occurs during the exercise, the PT should adjust so that the exercises do not induce headache.
- X1 and X2 viewing can be used as habituation. For example, if yaw and pitch head movements are symptom provoking, you can use these as habituation exercises.

You Tube Website: Emory Dizziness and Balance

HABITUATION

HOME EXERCISE PROGRAM PRINCIPLES

- The VBT Home Exercise Program (HEP) should be custom designed for each participant
- The HEP session should be able to be completed in under 10 minutes so that it is not too overwhelming for participants to complete 2-3 times per day.
- The PT should specifically write out the home program for the participant and require that participants keep a log of activities completed, and symptoms.
- The PT should stress that the exercises should not induce headache.
  - If headache increases with exercise, the participant should contact the PT so that exercises can be adjusted (e.g. increasing target size, slowing down head movement, sitting, decreasing time).

HEP for a patient in week 1 of VBT who has poor dynamic visual acuity, static balance problems and visual vertigo.

AM SESSION:

- Standing: X1 viewing to a far target on a blank wall in yaw (1 minute) and pitch (1 minute)
- Sitting: Gaze shifting to 2 targets on a blank wall in yaw (1 minute) and pitch (1 minute)
- Single legged stance with eyes closed (2 minutes total)

NOON SESSION

- Watch a prescribed you-tube video to tolerance twice (allow symptoms to return to baseline and document seconds)
- Remembered targets in yaw (1 minute) and pitch (1 minute)

PM SESSON:

- Take a 5 minute walk outside if weather allows, turn head to look around (dynamic balance)
- X1 viewing in yaw (1 minute) and pitch (1 minute) to hand held target
- Standing: Gaze shifting to 2 targets on a blank wall in yaw (1 minute) and pitch (1 minute)

*Please contact your PT if exercises induce headache. Symptoms of dizziness should return to baseline no more than 15 minutes following each session.

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CONCUSSION CASE

Thanks to Brian King, PT, MS, NCS for this case!

Concussion Case

- 16 year old female
- Hit back of head on car frame as she was trying to get into her car (about 2 weeks prior)
- Immediate headache, neck pain, and sleepiness
- At school next day – could not focus on words and nauseated from lights and noises
  - Passive learning half days for first 2 weeks
  - Passive learning for full day on day of evaluation with plan to start active learning the next week

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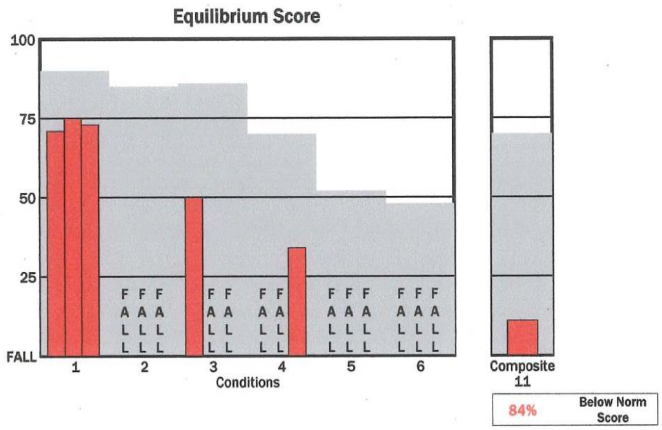
- Ongoing symptoms:
  - Consistent headaches after school day
  - Dizziness (gets worse when in the car)
  - Avoids activities that involve too much stimulation
  - Decreased balance
  - Headache (today pain 7/10; past week range 6-9/10)
- First concussion
- Initially had difficulty sleeping – now taking double the dose of melatonin originally recommended and reports sleep is better

Objective

- Functional Gait Assessment (FGA): 17/30
- Balance Error Scoring System (BESS): 27/60
- Convergence Insufficiency Symptom Survey (CISS): 45/60
- Visual Vertigo Analog Scale (VVAS):
  - Passenger in car – 7.5 cm
  - Under fluorescent lights – 8 cm
  - Walk over patterned floor – 8 cm
  - Watch action television – 7.5 cm
  - Walk through supermarket, shopping mall, on escalators, walk over patterned floor, watch movie at movie theater – pt avoids

SOT Baseline (visit 2)



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The Balke Protocol

Time (min)	Speed (mph)	% Grade
1	3.3	0
2	3.3	2
3	3.3	3
•	Speed is constant at 3.3 mph	
•	Elevation increases	
•	1% each minute	
22	3.3	22

VISIT 3:

- Went 8 min 45 sec; stopped for headache
- 5% incline
- HR max to 141

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Objective / Orthopedic

- Pain block week prior to being seen
- PROM –
  - L SB and RR minimally restricted
- JM:
  - OA in extended position with side bent to R and rotated L
- MMT:
  - Deep Neck Flexor Endurance 2 seconds (norm females = 29 seconds)
  - C-spine RR 3+ w/pain

Treatment

- HEP – X1; started with 30 seconds duration, sitting only from about 8 feet away
- Next visit – increased to 45 seconds, added in X1 at arms distance
- Next visit: gaze shifting exercise; 1 min 45 seconds
- Increased duration of X1 to 60s
- Increase cardiovascular exercise time – split between treadmill and Nustep

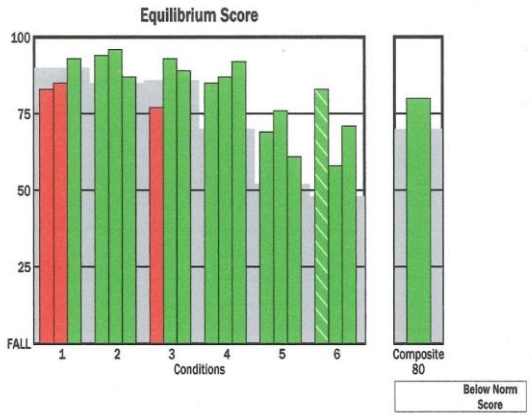
Treatment

- Added full visual field to X1 exercise
- Added in remembered target exercise
- On date of discharge – added X2 and gait with head turns

Discharge

- About 3.5 months after initial visit, pt reported she was feeling better and overall back to baseline. Driving without any symptoms. School work going well.
- FGA: 17/30 – 27/30
- BESS: 27/60 – 10/60
- VVAS: 0 on all items except:
  - "watch traffic": 3 cm
  - "walk over patterned floor": 1 cm
  - "movie at theater" : not rated

SOT - Discharge



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Knowledge that will change your world

BJSM Online First, published on April 26, 2017 as 10.1136/bjsports-2017-097506SCAT5

SCAT5©

SPORT CONCUSSION ASSESSMENT TOOL – 5TH EDITION

DEVELOPED BY THE CONCUSSION IN SPORT GROUP

FOR USE BY MEDICAL PROFESSIONALS ONLY

supported by

Patient details

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date of Injury: _____ Time: _____

WHAT IS THE SCAT5?

The SCAT5 is a standardized tool for evaluating concussions designed for use by physicians and licensed healthcare professionals[1]. The SCAT5 cannot be performed correctly in less than 10 minutes.

If you are not a physician or licensed healthcare professional, please use the Concussion Recognition Tool 5 (CRT5). The SCAT5 is to be used for evaluating athletes aged 13 years and older. For children aged 12 years or younger, please use the Child SCAT5.

Preseason SCAT5 baseline testing can be useful for interpreting post-injury test scores, but is not required for that purpose.Detailed instructions for use of the SCAT5 are provided on page 7. Please read through these instructions carefully before testing the athlete. Brief verbal instructions for each test are given in italics. The only equipment required for the tester is a watch or timer.

Recognise and Remove

A head impact by either a direct blow or indirect transmission of force can be associated with a serious and potentially fatal brain injury. If there are significant concerns, including any of the red flags listed in Box 1, then activation of emergency procedures and urgent transport to the nearest hospital should be arranged.

Key points

- Any athlete with suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration. No athlete diagnosed with concussion should be returned to play on the day of injury.
- If an athlete is suspected of having a concussion and medical personnel are not immediately available, the athlete should be referred to a medical facility for urgent assessment.
- Athletes with suspected concussion should not drink alcohol, use recreational drugs and should not drive a motor vehicle until cleared to do so by a medical professional.
- Concussion signs and symptoms evolve over time and it is important to consider repeat evaluation in the assessment of concussion.
- The diagnosis of a concussion is a clinical judgment, made by a medical professional. The SCAT5 should NOT be used by itself to make, or exclude, the diagnosis of concussion. An athlete may have a concussion even if their SCAT5 is "normal".

Remember:

- The basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Do not attempt to move the athlete (other than that required for airway management) unless trained to do so.
- Assessment for a spinal cord injury is a critical part of the initial on-field assessment.
- Do not remove a helmet or any other equipment unless trained to do so safely.

1

IMMEDIATE OR ON-FIELD ASSESSMENT

The following elements should be assessed for all athletes who are suspected of having a concussion prior to proceeding to the neurocognitive assessment and ideally should be done on-field after the first first aid / emergency care priorities are completed.

If any of the "Red Flags" or observable signs are noted after a direct or indirect blow to the head, the athlete should be immediately and safely removed from participation and evaluated by a physician or licensed healthcare professional.

Consideration of transportation to a medical facility should be at the discretion of the physician or licensed healthcare professional.

The GCS is important as a standard measure for all patients and can be done serially if necessary in the event of deterioration in conscious state. The Maddocks questions and cervical spine exam are critical steps of the immediate assessment; however, these do not need to be done serially.

STEP 1: RED FLAGS

RED FLAGS:

- **Neck pain or tenderness**
- **Double vision**
- **Weakness or tingling/ burning in arms or legs**
- **Severe or increasing headache**
- **Seizure or convulsion**
- **Loss of consciousness**
- **Deteriorating conscious state**
- **Vomiting**
- **Increasingly restless, agitated or combative**

STEP 2: OBSERVABLE SIGNS

Witnessed ☐ Observed on Video ☐

Lying motionless on the playing surface	Y	N
Balance / gait difficulties / motor incoordination: stumbling, slow / laboured movements	Y	N
Disorientation or confusion, or an inability to respond appropriately to questions	Y	N
Blank or vacant look	Y	N
Facial injury after head trauma	Y	N

STEP 3: MEMORY ASSESSMENT MADDOCKS QUESTIONS[2]

"I am going to ask you a few questions, please listen carefully and give your best effort. First, tell me what happened?"

Mark Y for correct answer / N for incorrect

What venue are we at today?	Y	N
Which half is it now?	Y	N
Who scored last in this match?	Y	N
What team did you play last week / game?	Y	N
Did your team win the last game?	Y	N

Note: Appropriate sport-specific questions may be substituted.

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

STEP 4: EXAMINATION GLASGOW COMA SCALE (GCS)[3]

Time of assessment			
Date of assessment			
Best eye response (E)			
No eye opening	1	1	1
Eye opening in response to pain	2	2	2
Eye opening to speech	3	3	3
Eyes opening spontaneously	4	4	4
Best verbal response (V)			
No verbal response	1	1	1
Incomprehensible sounds	2	2	2
Inappropriate words	3	3	3
Confused	4	4	4
Oriented	5	5	5
Best motor response (M)			
No motor response	1	1	1
Extension to pain	2	2	2
Abnormal flexion to pain	3	3	3
Flexion / Withdrawal to pain	4	4	4
Localizes to pain	5	5	5
Obeys commands	6	6	6
Glasgow Coma score (E + V + M)			

CERVICAL SPINE ASSESSMENT

Does the athlete report that their neck is pain free at rest?	Y	N
If there is NO neck pain at rest, does the athlete have a full range of ACTIVE pain free movement?	Y	N
Is the limb strength and sensation normal?	Y	N

In a patient who is not lucid or fully conscious, a cervical spine injury should be assumed until proven otherwise.

OFFICE OR OFF-FIELD ASSESSMENT

Please note that the neurocognitive assessment should be done in a distraction-free environment with the athlete in a resting state.

STEP 1: ATHLETE BACKGROUND

Sport / team / school: _____

Date / time of injury: _____

Years of education completed: _____

Age: _____

Gender: M / F / Other

Dominant hand: left / neither / right

How many diagnosed concussions has the athlete had in the past?: _____

When was the most recent concussion?: _____

How long was the recovery (time to being cleared to play) from the most recent concussion?: _____ (days)

Has the athlete ever been:

Hospitalized for a head injury?	Yes	No
Diagnosed / treated for headache disorder or migraines?	Yes	No
Diagnosed with a learning disability / dyslexia?	Yes	No
Diagnosed with ADD / ADHD?	Yes	No
Diagnosed with depression, anxiety or other psychiatric disorder?	Yes	No

Current medications? If yes, please list:

_____

_____

_____

_____

_____

_____

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

2

STEP 2: SYMPTOM EVALUATION

The athlete should be given the symptom form and asked to read this instruction paragraph out loud then complete the symptom scale. For the baseline assessment, the athlete should rate his/her symptoms based on how he/she typically feels and for the post injury assessment the athlete should rate their symptoms at this point in time.

Please Check: ☐ **Baseline** ☐ **Post-Injury**

Please hand the form to the athlete

	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 vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "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
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
Trouble falling asleep (if applicable)	0	1	2	3	4	5	6

Total number of symptoms:	of 22
Symptom severity score:	of 132
Do your symptoms get worse with physical activity?	Y N
Do your symptoms get worse with mental activity?	Y N
If 100% is feeling perfectly normal, what percent of normal do you feel?	

If not 100%, why?

_____

_____

_____

Please hand form back to examiner

3

STEP 3: COGNITIVE SCREENING

Standardised Assessment of Concussion (SAC)[4]

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

ORIENTATION

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
What time is it right now? (within 1 hour)	0	1
Orientation score		of 5

IMMEDIATE MEMORY

The Immediate Memory component can be completed using the traditional 5-word per trial list or optionally using 10-words per trial to minimise any ceiling effect. All 3 trials must be administered irrespective of the number correct on the first trial. Administer at the rate of one word per second.

Please choose EITHER the 5 or 10 word list groups and circle the specific word list chosen for this test.

I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order. For Trials 2 & 3: I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before.

List	Alternate 5 word lists					Score (of 5) Trial 1	Trial 2	Trial 3
A	Finger	Penny	Blanket	Lemon	Insect			
B	Candle	Paper	Sugar	Sandwich	Wagon			
C	Baby	Monkey	Perfume	Sunset	Iron			
D	Elbow	Apple	Carpet	Saddle	Bubble			
E	Jacket	Arrow	Pepper	Cotton	Movie			
F	Dollar	Honey	Mirror	Saddle	Anchor			
					Immediate Memory Score			of 15
					Time that last trial was completed			

List	Alternate 10 word lists					Score (of 10) Trial 1	Trial 2	Trial 3
G	Finger Candle	Penny Paper	Blanket Sugar	Lemon Sandwich	Insect Wagon			
H	Baby Elbow	Monkey Apple	Perfume Carpet	Sunset Saddle	Iron Bubble			
I	Jacket Dollar	Arrow Honey	Pepper Mirror	Cotton Saddle	Movie Anchor			
					Immediate Memory Score			of 30
					Time that last trial was completed			

CONCENTRATION

DIGITS BACKWARDS

Please circle the Digit list chosen (A, B, C, D, E, F). Administer at the rate of one digit per second reading DOWN the selected column.

I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7.

Concentration Number Lists (circle one)

List A	List B	List C			
4-9-3	5-2-6	1-4-2	Y	N	0
6-2-9	4-1-5	6-5-8	Y	N	1
3-8-1-4	1-7-9-5	6-8-3-1	Y	N	0
3-2-7-9	4-9-6-8	3-4-8-1	Y	N	1
6-2-9-7-1	4-8-5-2-7	4-9-1-5-3	Y	N	0
1-5-2-8-6	6-1-8-4-3	6-8-2-5-1	Y	N	1
7-1-8-4-6-2	8-3-1-9-6-4	3-7-6-5-1-9	Y	N	0
5-3-9-1-4-8	7-2-4-8-5-6	9-2-6-5-1-4	Y	N	1
List D	**List E**	**List F**			
7-8-2	3-8-2	2-7-1	Y	N	0
9-2-6	5-1-8	4-7-9	Y	N	1
4-1-8-3	2-7-9-3	1-6-8-3	Y	N	0
9-7-2-3	2-1-6-9	3-9-2-4	Y	N	1
1-7-9-2-6	4-1-8-6-9	2-4-7-5-8	Y	N	0
4-1-7-5-2	9-4-1-7-5	8-3-9-6-4	Y	N	1
2-6-4-8-1-7	6-9-7-3-8-2	5-8-6-2-4-9	Y	N	0
8-4-1-9-3-5	4-2-7-9-3-8	3-1-7-8-2-6	Y	N	1
		Digits Score:			of 4

MONTHS IN REVERSE ORDER

Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November. Go ahead.

Dec - Nov - Oct - Sept - Aug - Jul - Jun - May - Apr - Mar - Feb - Jan	0 1
Months Score	of 1
Concentration Total Score (Digits + Months)	of 5

4

STEP 4: NEUROLOGICAL SCREEN

See the instruction sheet (page 7) for details of test administration and scoring of the tests.

Can the patient read aloud (e.g. symptom check-list) and follow instructions without difficulty?	Y	N
Does the patient have a full range of pain-free PASSIVE cervical spine movement?	Y	N
Without moving their head or neck, can the patient look side-to-side and up-and-down without double vision?	Y	N
Can the patient perform the finger nose coordination test normally?	Y	N
Can the patient perform tandem gait normally?	Y	N

BALANCE EXAMINATION

Modified Balance Error Scoring System (mBESS) testing[5]

Which foot was tested (i.e. which is the non-dominant foot) ☐ Left ☐ Right

Testing surface (hard floor, field, etc.) _____

Footwear (shoes, barefoot, braces, tape, etc.) _____

Condition	Errors
Double leg stance	of 10
Single leg stance (non-dominant foot)	of 10
Tandem stance (non-dominant foot at the back)	of 10
Total Errors	of 30

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

5

STEP 5: DELAYED RECALL:

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section. Score 1 pt. for each correct response.

Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.

Time Started _____

Please record each word correctly recalled. Total score equals number of words recalled.

_____

_____

_____

Total number of words recalled accurately: _____ of 5 or _____ of 10

6

STEP 6: DECISION

	Date & time of assessment:		
Domain			
Symptom number (of 22)			
Symptom severity score (of 132)			
Orientation (of 5)			
Immediate memory	of 15 of 30	of 15 of 30	of 15 of 30
Concentration (of 5)			
Neuro exam	Normal Abnormal	Normal Abnormal	Normal Abnormal
Balance errors (of 30)			
Delayed Recall	of 5 of 10	of 5 of 10	of 5 of 10

Date and time of injury: _____

If the athlete is known to you prior to their injury, are they different from their usual self?

☐ **Yes** ☐ **No** ☐ **Unsure** ☐ **Not Applicable**

(If different, describe why in the clinical notes section)

Concussion Diagnosed?

☐ **Yes** ☐ **No** ☐ **Unsure** ☐ **Not Applicable**

If re-testing, has the athlete improved?

☐ **Yes** ☐ **No** ☐ **Unsure** ☐ **Not Applicable**

I am a physician or licensed healthcare professional and I have personally administered or supervised the administration of this SCAT5.

Signature: _____

Name: _____

Title: _____

Registration number (if applicable): _____

Date: _____

SCORING ON THE SCAT5 SHOULD NOT BE USED AS A STAND-ALONE METHOD TO DIAGNOSE CONCUSSION, MEASURE RECOVERY OR MAKE DECISIONS ABOUT AN ATHLETE'S READINESS TO RETURN TO COMPETITION AFTER CONCUSSION.

CLINICAL NOTES:

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

CONCUSSION INJURY ADVICE

(To be given to the person monitoring the concussed athlete)

This patient has received an injury to the head. A careful medical examination has been carried out and no sign of any serious complications has been found. Recovery time is variable across individuals and the patient will need monitoring for a further period by a responsible adult. Your treating physician will provide guidance as to this timeframe.

If you notice any change in behaviour, vomiting, worsening headache, double vision or excessive drowsiness, please telephone your doctor or the nearest hospital emergency department immediately.

Other important points:

Initial rest: Limit physical activity to routine daily activities (avoid exercise, training, sports) and limit activities such as school, work, and screen time to a level that does not worsen symptoms.

1) Avoid alcohol

2) Avoid prescription or non-prescription drugs without medical supervision. Specifically:

   a) Avoid sleeping tablets

   b) Do not use aspirin, anti-inflammatory medication or stronger pain medications such as narcotics

3) Do not drive until cleared by a healthcare professional.

4) Return to play/sport requires clearance by a healthcare professional.

Clinic phone number: _____

Patient's name: _____

Date / time of injury: _____

Date / time of medical review: _____

Healthcare Provider: _____

Contact details or stamp

INSTRUCTIONS

Words in *Italics* throughout the SCAT5 are the instructions given to the athlete by the clinician

Symptom Scale

The time frame for symptoms should be based on the type of test being administered. At baseline it is advantageous to assess how an athlete "typically" feels whereas during the acute/post-acute stage it is best to ask how the athlete feels at the time of testing.

The symptom scale should be completed by the athlete, not by the examiner. In situations where the symptom scale is being completed after exercise, it should be done in a resting state, generally by approximating his/her resting heart rate.

For total number of symptoms, maximum possible is 22 except immediately post injury, if sleep item is omitted, which then creates a maximum of 21.

For Symptom severity score, add all scores in table, maximum possible is 22 x 6 = 132, except immediately post injury if sleep item is omitted, which then creates a maximum of 21x6=126.

Immediate Memory

The Immediate Memory component can be completed using the traditional 5-word per trial list or, optionally, using 10-words per trial. The literature suggests that the Immediate Memory has a notable ceiling effect when a 5-word list is used. In settings where this ceiling is prominent, the examiner may wish to make the task more difficult by incorporating two 5–word groups for a total of 10 words per trial. In this case, the maximum score per trial is 10 with a total trial maximum of 30.

Choose one of the word lists (either 5 or 10). Then perform 3 trials of immediate memory using this list.

Complete all 3 trials regardless of score on previous trials.

"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order." The words must be read at a rate of one word per second.

Trials 2 & 3 MUST be completed regardless of score on trial 1 & 2.

Trials 2 & 3:

"I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before."

Score 1 pt. for each correct response. Total score equals sum across all 3 trials. Do NOT inform the athlete that delayed recall will be tested.

Concentration

Digits backward

Choose one column of digits from lists A, B, C, D, E or F and administer those digits as follows:

Say: *"I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7."*

Begin with first 3 digit string.

If correct, circle "Y" for correct and go to next string length. If incorrect, circle "N" for the first string length and read trial 2 in the same string length. One point possible for each string length. Stop after incorrect on both trials (2 N's) in a string length. The digits should be read at the rate of one per second.

Months in reverse order

"Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November ... Go ahead"

1 pt. for entire sequence correct

Delayed Recall

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section.

"Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order."

Score 1 pt. for each correct response

Modified Balance Error Scoring System (mBESS)[5] testing

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)[5]. A timing device is required for this testing.

Each of 20-second trial/stance is scored by counting the number of errors. The examiner will begin counting errors only after the athlete has assumed the proper start position. The modified BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum number of errors for any single condition is 10. If the athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once the athlete is set. Athletes that are unable to maintain the testing procedure for a minimum of five seconds at the start are assigned the highest possible score, ten, for that testing condition.

OPTION: For further assessment, the same 3 stances can be performed on a surface of medium density foam (e.g., approximately 50cm x 40cm x 6cm).

Balance testing – types of errors

1. Hands lifted off iliac crest
2. Opening eyes
3. Step, stumble, or fall
4. Moving hip into > 30 degrees abduction
5. Lifting forefoot or heel
6. Remaining out of test position > 5 sec

"I am now going to test your balance. Please take your shoes off (if applicable), roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances."

(a) Double leg stance:

"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."

(b) Single leg stance:

"If you were to kick a ball, which foot would you use? [This will be the dominant foot] *Now stand on your non-dominant foot. The dominant leg should be held in approximately 30 degrees of hip flexion and 45 degrees of knee flexion. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

(c) Tandem stance:

"Now stand heel-to-toe with your non-dominant foot in back. Your weight should be evenly distributed across both feet. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."

Tandem Gait

Participants are instructed to stand with their feet together behind a starting line (the test is best done with footwear removed). Then, they walk in a forward direction as quickly and as accurately as possible along a 38mm wide (sports tape), 3 metre line with an alternate foot heel-to-toe gait ensuring that they approximate their heel and toe on each step. Once they cross the end of the 3m line, they turn 180 degrees and return to the starting point using the same gait. Athletes fail the test if they step off the line, have a separation between their heel and toe, or if they touch or grab the examiner or an object.

Finger to Nose

"I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended), pointing in front of you. When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose, and then return to the starting position, as quickly and as accurately as possible."

References

1. McCrory et al. Consensus Statement On Concussion In Sport – The 5th International Conference On Concussion In Sport Held In Berlin, October 2016. British Journal of Sports Medicine 2017 (available at www.bjsm.bmj.com)
2. Maddocks, DL; Dicker, GD; Saling, MM. The assessment of orientation following concussion in athletes. Clinical Journal of Sport Medicine 1995; 5: 32-33
3. Jennett, B., Bond, M. Assessment of outcome after severe brain damage: a practical scale. Lancet 1975; i: 480-484
4. McCrea M. Standardized mental status testing of acute concussion. Clinical Journal of Sport Medicine. 2001; 11: 176-181
5. Guskiewicz KM. Assessment of postural stability following sport-related concussion. Current Sports Medicine Reports. 2003; 2: 24-30

CONCUSSION INFORMATION

Any athlete suspected of having a concussion should be removed from play and seek medical evaluation.

Signs to watch for

Problems could arise over the first 24-48 hours. The athlete should not be left alone and must go to a hospital at once if they experience:

- Worsening headache
- Drowsiness or inability to be awakened
- Inability to recognize people or places
- Repeated vomiting
- Unusual behaviour or confusion or irritable
- Seizures (arms and legs jerk uncontrollably)
- Weakness or numbness in arms or legs
- Unsteadiness on their feet.
- Slurred speech

Consult your physician or licensed healthcare professional after a suspected concussion. Remember, it is better to be safe.

Rest & Rehabilitation

After a concussion, the athlete should have physical rest and relative cognitive rest for a few days to allow their symptoms to improve. In most cases, after no more than a few days of rest, the athlete should gradually increase their daily activity level as long as their symptoms do not worsen. Once the athlete is able to complete their usual daily activities without concussion-related symptoms, the second step of the return to play/sport progression can be started. The athlete should not return to play/sport until their concussion-related symptoms have resolved and the athlete has successfully returned to full school/learning activities.

When returning to play/sport, the athlete should follow a stepwise, **medically managed exercise progression, with increasing amounts of exercise.** For example:

Graduated Return to Sport Strategy

Exercise step	Functional exercise at each step	Goal of each step
1. Symptom-limited activity	Daily activities that do not provoke symptoms.	Gradual reintroduction of work/school activities.
2. Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training.	Increase heart rate.
3. Sport-specific exercise	Running or skating drills. No head impact activities.	Add movement.
4. Non-contact training drills	Harder training drills, e.g., passing drills. May start progressive resistance training.	Exercise, coordination, and increased thinking.
5. Full contact practice	Following medical clearance, participate in normal training activities.	Restore confidence and assess functional skills by coaching staff.
6. Return to play/sport	Normal game play.	

In this example, it would be typical to have 24 hours (or longer) for each step of the progression. If any symptoms worsen while exercising, the athlete should go back to the previous step. Resistance training should be added only in the later stages (Stage 3 or 4 at the earliest).

Written clearance should be provided by a healthcare professional before return to play/sport as directed by local laws and regulations.

Graduated Return to School Strategy

Concussion may affect the ability to learn at school. The athlete may need to miss a few days of school after a concussion. When going back to school, some athletes may need to go back gradually and may need to have some changes made to their schedule so that concussion symptoms do not get worse. If a particular activity makes symptoms worse, then the athlete should stop that activity and rest until symptoms get better. To make sure that the athlete can get back to school without problems, it is important that the healthcare provider, parents, caregivers and teachers talk to each other so that everyone knows what the plan is for the athlete to go back to school.

Note: If mental activity does not cause any symptoms, the athlete may be able to skip step 2 and return to school part-time before doing school activities at home first.

Mental Activity	Activity at each step	Goal of each step
1. Daily activities that do not give the athlete symptoms	Typical activities that the athlete does during the day as long as they do not increase symptoms (e.g. reading, texting, screen time). Start with 5-15 minutes at a time and gradually build up.	Gradual return to typical activities.
2. School activities	Homework, reading or other cognitive activities outside of the classroom.	Increase tolerance to cognitive work.
3. Return to school part-time	Gradual introduction of school-work. May need to start with a partial school day or with increased breaks during the day.	Increase academic activities.
4. Return to school full-time	Gradually progress school activities until a full day can be tolerated.	Return to full academic activities and catch up on missed work.

If the athlete continues to have symptoms with mental activity, some other accomodations that can help with return to school may include:

- Starting school later, only going for half days, or going only to certain classes
- More time to finish assignments/tests
- Quiet room to finish assignments/tests
- Not going to noisy areas like the cafeteria, assembly halls, sporting events, music class, shop class, etc.
- Taking lots of breaks during class, homework, tests
- No more than one exam/day
- Shorter assignments
- Repetition/memory cues
- Use of a student helper/tutor
- Reassurance from teachers that the child will be supported while getting better

The athlete should not go back to sports until they are back to school/learning, without symptoms getting significantly worse and no longer needing any changes to their schedule.

BJSM Online First, published on April 26, 2017 as 10.1136/bjsports-2017-097492childscat5

Child SCAT5©

SPORT CONCUSSION ASSESSMENT TOOL

FOR CHILDREN AGES 5 TO 12 YEARS

FOR USE BY MEDICAL PROFESSIONALS ONLY

supported by

Patient details

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date of Injury: _____ Time: _____

WHAT IS THE CHILD SCAT5?

The Child SCAT5 is a standardized tool for evaluating concussions designed for use by physicians and licensed healthcare professionals[1].

If you are not a physician or licensed healthcare professional, please use the Concussion Recognition Tool 5 (CRT5). The Child SCAT5 is to be used for evaluating Children aged 5 to 12 years. For athletes aged 13 years and older, please use the SCAT5.

Preseason Child SCAT5 baseline testing can be useful for interpreting post-injury test scores, but not required for that purpose. Detailed instructions for use of the Child SCAT5 are provided on page 7. Please read through these instructions carefully before testing the athlete. Brief verbal instructions for each test are given in italics. The only equipment required for the tester is a watch or timer.

Recognise and Remove

A head impact by either a direct blow or indirect transmission of force can be associated with a serious and potentially fatal brain injury. If there are significant concerns, including any of the red flags listed in Box 1, then activation of emergency procedures and urgent transport to the nearest hospital should be arranged.

Key points

- Any athlete with suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration. No athlete diagnosed with concussion should be returned to play on the day of injury.
- If the child is suspected of having a concussion and medical personnel are not immediately available, the child should be referred to a medical facility for urgent assessment.
- Concussion signs and symptoms evolve over time and it is important to consider repeat evaluation in the assessment of concussion.
- The diagnosis of a concussion is a clinical judgment, made by a medical professional. The Child SCAT5 should NOT be used by itself to make, or exclude, the diagnosis of concussion. An athlete may have a a concussion even if their Child SCAT5 is "normal".

Remember:

- The basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Do not attempt to move the athlete (other than that required for airway management) unless trained to do so.
- Assessment for a spinal cord injury is a critical part of the initial on-field assessment.
- Do not remove a helmet or any other equipment unless trained to do so safely.

1

IMMEDIATE OR ON-FIELD ASSESSMENT

The following elements should be assessed for all athletes who are suspected of having a concussion prior to proceeding to the neurocognitive assessment and ideally should be done on-field after the first first aid / emergency care priorities are completed.

If any of the "Red Flags" or observable signs are noted after a direct or indirect blow to the head, the athlete should be immediately and safely removed from participation and evaluated by a physician or licensed healthcare professional.

Consideration of transportation to a medical facility should be at the discretion of the physician or licensed healthcare professional.

The GCS is important as a standard measure for all patients and can be done serially if necessary in the event of deterioration in conscious state. The cervical spine exam is a critical step of the immediate assessment, however, it does not need to be done serially.

STEP 1: RED FLAGS

RED FLAGS:

- **Neck pain or tenderness**
- **Double vision**
- **Weakness or tingling/ burning in arms or legs**
- **Severe or increasing headache**
- **Seizure or convulsion**
- **Loss of consciousness**
- **Deteriorating conscious state**
- **Vomiting**
- **Increasingly restless, agitated or combative**

STEP 2: OBSERVABLE SIGNS

Witnessed ☐ Observed on Video ☐

Lying motionless on the playing surface	Y	N
Balance / gait difficulties / motor incoordination: stumbling, slow / laboured movements	Y	N
Disorientation or confusion, or an inability to respond appropriately to questions	Y	N
Blank or vacant look	Y	N
Facial injury after head trauma	Y	N

STEP 3: EXAMINATION
GLASGOW COMA SCALE (GCS)[2]

Time of assessment			
Date of assessment			
Best eye response (E)			
No eye opening	1	1	1
Eye opening in response to pain	2	2	2
Eye opening to speech	3	3	3
Eyes opening spontaneously	4	4	4
Best verbal response (V)			
No verbal response	1	1	1
Incomprehensible sounds	2	2	2
Inappropriate words	3	3	3
Confused	4	4	4
Oriented	5	5	5
Best motor response (M)			
No motor response	1	1	1
Extension to pain	2	2	2
Abnormal flexion to pain	3	3	3
Flexion / Withdrawal to pain	4	4	4
Localizes to pain	5	5	5
Obeys commands	6	6	6
Glasgow Coma score (E + V + M)			

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

CERVICAL SPINE ASSESSMENT

Does the athlete report that their neck is pain free at rest?	Y	N
If there is NO neck pain at rest, does the athlete have a full range of ACTIVE pain free movement?	Y	N
Is the limb strength and sensation normal?	Y	N

In a patient who is not lucid or fully conscious, a cervical spine injury should be assumed until proven otherwise.

OFFICE OR OFF-FIELD ASSESSMENT
STEP 1: ATHLETE BACKGROUND

Please note that the neurocognitive assessment should be done in a distraction-free environment with the athlete in a resting state.

Sport / team / school: _____

Date / time of injury: _____

Years of education completed: _____

Age: _____

Gender: M / F / Other

Dominant hand: left / neither / right

How many diagnosed concussions has the athlete had in the past?: _____

When was the most recent concussion?: _____

How long was the recovery (time to being cleared to play) from the most recent concussion?: _____ (days)

Has the athlete ever been:

Hospitalized for a head injury?	Yes	No
Diagnosed / treated for headache disorder or migraines?	Yes	No
Diagnosed with a learning disability / dyslexia?	Yes	No
Diagnosed with ADD / ADHD?	Yes	No
Diagnosed with depression, anxiety or other psychiatric disorder?	Yes	No

Current medications? If yes, please list: _____

STEP 2: SYMPTOM EVALUATION

The athlete should be given the symptom form and asked to read this instruction paragraph out loud then complete the symptom scale. For the baseline assessment, the athlete should rate his/her symptoms based on how he/she typically feels and for the post injury assessment the athlete should rate their symptoms at this point in time.

To be done in a resting state

Please Check: ☐ Baseline ☐ Post-Injury

2

Child Report[3]

	Not at all/ Never	A little/ Rarely	Somewhat/ Sometimes	A lot/ Often
I have headaches	0	1	2	3
I feel dizzy	0	1	2	3
I feel like the room is spinning	0	1	2	3
I feel like I'm going to faint	0	1	2	3
Things are blurry when I look at them	0	1	2	3
I see double	0	1	2	3
I feel sick to my stomach	0	1	2	3
My neck hurts	0	1	2	3
I get tired a lot	0	1	2	3
I get tired easily	0	1	2	3
I have trouble paying attention	0	1	2	3
I get distracted easily	0	1	2	3
I have a hard time concentrating	0	1	2	3
I have problems remembering what people tell me	0	1	2	3
I have problems following directions	0	1	2	3
I daydream too much	0	1	2	3
I get confused	0	1	2	3
I forget things	0	1	2	3
I have problems finishing things	0	1	2	3
I have trouble figuring things out	0	1	2	3
It's hard for me to learn new things	0	1	2	3
Total number of symptoms:				of 21
Symptom severity score:				of 63
Do the symptoms get worse with physical activity?			Y	N
Do the symptoms get worse with trying to think?			Y	N

Overall rating for child to answer:

	Very bad									Very good
On a scale of 0 to 10 (where 10 is normal), how do you feel now?	0	1	2	3	4	5	6	7	8	9	10

If not 10, in what way do you feel different?:

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

Parent Report

The child:

	Not at all/ Never	A little/ Rarely	Somewhat/ Sometimes	A lot/ Often
has headaches	0	1	2	3
feels dizzy	0	1	2	3
has a feeling that the room is spinning	0	1	2	3
feels faint	0	1	2	3
has blurred vision	0	1	2	3
has double vision	0	1	2	3
experiences nausea	0	1	2	3
has a sore neck	0	1	2	3
gets tired a lot	0	1	2	3
gets tired easily	0	1	2	3
has trouble sustaining attention	0	1	2	3
is easily distracted	0	1	2	3
has difficulty concentrating	0	1	2	3
has problems remembering what he/she is told	0	1	2	3
has difficulty following directions	0	1	2	3
tends to daydream	0	1	2	3
gets confused	0	1	2	3
is forgetful	0	1	2	3
has difficulty completing tasks	0	1	2	3
has poor problem solving skills	0	1	2	3
has problems learning	0	1	2	3
Total number of symptoms:				of 21
Symptom severity score:				of 63
Do the symptoms get worse with physical activity?			Y	N
Do the symptoms get worse with mental activity?			Y	N

Overall rating for parent/teacher/coach/carer to answer

On a scale of 0 to 100% (where 100% is normal), how would you rate the child now?

If not 100%, in what way does the child seem different?

3

STEP 3: COGNITIVE SCREENING

Standardized Assessment of Concussion - Child Version (SAC-C)[4]

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

IMMEDIATE MEMORY

The Immediate Memory component can be completed using the traditional 5-word per trial list or optionally using 10-words per trial to minimise any ceiling effect. All 3 trials must be administered irrespective of the number correct on the first trial. Administer at the rate of one word per second.

Please choose EITHER the 5 or 10 word list groups and circle the specific word list chosen for this test.

I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order. For Trials 2 & 3: I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before.

List	Alternate 5 word lists					Score (of 5) Trial 1	Trial 2	Trial 3
A	Finger	Penny	Blanket	Lemon	Insect			
B	Candle	Paper	Sugar	Sandwich	Wagon			
C	Baby	Monkey	Perfume	Sunset	Iron			
D	Elbow	Apple	Carpet	Saddle	Bubble			
E	Jacket	Arrow	Pepper	Cotton	Movie			
F	Dollar	Honey	Mirror	Saddle	Anchor			
					Immediate Memory Score			of 15
					Time that last trial was completed			

List	Alternate 10 word lists					Score (of 10) Trial 1	Trial 2	Trial 3
G	Finger Candle	Penny Paper	Blanket Sugar	Lemon Sandwich	Insect Wagon			
H	Baby Elbow	Monkey Apple	Perfume Carpet	Sunset Saddle	Iron Bubble			
I	Jacket Dollar	Arrow Honey	Pepper Mirror	Cotton Saddle	Movie Anchor			
					Immediate Memory Score			of 30
					Time that last trial was completed			

CONCENTRATION

DIGITS BACKWARDS

Please circle the Digit list chosen (A, B, C, D, E, F). Administer at the rate of one digit per second reading DOWN the selected column.

I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7.

Concentration Number Lists (circle one)					
List A	List B	List C			
5-2	4-1	4-9	Y	N	0
4-1	9-4	6-2	Y	N	1
4-9-3	5-2-6	1-4-2	Y	N	0
6-2-9	4-1-5	6-5-8	Y	N	1
3-8-1-4	1-7-9-5	6-8-3-1	Y	N	0
3-2-7-9	4-9-6-8	3-4-8-1	Y	N	1
6-2-9-7-1	4-8-5-2-7	4-9-1-5-3	Y	N	0
1-5-2-8-6	6-1-8-4-3	6-8-2-5-1	Y	N	1
7-1-8-4-6-2	8-3-1-9-6-4	3-7-6-5-1-9	Y	N	0
5-3-9-1-4-8	7-2-4-8-5-6	9-2-6-5-1-4	Y	N	1
List D	List E	List F			
2-7	9-2	7-8	Y	N	0
5-9	6-1	5-1	Y	N	1
7-8-2	3-8-2	2-7-1	Y	N	0
9-2-6	5-1-8	4-7-9	Y	N	1
4-1-8-3	2-7-9-3	1-6-8-3	Y	N	0
9-7-2-3	2-1-6-9-	3-9-2-4	Y	N	1
1-7-9-2-6	4-1-8-6-9	2-4-7-5-8	Y	N	0
4-1-7-5-2	9-4-1-7-5	8-3-9-6-4	Y	N	1
2-6-4-8-1-7	6-9-7-3-8-2	5-8-6-2-4-9	Y	N	0
8-4-1-9-3-5	4-2-7-3-9-8	3-1-7-8-2-6	Y	N	1
		Digits Score:			of 5

DAYS IN REVERSE ORDER

Now tell me the days of the week in reverse order. Start with the last day and go backward. So you'll say Sunday, Saturday. Go ahead.

Sunday - Saturday - Friday - Thursday - Wednesday - Tuesday - Monday	0 1
Days Score	of 1
Concentration Total Score (Digits + Days)	of 6

4

STEP 4: NEUROLOGICAL SCREEN

See the instruction sheet (page 7) for details of test administration and scoring of the tests.

Can the patient read aloud (e.g. symptom check-list) and follow instructions without difficulty?	Y	N
Does the patient have a full range of pain-free PASSIVE cervical spine movement?	Y	N
Without moving their head or neck, can the patient look side-to-side and up-and-down without double vision?	Y	N
Can the patient perform the finger nose coordination test normally?	Y	N
Can the patient perform tandem gait normally?	Y	N

BALANCE EXAMINATION

Modified Balance Error Scoring System (BESS) testing[5]

Which foot was tested (i.e. which is the non-dominant foot) ☐ Left ☐ Right

Testing surface (hard floor, field, etc.) _____

Footwear (shoes, barefoot, braces, tape, etc.) _____

Condition	Errors	
Double leg stance	of 10	
Single leg stance (non-dominant foot, 10-12 y/o only)	of 10	
Tandem stance (non-dominant foot at back)	of 10	
Total Errors	5-9 y/o of 20	10-12 y/o of 30

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

5

STEP 5: DELAYED RECALL:

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section. Score 1 pt. for each correct response.

Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.

Time Started _____

Please record each word correctly recalled. Total score equals number of words recalled.

_____

_____

_____

Total number of words recalled accurately: of 5 or of 10

6

STEP 6: DECISION

	Date & time of assessment:		
Domain			
Symptom number Child report (of 21) Parent report (of 21)			
Symptom severity score Child report (of 63) Parent report (of 63)			
Immediate memory	of 15 of 30	of 15 of 30	of 15 of 30
Concentration (of 6)			
Neuro exam	Normal Abnormal	Normal Abnormal	Normal Abnormal
Balance errors (5-9 y/o of 20) (10-12 y/o of 30)			
Delayed Recall	of 5 of 10	of 5 of 10	of 5 of 10

Date and time of injury: _____

If the athlete is known to you prior to their injury, are they different from their usual self?

☐ **Yes** ☐ **No** ☐ **Unsure** ☐ **Not Applicable**

(If different, describe why in the clinical notes section)

Concussion Diagnosed?

☐ **Yes** ☐ **No** ☐ **Unsure** ☐ **Not Applicable**

If re-testing, has the athlete improved?

☐ **Yes** ☐ **No** ☐ **Unsure** ☐ **Not Applicable**

I am a physician or licensed healthcare professional and I have personally administered or supervised the administration of this Child SCAT5.

Signature: _____

Name: _____

Title: _____

Registration number (if applicable): _____

Date: _____

SCORING ON THE CHILD SCAT5 SHOULD NOT BE USED AS A STAND-ALONE METHOD TO DIAGNOSE CONCUSSION, MEASURE RECOVERY OR MAKE DECISIONS ABOUT AN ATHLETE'S READINESS TO RETURN TO COMPETITION AFTER CONCUSSION.

For the Neurological Screen (page 5), if the child cannot read, ask him/her to describe what they see in this picture.

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

CLINICAL NOTES:

Concussion injury advice for the child and parents/carergivers

(To be given to the person monitoring the concussed child)

This child has had an injury to the head and needs to be carefully watched for the next 24 hours by a responsible adult.

If you notice any change in behavior, vomiting, dizziness, worsening headache, double vision or excessive drowsiness, please call an ambulance to take the child to hospital immediately.

Other important points:

Following concussion, the child should rest for at least 24 hours.

- The child should not use a computer, internet or play video games if these activities make symptoms worse.
- The child should not be given any medications, including pain killers, unless prescribed by a medical doctor.
- The child should not go back to school until symptoms are improving.
- The child should not go back to sport or play until a doctor gives permission.

Clinic phone number: _____

Patient's name: _____

Date / time of injury: _____

Date / time of medical review: _____

Healthcare Provider: _____

Contact details or stamp

INSTRUCTIONS

Words in *Italics* throughout the Child SCAT5 are the instructions given to the athlete by the clinician

Symptom Scale

In situations where the symptom scale is being completed after exercise, it should still be done in a resting state, at least 10 minutes post exercise.

At Baseline

- The child is to complete the Child Report, according to how he/she feels today, and
- The parent/carer is to complete the Parent Report according to how the child has been over the previous week.

On the day of injury

- The child is to complete the Child Report, according to how he/she feels now.
- If the parent is present, and has had time to assess the child on the day of injury, the parent completes the Parent Report according to how the child appears now.

On all subsequent days

- The child is to complete the Child Report, according to how he/she feels today, and
- The parent/carer is to complete the Parent Report according to how the child has been over the previous 24 hours.

For Total number of symptoms, maximum possible is 21

For Symptom severity score, add all scores in table, maximum possible is 21 x 3 = 63

Standardized Assessment of Concussion Child Version (SAC-C)

Immediate Memory

Choose one of the 5-word lists. Then perform 3 trials of immediate memory using this list.

Complete all 3 trials regardless of score on previous trials.

"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order." The words must be read at a rate of one word per second.

OPTION: The literature suggests that the Immediate Memory has a notable ceiling effect when a 5-word list is used. (In younger children, use the 5-word list). In settings where this ceiling is prominent the examiner may wish to make the task more difficult by incorporating two 5–word groups for a total of 10 words per trial. In this case the maximum score per trial is 10 with a total trial maximum of 30.

Trials 2 & 3 MUST be completed regardless of score on trial 1 & 2.

Trials 2 & 3: *"I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before."*

Score 1 pt. for each correct response. Total score equals sum across all 3 trials. Do NOT inform the athlete that delayed recall will be tested.

Concentration

Digits backward

Choose one column only, from List A, B, C, D, E or F, and administer those digits as follows:

"I am going to read you some numbers and when I am done, you say them back to me backwards, in reverse order of how I read them to you. For example, if I say 7-1, you would say 1-7."

If correct, circle "Y" for correct and go to next string length. If incorrect, circle "N" for the first string length and read trial 2 in the same string length. One point possible for each string length. Stop after incorrect on both trials (2 N's) in a string length. The digits should be read at the rate of one per second.

Days of the week in reverse order

"Now tell me the days of the week in reverse order. Start with Sunday and go backward. So you'll say Sunday, Saturday ... Go ahead"

1 pt. for entire sequence correct

Delayed Recall

The delayed recall should be performed after at least 5 minutes have elapsed since the end of the Immediate Recall section.

"Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order."

Circle each word correctly recalled. Total score equals number of words recalled.

Neurological Screen

Reading

The child is asked to read a paragraph of text from the instructions in the Child SCAT5. For children who can not read, they are asked to describe what they see in a photograph or picture, such as that on page 6 of the Child SCAT5.

Modified Balance Error Scoring System (mBESS)[5] testing

These instructions are to be read by the person administering the Child SCAT5, and each balance task should be demonstrated to the child. The child should then be asked to copy what the examiner demonstrated.

Each of 20-second trial/stance is scored by counting the number of errors. The This balance testing is based on a modified version of the Balance Error Scoring System (BESS)[5].

A stopwatch or watch with a second hand is required for this testing.

"I am now going to test your balance. Please take your shoes off, roll up your pants above your ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of two different parts."

OPTION: For further assessment, the same 3 stances can be performed on a surface of medium density foam (e.g., approximately 50cm x 40cm x 6cm).

(a) Double leg stance:

The first stance is standing with the feet together with hands on hips and with eyes closed. The child should try to maintain stability in that position for 20 seconds. You should inform the child that you will be counting the number of times the child moves out of this position. You should start timing when the child is set and the eyes are closed.

(b) Tandem stance:

Instruct or show the child how to stand heel-to-toe with the non-dominant foot in the back. Weight should be evenly distributed across both feet. Again, the child should try to maintain stability for 20 seconds with hands on hips and eyes closed. You should inform the child that you will be counting the number of times the child moves out of this position. If the child stumbles out of this position, instruct him/her to open the eyes and return to the start position and continue balancing. You should start timing when the child is set and the eyes are closed.

(c) Single leg stance (10-12 year olds only):

"If you were to kick a ball, which foot would you use? [This will be the dominant foot] *Now stand on your other foot. You should bend your other leg and hold it up (show the child). Again, try to stay in that position for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you move out of this position, open your eyes and return to the start position and keep balancing. I will start timing when you are set and have closed your eyes."*

Balance testing – types of errors

1. Hands lifted off iliac crest
2. Opening eyes
3. Step, stumble, or fall
4. Moving hip into > 30 degrees abduction
5. Lifting forefoot or heel
6. Remaining out of test position > 5 sec

Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the child. The examiner will begin counting errors only after the child has assumed the proper start position. The modified BESS is calculated by adding one error point for each error during the 20-second tests. The maximum total number of errors for any single condition is 10. If a child commits multiple errors simultaneously, only one error is recorded but the child should quickly return to the testing position, and counting should resume once subject is set. Children who are unable to maintain the testing procedure for a minimum of five seconds at the start are assigned the highest possible score, ten, for that testing condition.

Tandem Gait

Instruction for the examiner - Demonstrate the following to the child:

The child is instructed to stand with their feet together behind a starting line (the test is best done with footwear removed). Then, they walk in a forward direction as quickly and as accurately as possible along a 38mm wide (sports tape), 3 metre line with an alternate foot heel-to-toe gait ensuring that they approximate their heel and toe on each step. Once they cross the end of the 3m line, they turn 180 degrees and return to the starting point using the same gait. Children fail the test if they step off the line, have a separation between their heel and toe, or if they touch or grab the examiner or an object.

Finger to Nose

The tester should demonstrate it to the child.

"I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended). When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose as quickly and as accurately as possible."

Scoring: 5 correct repetitions in < 4 seconds = 1

Note for testers: Children fail the test if they do not touch their nose, do not fully extend their elbow or do not perform five repetitions.

References

1. McCrory et al. Consensus Statement On Concussion In Sport – The 5th International Conference On Concussion In Sport Held In Berlin, October 2016. British Journal of Sports Medicine 2017 (available at www.bjsm.bmj.com)
2. Jennett, B., Bond, M. Assessment of outcome after severe brain damage: a practical scale. Lancet 1975; i: 480-484
3. Ayr, L.K., Yeates, K.O., Taylor, H.G., Brown, M. Dimensions of postconcussive symptoms in children with mild traumatic brain injuries. Journal of the International Neuropsychological Society. 2009; 15:19–30
4. McCrea M. Standardized mental status testing of acute concussion. Clinical Journal of Sports Medicine. 2001; 11: 176-181
5. Guskiewicz KM. Assessment of postural stability following sport-related concussion. Current Sports Medicine Reports. 2003; 2: 24-30

CONCUSSION INFORMATION

If you think you or a teammate has a concussion, tell your coach/trainer/parent right away so that you can be taken out of the game. You or your teammate should be seen by a doctor as soon as possible. YOU OR YOUR TEAMMATE SHOULD NOT GO BACK TO PLAY/SPORT THAT DAY.

Signs to watch for

Problems can happen over the first 24-48 hours. You or your teammate should not be left alone and must go to a hospital right away if any of the following happens:

- New headache, or headache gets worse
- Neck pain that gets worse
- Becomes sleepy/drowsy or can't be woken up
- Cannot recognise people or places
- Feeling sick to your stomach or vomiting
- Acting weird/strange, seems/feels confused, or is irritable
- Has any seizures (arms and/or legs jerk uncontrollably)
- Has weakness, numbness or tingling (arms, legs or face)
- Is unsteady walking or standing
- Talking is slurred
- Cannot understand what someone is saying or directions

Consult your physician or licensed healthcare professional after a suspected concussion. Remember, it is better to be safe.

Graduated Return to Sport Strategy

After a concussion, the child should rest physically and mentally for a few days to allow symptoms to get better. In most cases, after a few days of rest, they can gradually increase their daily activity level as long as symptoms don't get worse. Once they are able to do their usual daily activities without symptoms, the child should gradually increase exercise in steps, guided by the healthcare professional (see below).

The athlete should not return to play/sport the day of injury.

NOTE: An initial period of a few days of both cognitive ("thinking") and physical rest is recommended before beginning the Return to Sport progression.

Exercise step	Functional exercise at each step	Goal of each step
1. Symptom-limited activity	Daily activities that do not provoke symptoms.	Gradual reintroduction of work/school activities.
2. Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training.	Increase heart rate.
3. Sport-specific exercise	Running or skating drills. No head impact activities.	Add movement.
4. Non-contact training drills	Harder training drills, e.g., passing drills. May start progressive resistance training.	Exercise, coordination, and increased thinking.
5. Full contact practice	Following medical clearance, participate in normal training activities.	Restore confidence and assess functional skills by coaching staff.
6. Return to play/sport	Normal game play.	

There should be at least 24 hours (or longer) for each step of the progression. If any symptoms worsen while exercising, the athlete should go back to the previous step. Resistance training should be added only in the later stages (Stage 3 or 4 at the earliest). The athlete should not return to sport until the concussion symptoms have gone, they have successfully returned to full school/learning activities, and the healthcare professional has given the child written permission to return to sport.

If the child has symptoms for more than a month, they should ask to be referred to a healthcare professional who is an expert in the management of concussion.

Graduated Return to School Strategy

Concussion may affect the ability to learn at school. The child may need to miss a few days of school after a concussion, but the child's doctor should help them get back to school after a few days. When going back to school, some children may need to go back gradually and may need to have some changes made to their schedule so that concussion symptoms don't get a lot worse. If a particular activity makes symptoms a lot worse, then the child should stop that activity and rest until symptoms get better. To make sure that the child can get back to school without problems, it is important that the health care provider, parents/caregivers and teachers talk to each other so that everyone knows what the plan is for the child to go back to school.

Note: If mental activity does not cause any symptoms, the child may be able to return to school part-time without doing school activities at home first.

Mental Activity	Activity at each step	Goal of each step
1. Daily activities that do not give the child symptoms	Typical activities that the child does during the day as long as they do not increase symptoms (e.g. reading, texting, screen time). Start with 5-15 minutes at a time and gradually build up.	Gradual return to typical activities.
2. School activities	Homework, reading or other cognitive activities outside of the classroom.	Increase tolerance to cognitive work.
3. Return to school part-time	Gradual introduction of school-work. May need to start with a partial school day or with increased breaks during the day.	Increase academic activities.
4. Return to school full-time	Gradually progress school activities until a full day can be tolerated.	Return to full academic activities and catch up on missed work.

If the child continues to have symptoms with mental activity, some other things that can be done to help with return to school may include:

- Starting school later, only going for half days, or going only to certain classes
- More time to finish assignments/tests
- Quiet room to finish assignments/tests
- Not going to noisy areas like the cafeteria, assembly halls, sporting events, music class, shop class, etc.
- Taking lots of breaks during class, homework, tests
- No more than one exam/day
- Shorter assignments
- Repetition/memory cues
- Use of a student helper/tutor
- Reassurance from teachers that the child will be supported while getting better

The child should not go back to sports until they are back to school/learning, without symptoms getting significantly worse and no longer needing any changes to their schedule.

Dizziness VAS:
Place a mark on the line corresponding to how dizzy you feel while sitting (baseline):

As bad as it can be

No dizziness at all

Dizziness VAS:

Place a mark on the line corresponding to how dizzy you feel following 1 minute of horizontal head turns at 1 Hz (DzVAS):

As bad as it can be

No dizziness at all

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						

Interpretation: This test is designed for use with patients ages 9-40 years. 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 care professional for more detailed assessment and management.

Equipment: Tape measure (cm); Metronome; Target w/ 14 point font print.

Baseline Symptoms – Record: Headache, Dizziness, Nausea & Fogginess on 0-10 scale prior to beginning screening.

- **Smooth Pursuits -** Test the ability to follow a slowly moving target. The patient and the examiner are seated. The examiner holds a fingertip at a distance of 3 ft. from the patient. The patient is instructed to maintain focus on the target as the examiner moves the target smoothly in the horizontal direction 1.5 ft. to the right and 1.5 ft. to the left of midline. One repetition is complete when the target moves back and forth to the starting position, and 2 repetitions are performed. The target should be moved at a rate requiring approximately 2 seconds to go fully from left to right and 2 seconds to go fully from right to left. The test is repeated with the examiner moving the target smoothly and slowly in the vertical direction 1.5 ft. above and 1.5 ft. below midline for 2 complete repetitions up and down. Again, the target should be moved at a rate requiring approximately 2 seconds to move the eyes fully upward and 2 seconds to move fully downward. Record: Headache, Dizziness, Nausea & Fogginess ratings after the test. (Figure 1)

- **Saccades** – Test the ability of the eyes to move quickly between targets. The patient and the examiner are seated.

- **Horizontal Saccades**: The examiner holds two single points (fingertips) horizontally at a distance of 3 ft. from the patient, and 1.5 ft. to the right and 1.5 ft. to the left of midline so that the patient must gaze 30 degrees to left and 30 degrees to the right. Instruct the patient to move their eyes as quickly as possible from point to point. One repetition is

complete when the eyes move back and forth to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea & Fogginess ratings after the test. (Figure 2)

- **Vertical Saccades**: Repeat the test with 2 points held vertically at a distance of 3 ft. from the patient, and 1.5 feet above and 1.5 feet below midline so that the patient must gaze 30 degrees upward and 30 degrees downward. Instruct the patient to move their eyes as quickly as possible from point to point. One repetition is complete when the eyes move up and down to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea & Fogginess ratings after the test. (Figure 3)

- **Convergence** – Measure the ability to view a near target without double vision. The patient is seated and wearing corrective lenses (if needed). The examiner is seated front of the patient and observes their eye movement during this test. The patient focuses on a small target (approximately 14 point font size) at arm's length and slowly brings it toward the tip of their nose. The patient is instructed to stop moving the target when they see two distinct images or when the examiner observes an outward deviation of one eye. Blurring of the image is ignored. The distance in cm. between target and the tip of nose is measured and recorded. This is repeated a total of 3 times with measures recorded each time. Record: Headache, Dizziness, Nausea & Fogginess ratings after the test. Abnormal: Near Point of convergence ≥ 6 cm from the tip of the nose. (Figure 4)

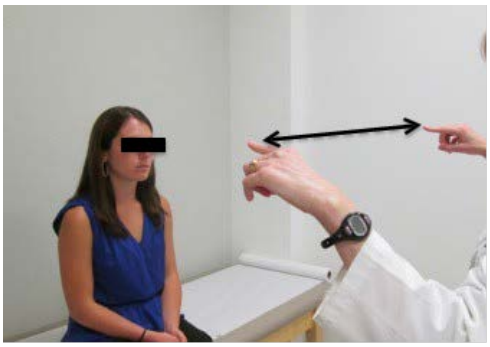
- **Vestibular-Ocular Reflex (VOR) Test** – Assess the ability to stabilize vision as the head moves. The patient and the examiner are seated. The examiner holds a target of approximately 14 point font size in front of the patient in midline at a distance of 3 ft.

- **Horizontal VOR Test**: The patient is asked to rotate their head horizontally while maintaining focus on the target. The head is moved at an amplitude of 20 degrees to each side and a metronome is used to ensure the speed of rotation is maintained at 180 beats/minute (one beat in each direction). One repetition is complete when the head moves back and forth to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea and Fogginess ratings 10 sec after the test is completed. (Figure 5)

- **Vertical VOR Test**: The test is repeated with the patient moving their head vertically. The head is moved in an amplitude of 20 degrees up and 20 degrees down and a metronome is used to ensure the speed of movement is maintained at 180 beats/minute (one beat in each direction). One repetition is complete when the head moves up and down to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea and Fogginess ratings after the test. (Figure 6)

- **Visual Motion Sensitivity (VMS) Test –** Test visual motion sensitivity and the ability to inhibit vestibular-induced eye movements using vision. The patient stands with feet shoulder width apart, facing a busy area of the clinic. The examiner stands next to and slightly behind the patient, so that the patient is guarded but the movement can be performed freely. The patient holds arm outstretched and focuses on their thumb. Maintaining focus on their thumb, the patient rotates, together as a unit, their head, eyes and trunk at an amplitude of 80 degrees to the right and 80 degrees to the left. A

metronome is used to ensure the speed of rotation is maintained at 50 beats/min (one beat in each direction). One repetition is complete when the trunk rotates back and forth to the starting position, and 5 repetitions are performed. Record: Headache, Dizziness, Nausea & Fogginess ratings after the test. (Figure 7)

Figure 1. Smooth pursuits.	**Figure 2. Horizontal saccades.**
	
Figure 3. Vertical saccades.	**Figure 4. Convergence**

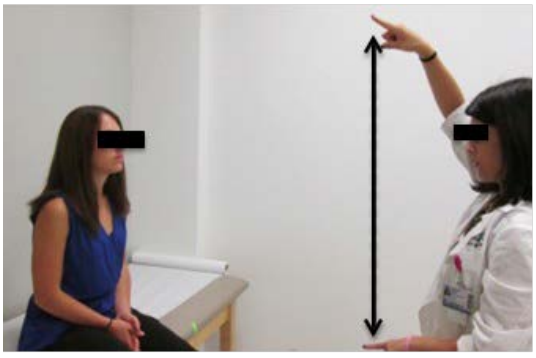



Figure 5. Horizontal VOR.	**Figure 6. Vertical VOR.**
	
VMS– use the visual vertigo analog scale.	

Hôpital juif de réadaptation
Jewish Rehabilitation Hospital

Visual Vertigo Analogue Scale

(Adapted from Longridge et al., 2002)

Indicate the amount of dizziness you experience in the following situations by marking off the scales below.

0 represents no dizziness  and 10 represents the most dizziness 

Walking through a supermarket aisle

 0 ——————— 10 

Being a passenger in a car

 0 ——————— 10 

Being under fluorescent lights

 0 ——————— 10 

Watching traffic at a busy intersection

 0 ——————— 10 

Walking through a shopping mall

 0 ——————— 10 

Going down an escalator

 0 ——————— 10 

Watching a movie at the movie theatre

 0 ——————— 10 

Walking over a patterned floor

 0 ——————— 10 

Watching action television

 0 ——————— 10 

from: J. Vestib Res. 2011;21(3):153-9.

Convergence Insufficiency Symptom Survey

Name_____ DATE__/__/__

Clinician instructions: Read the following subject instructions and then each item exactly as written. If subject responds with "yes" - please qualify with frequency choices. **Do not give examples.**

Patient instructions: Please answer the following questions about how your eyes feel when reading or doing close work.

		Never	(not very often) Infrequently	Sometimes	Fairly often	Always
1.	Do your eyes feel tired when reading or doing close work?					
2.	Do your eyes feel uncomfortable when reading or doing close work?					
3.	Do you have headaches when reading or doing close work?					
4.	Do you feel sleepy when reading or doing close work?					
5.	Do you lose concentration when reading or doing close work?					
6.	Do you have trouble remembering what you have read?					
7.	Do you have double vision when reading or doing close work?					
8.	Do you see the words move, jump, swim or appear to float on the page when reading or doing close work?					
9.	Do you feel like you read slowly?					
10.	Do your eyes ever hurt when reading or doing close work?					
11.	Do your eyes ever feel sore when reading or doing close work?					
12.	Do you feel a "pulling" feeling around your eyes when reading or doing close work?					
13.	Do you notice the words blurring or coming in and out of focus when reading or doing close work?					
14.	Do you lose your place while reading or doing close work?					
15.	Do you have to re-read the same line of words when reading?					
		__x 0	__ x 1	__ x 2	__ x 3	__ x 4

TOTAL SCORE _____

REFER TO OPTOMETRY IF SCORE IS 16 OR GREATER

Dizziness Handicap Inventory

Instructions: The purpose of this scale is to identify difficulties that you may be experiencing because of your dizziness. Please check "always", or "no" or "sometimes" to each question. Answer each question only as it pertains to your dizziness problem.

	Questions	Always	Sometimes	No
P1	Does looking up increase your problem?	☐	☐	☐
E2	Because of your problem, do you feel frustrated?	☐	☐	☐
F3	Because of your problem, do you restrict your travel for business or pleasure?	☐	☐	☐
P4	Does walking down the aisle of a supermarket increase your problem?	☐	☐	☐
F5	Because of your problem, do you have difficulty getting into or out of bed?	☐	☐	☐
F6	Does your problem significantly restrict your participation in social activities, such as going out to dinner, going to movies, dancing or to parties?	☐	☐	☐
F7	Because of your problem, do you have difficulty reading?	☐	☐	☐
F8	Does performing more ambitious activities like sports, dancing, and household chores, such as sweeping or putting dishes away; increase your problem?	☐	☐	☐
E9	Because of your problem, are you afraid to leave your home without having someone accompany you?	☐	☐	☐
E10	Because of your problem, have you been embarrassed in front of others?	☐	☐	☐
P11	Do quick movements of your head increase your problem?	☐	☐	☐
F12	Because of your problem, do you avoid heights?	☐	☐	☐
P13	Does turning over in bed increase your problem?	☐	☐	☐
F14	Because of your problem, is it difficult for you to do strenuous housework or yard work?	☐	☐	☐
E15	Because of your problem, are you afraid people may think that you are intoxicated?	☐	☐	☐
F16	Because of your problem, is it difficult for you to go for a walk by yourself?	☐	☐	☐
P17	Does walking down a sidewalk increase your problem?	☐	☐	☐
E18	Because of your problem, is it difficult for you to concentrate?	☐	☐	☐
F19	Because of your problem, is it difficult for you to walk around your house in the dark?	☐	☐	☐
E20	Because of your problem, are you afraid to stay home alone?	☐	☐	☐
E21	Because of your problem, do you feel handicapped?	☐	☐	☐
E22	Has your problem placed stress on your relationship with members of your family or friends?	☐	☐	☐
E23	Because of your problem, are you depressed?	☐	☐	☐
F24	Does your problem interfere with your job or household responsibilities?	☐	☐	☐
P25	Does bending over increase your problem?	☐	☐	☐

Scoring for Dizziness Handicap Inventory

Eval	Total Functional	Total Emotional	Total Physical	TOTAL SCORE
Reassess #1				
Reassess #2				
Reassess #3				
Reassess #4				

Always = 4

Sometimes = 2

No = 0

P = physical

E = emotional

F = functional

Subscales

Notes:

1. **Subjective measure of the patient's perception of handicap due to the dizziness**
2. **Top score is 100 (maximum perceived disability)**
3. **Bottom score is 0 (no perceived disability)**
4. **The following 5 items can be useful in predicting BPPV**
   - **Does looking up increase your problem?**
   - **Because of your problem, do you have difficulty getting into or out of bed?**
   - **Do quick movements of your head increase your problem?**
   - **Does bending over increase your problem?**
5. **Can use subscale scores to track change as well**

NAME: DATE:

VANDERBILT PEDIATRIC DIZZINESS HANDICAP INVENTORY-PATIENT CAREGIVER (DHI-PC) (AGES 5-12 YEARS)

Instructions: The purpose of this questionnaire is to identify difficulties that your child may be experiencing because of his or her dizziness or unsteadiness. Please answer "yes", "no", or "sometimes" to each question. **Answer each question as it pertains to your child's dizziness problem only**.

	Yes (4)	Sometimes (2)	No (0)
1. Does your child's problem make him/her feel tired?			
2. Is your child's life ruled by his/her problem?			
3. Does your child's problem make it difficult for him/her to play?			
4. Because of his/her problem, does your child feel frustrated?			
5. Because of his/her problem, has your child been embarrassed in front of others?			
6. Because of his/her problem, is it difficult for your child to concentrate?			
7. Because of his/her problem, is your child tense?			
8. Do other people seem irritated with your child's problem?			
9. Because of his/her problem, does your child worry?			
10. Because of his/her problem, does your child feel angry?			
11. Because of his/her problem, does your child feel "down"?			
12. Because of his/her problem, does your child feel unhappy?			
13. Because of his/her problem, does your child feel different from other children?			
14. Does your child's problem significantly restrict his/her participation in social or educational activities, such as going to dinner, meeting with friends, field trips, or to parties?			
15. Because of your child's problem, is it difficult for him/her to walk around the house in the dark?			
16. Because of his/her problem, does your child have difficulty walking up stairs?			
17. Because of his/her problem, does your child have difficulty walking one or two blocks?			
18. Because of his/her problem, does your child have difficulty riding a bike or scooter?			
19. Because of his/her problem, does your child have difficulty reading or doing schoolwork?			
20. Does your child's problem make it difficult to successfully do activities that others his/her age can do?			
21. Because of his/her problem, does your child have trouble concentrating at school?			
		TOTAL SCORE	

Balance Error Scoring System (BESS)

Developed by researchers and clinicians at the University of North Carolina's Sports Medicine Research Laboratory, Chapel Hill, NC 27599-8700

The Balance Error Scoring System provides a portable, cost-effective, and objective method of assessing static postural stability. In the absence of expensive, sophisticated postural stability assessment tools, the BESS can be used to assess the effects of mild head injury on static postural stability. Information obtained from this clinical balance tool can be used to assist clinicians in making return to play decisions following mild head injury.

The BESS can be performed in nearly any environment and takes approximately 10 minutes to conduct.

Materials

1) Testing surfaces
   -two testing surfaces are need to complete the BESS test: floor/ground and foam pad.

   1a) Floor/Ground: Any level surface is appropriate.

   1b) Foam Pad (Power Systems Airex Balance Pad 81000)
   Address = PO Box 31709 Knoxville, TN 37930 tel = 1-800-321-6975
   Web Address = www.power-systems.com

   Dimensions: Length: 10" Width: 10" Height: 2.5"

   The purpose of the foam pad is to create an unstable surface and a more challenging balance task, which varies by body weight. It has been hypothesized that as body weight increases the foam will deform to a greater degree around the foot. The heavier the person the more the foam will deform. As the foam deforms around the foot, there is an increase in support on the lateral surfaces of the foot. The increased contact area between the foot and foam has also been theorized to increase the tactile sense of the foot, also helping to increase postural stability. The increase in tactile sense will cause additional sensory information to be sent to the CNS. As the brain processes this information it can make better decisions when responding to the unstable foam surface.

2) Stop watch
   -necessary for timing the subjects during the 6, twenty second trials

3) An assistant to act as a spotter
   -the spotter is necessary to assist the subject should they become unstable and begin to fall. The spotter's attention is especially important during the foam surface.

4) BESS Testing Protocol
   -these instructions should be read to the subject during administration of the BESS

5) BESS Score Card (See end of document)

BESS Test Administration

1) Before administering the BESS, the following materials should be present:
   -foam pad
   -stop watch
   -spotter
   -BESS Testing Protocol
   -BESS Score Card
2) Before testing, instruct the individual to remove shoes and any ankle taping if necessary. Socks may be worn if desired.
3) Read the instructions to the subject as they are written in the BESS Testing Protocol.
4) Record errors on the BESS Score Card as they are described below.

Scoring the BESS

Each of the twenty-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the subject. The examiner will begin counting errors only after the individual has assumed the proper testing position.

Errors: An error is credited to the subject when any of the following occur:

- moving the hands off of the iliac crests
- opening the eyes
- step stumble or fall
- abduction or flexion of the hip beyond 30°
- lifting the forefoot or heel off of the testing surface
- remaining out of the proper testing position for greater than 5 seconds

-**The maximum total number of errors for any single condition is 10**.

Normal Scores for Each Possible Testing Surface

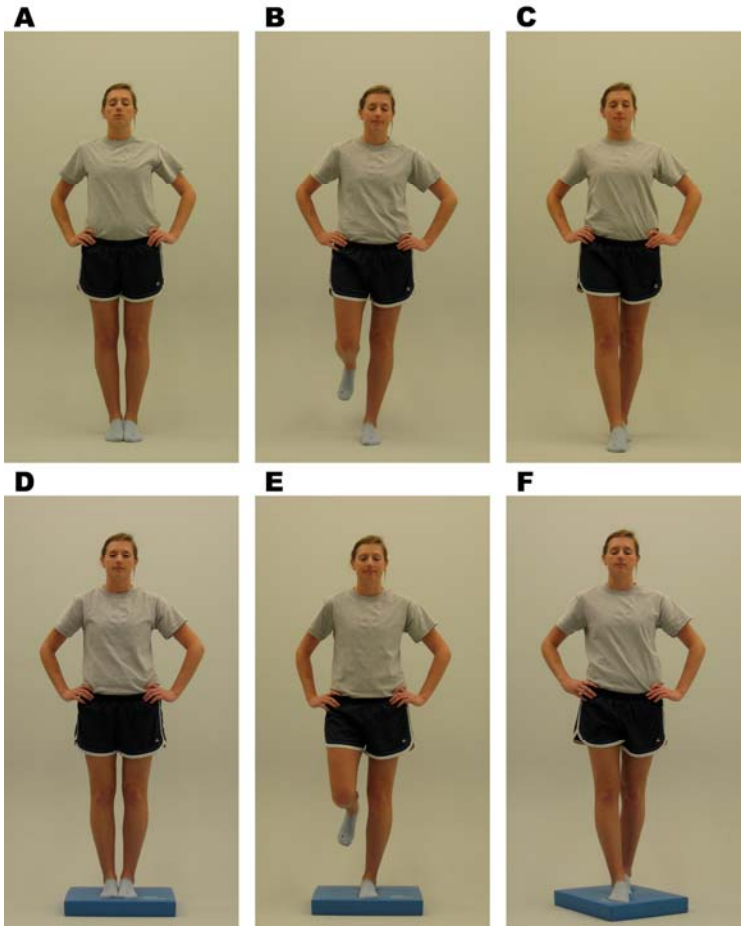
	Firm Surface	Foam Surface	
Double Leg Stance	.009 ± .12	.33 ± .90	
Single Leg Stance	2.45 ± 2.33	5.06 ± 2.80	
Tandem Stance	.91 ± 1.36	3.26 ± 2.62	
Surface Total	3.37 ± 3.10	8.65 ± 5.13	
BESS Total Score			12.03 ± 7.34

Maximum Number of Errors Possible for Each Testing Surface

	Firm Surface	Foam Surface
Double Leg Stance	10	10
Single Leg Stance	10	10
Tandem Stance	10	10
Surface Total	30	30

-if a subject commits multiple errors simultaneously, only one error is recorded. For example, if an individual steps or stumbles, opens their eyes, and removes their hands from their hips simultaneously, then they are credited with only **one error**.

-subjects that are unable to maintain the testing procedure for a minimum of **five seconds** are assigned the highest possible score, ten, for that testing condition.



A&D: ***Double leg stance***: Standing on a firm surface with feet side by side (touching), hands on the hips and eyes closed

B&E: ***Single leg stance***: Standing on a firm surface on the non-dominant foot (defined below), the hip is flexed to approximately 30° and knee flexed to approximately 45°. Hands are on the hips and eyes closed.

**Non-Dominant Leg*: The non-dominant leg is defined as the opposite leg of the preferred kicking leg

C&F: ***Tandem Stance***: Standing heel to toe on a firm surface with the non-dominate foot (defined above) in the back. Heel of the dominant foot should be touching the toe of the non-dominant foot. Hands are on the hips and their eyes are closed.

Script for the BESS Testing Protocol

Direction to the subject: *I am now going to test your balance.*

Please take your shoes off, roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable).

This test will consist of 6 - twenty second tests with three different stances on two different surfaces. I will describe the stances as we go along.

DOUBLE LEG STANCE:

Direction to the subject: *The first stance is standing with your feet together like this* [administrator demonstrates two-legged stance]

You will be standing with your hands on your hips with your eyes closed. You should try to maintain stability in that position for entire 20 seconds. I will be counting the number of times you move out of this position. For example: if you take your hands off your hips, open your eyes, take a step, lift your toes or your heels. If you do move out of the testing stance, simply open your eyes, regain your balance, get back into the testing position as quickly as possible, and close your eyes again.

There will be a person positioned by you to help you get into the testing stance and to help if you lose your balance.

Direction to the spotter: *You are to assist the subject if they fall during the test and to help them get back into the position.*

Direction to the subject: *Put your feet together, put your hands on your hips and when you close your eyes the testing time will begin* [Start timer when subject closes their eyes]

SINGLE LEG STANCE:

Direction to subject: *If you were to kick a ball, which foot would you use?* [This will be the **dominant** foot]

*Now stand on your **non-dominant** foot.*

[Before continuing the test assess the position of the dominant leg as such: the dominant leg should be held in approximately 30 degrees of hip flexion and 45 degrees of knee flexion]

Again, you should try to maintain stability for 20 seconds with your eyes closed. I will be counting the number of times you move out of this position.

Place your hands on your hips. When you close your eyes the testing time will begin. [Start timer when subject closes their eyes]

Direction to the spotter: *You are to assist the subject if they fall during the test and to help them get back into the position.*

TANDEM STANCE:

Directions to the subject: *Now stand heel-to-toe with your* **non-dominant** *foot in back. Your weight should be evenly distributed across both feet.*

Again, you should try to maintain stability for 20 seconds with your eyes closed. I will be counting the number of times you move out of this position.

Place your hands on your hips. When you close your eyes the testing time will begin.
[Start timer when subject closes their eyes]

Direction to the spotter: *You are to assist the subject if they fall during the test and to help them get back into the position.*

***** Repeat each set of instructions for the foam pad**

Score Card

Balance Error Scoring System (BESS)
(Guskiewicz)

Balance Error Scoring System – Types of Errors
1. Hands lifted off iliac crest 2. Opening eyes 3. Step, stumble, or fall 4. Moving hip into > 30 degrees abduction 5. Lifting forefoot or heel 6. Remaining out of test position >5 sec
The BESS is calculated by adding one error point for each error during the 6 20-second tests.

SCORE CARD: **(# errors)**	FIRM Surface	FOAM Surface
Double Leg Stance (feet together)		
Single Leg Stance (non-dominant foot)		
Tandem Stance (non-dom foot in back)		
Total Scores:		
BESS TOTAL:		

Which **foot** was tested: ☐ Left ☐ Right
(i.e. which is the **non-dominant** foot)

Appendix.

Functional Gait Assessment[a]

Requirements: A marked 6-m (20-ft) walkway that is marked with a 30.48-cm (12-in) width.

_____1. GAIT LEVEL SURFACE

Instructions: *Walk at your normal speed from here to the next mark (6 m [20 ft]).*

Grading: Mark the highest category that applies.

(3) Normal—Walks 6 m (20 ft) in less than 5.5 seconds, no assistive devices, good speed, no evidence for imbalance, normal gait pattern, deviates no more than 15.24 cm (6 in) outside of the 30.48-cm (12-in) walkway width.

(2) Mild impairment—Walks 6 m (20 ft) in less than 7 seconds but greater than 5.5 seconds, uses assistive device, slower speed, mild gait deviations, or deviates 15.24–25.4 cm (6–10 in) outside of the 30.48-cm (12-in) walkway width.

(1) Moderate impairment—Walks 6 m (20 ft), slow speed, abnormal gait pattern, evidence for imbalance, or deviates 25.4–38.1 cm (10–15 in) outside of the 30.48-cm (12-in) walkway width. Requires more than 7 seconds to ambulate 6 m (20 ft).

(0) Severe impairment—Cannot walk 6 m (20 ft) without assistance, severe gait deviations or imbalance, deviates greater than 38.1 cm (15 in) outside of the 30.48-cm (12-in) walkway width or reaches and touches the wall.

_____2. CHANGE IN GAIT SPEED

Instructions: *Begin walking at your normal pace (for 1.5 m [5 ft]). When I tell you "go," walk as fast as you can (for 1.5 m [5 ft]). When I tell you "slow," walk as slowly as you can (for 1.5 m [5 ft]).*

Grading: Mark the highest category that applies.

(3) Normal—Able to smoothly change walking speed without loss of balance or gait deviation. Shows a significant difference in walking speeds between normal, fast, and slow speeds. Deviates no more than 15.24 cm (6 in) outside of the 30.48-cm (12-in) walkway width.

(2) Mild impairment—Is able to change speed but demonstrates mild gait deviations, deviates 15.24–25.4 cm (6–10 in) outside of the 30.48-cm (12-in) walkway width, or no gait deviations but unable to achieve a significant change in velocity, or uses an assistive device.

(1) Moderate impairment—Makes only minor adjustments to walking speed, or accomplishes a change in speed with significant gait deviations, deviates 25.4–38.1 cm (10–15 in) outside the 30.48-cm (12-in) walkway width, or changes speed but loses balance but is able to recover and continue walking.

(0) Severe impairment—Cannot change speeds, deviates greater than 38.1 cm (15 in) outside 30.48-cm (12-in) walkway width, or loses balance and has to reach for wall or be caught.

_____3. GAIT WITH HORIZONTAL HEAD TURNS

Instructions: *Walk from here to the next mark 6 m (20 ft) away. Begin walking at your normal pace. Keep walking straight; after 3 steps, turn your head to the right and keep walking straight while looking to the right. After 3 more steps, turn your head to the left and keep walking straight while looking left. Continue alternating looking right and left every 3 steps until you have completed 2 repetitions in each direction.*

Grading: Mark the highest category that applies.

(3) Normal—Performs head turns smoothly with no change in gait. Deviates no more than 15.24 cm (6 in) outside 30.48-cm (12-in) walkway width.

(2) Mild impairment—Performs head turns smoothly with slight change in gait velocity (eg, minor disruption to smooth gait path), deviates 15.24–25.4 cm (6–10 in) outside 30.48-cm (12-in) walkway width, or uses an assistive device.

(1) Moderate impairment—Performs head turns with moderate change in gait velocity, slows down, deviates 25.4–38.1 cm (10–15 in) outside 30.48-cm (12-in) walkway width but recovers, can continue to walk.

(0) Severe impairment—Performs task with severe disruption of gait (eg, staggers 38.1 cm [15 in] outside 30.48-cm (12-in) walkway width, loses balance, stops, or reaches for wall).

_____4. GAIT WITH VERTICAL HEAD TURNS

Instructions: *Walk from here to the next mark (6 m [20 ft]). Begin walking at your normal pace. Keep walking straight; after 3 steps, tip your head up and keep walking straight while looking up. After 3 more steps, tip your head down, keep walking straight while looking down. Continue alternating looking up and down every 3 steps until you have completed 2 repetitions in each direction.*

Grading: Mark the highest category that applies.

(3) Normal—Performs head turns with no change in gait. Deviates no more than 15.24 cm (6 in) outside 30.48-cm (12-in) walkway width.

(2) Mild impairment—Performs task with slight change in gait velocity (eg, minor disruption to smooth gait path), deviates 15.24–25.4 cm (6–10 in) outside 30.48-cm (12-in) walkway width or uses assistive device.

(1) Moderate impairment—Performs task with moderate change in gait velocity, slows down, deviates 25.4–38.1 cm (10–15 in) outside 30.48-cm (12-in) walkway width but recovers, can continue to walk.

(0) Severe impairment—Performs task with severe disruption of gait (eg, staggers 38.1 cm [15 in] outside 30.48-cm (12-in) walkway width, loses balance, stops, reaches for wall).

_____5. GAIT AND PIVOT TURN

Instructions: *Begin with walking at your normal pace. When I tell you, "turn and stop," turn as quickly as you can to face the opposite direction and stop.*

Grading: Mark the highest category that applies.

(3) Normal—Pivot turns safely within 3 seconds and stops quickly with no loss of balance.

(2) Mild impairment—Pivot turns safely in >3 seconds and stops with no loss of balance, or pivot turns safely within 3 seconds and stops with mild imbalance, requires small steps to catch balance.

(1) Moderate impairment—Turns slowly, requires verbal cueing, or requires several small steps to catch balance following turn and stop.

(0) Severe impairment—Cannot turn safely, requires assistance to turn and stop.

_____6. STEP OVER OBSTACLE

Instructions: *Begin walking at your normal speed. When you come to the shoe box, step over it, not around it, and keep walking.*

Grading: Mark the highest category that applies.

(3) Normal—Is able to step over 2 stacked shoe boxes taped together (22.86 cm [9 in] total height) without changing gait speed; no evidence of imbalance.

(2) Mild impairment—Is able to step over one shoe box (11.43 cm [4.5 in] total height) without changing gait speed; no evidence of imbalance.

(1) Moderate impairment—Is able to step over one shoe box (11.43 cm [4.5 in] total height) but must slow down and adjust steps to clear box safely. May require verbal cueing.

(0) Severe impairment—Cannot perform without assistance.

(Continued)

Appendix.
Continued

_____7. GAIT WITH NARROW BASE OF SUPPORT

Instructions: *Walk on the floor with arms folded across the chest, feet aligned heel to toe in tandem for a distance of 3.6 m [12 ft]. The number of steps taken in a straight line are counted for a maximum of 10 steps.*
Grading: Mark the highest category that applies.

(3) Normal—Is able to ambulate for 10 steps heel to toe with no staggering.
(2) Mild impairment—Ambulates 7–9 steps.
(1) Moderate impairment—Ambulates 4–7 steps.
(0) Severe impairment—Ambulates less than 4 steps heel to toe or cannot perform without assistance.

_____8. GAIT WITH EYES CLOSED

Instructions: *Walk at your normal speed from here to the next mark (6 m [20 ft]) with your eyes closed.*
Grading: Mark the highest category that applies.

(3) Normal—Walks 6 m (20 ft), no assistive devices, good speed, no evidence of imbalance, normal gait pattern, deviates no more than 15.24 cm (6 in) outside 30.48-cm (12-in) walkway width. Ambulates 6 m (20 ft) in less than 7 seconds.
(2) Mild impairment—Walks 6 m (20 ft), uses assistive device, slower speed, mild gait deviations, deviates 15.24–25.4 cm (6–10 in) outside 30.48-cm (12-in) walkway width. Ambulates 6 m (20 ft) in less than 9 seconds but greater than 7 seconds.
(1) Moderate impairment—Walks 6 m (20 ft), slow speed, abnormal gait pattern, evidence for imbalance, deviates 25.4–38.1 cm (10–15 in) outside 30.48-cm (12-in) walkway width. Requires more than 9 seconds to ambulate 6 m (20 ft).
(0) Severe impairment—Cannot walk 6 m (20 ft) without assistance, severe gait deviations or imbalance, deviates greater than 38.1 cm (15 in) outside 30.48-cm (12-in) walkway width or will not attempt task.

_____9. AMBULATING BACKWARDS

Instructions: *Walk backwards until I tell you to stop.*
Grading: Mark the highest category that applies.

(3) Normal—Walks 6 m (20 ft), no assistive devices, good speed, no evidence for imbalance, normal gait pattern, deviates no more than 15.24 cm (6 in) outside 30.48-cm (12-in) walkway width.
(2) Mild impairment—Walks 6 m (20 ft), uses assistive device, slower speed, mild gait deviations, deviates 15.24–25.4 cm (6–10 in) outside 30.48-cm (12-in) walkway width.
(1) Moderate impairment—Walks 6 m (20 ft), slow speed, abnormal gait pattern, evidence for imbalance, deviates 25.4–38.1 cm (10–15 in) outside 30.48-cm (12-in) walkway width.
(0) Severe impairment—Cannot walk 6 m (20 ft) without assistance, severe gait deviations or imbalance, deviates greater than 38.1 cm (15 in) outside 30.48-cm (12-in) walkway width or will not attempt task.

_____10. STEPS

Instructions: *Walk up these stairs as you would at home (ie, using the rail if necessary). At the top turn around and walk down.*
Grading: Mark the highest category that applies.

(3) Normal—Alternating feet, no rail.
(2) Mild impairment—Alternating feet, must use rail.
(1) Moderate impairment—Two feet to a stair; must use rail.
(0) Severe impairment—Cannot do safely.

TOTAL SCORE: _____ MAXIMUM SCORE 30

[a] Adapted from Dynamic Gait Index.[1] Modified and reprinted with permission of authors and Lippincott Williams & Wilkins (http://lww.com).

Walker, M.L. (2007). **Reference Group Data for the Functional Gait Assessment**. *Physical Therapy* (87)11, 1468-1477.

Table 1.
Functional Gait Assessment Total Scores by Decade

Age (y)	N	Minimum Score	Maximum Score	Mean	SD	95% Confidence Interval
40–49	27	24	30	28.9	1.5	28.3–29.5
50–59	33	25	30	28.4	1.6	27.9–29.0
60–69	63	20	30	27.1	2.3	26.5–27.7
70–79	44	16	30	24.9	3.6	23.9–26.0
80–89	33	10	28	20.8	4.7	19.2–22.6
Total	200	10	30	26.1	4.0	25.5–26.6

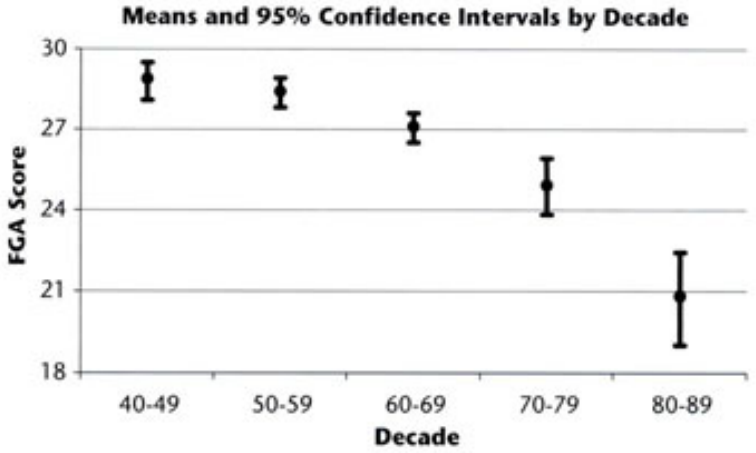


Figure 2.
Comparison of the mean Functional Gait Assessment (FGA) total scores and 95% confidence intervals by decade. A perfect score is 30.

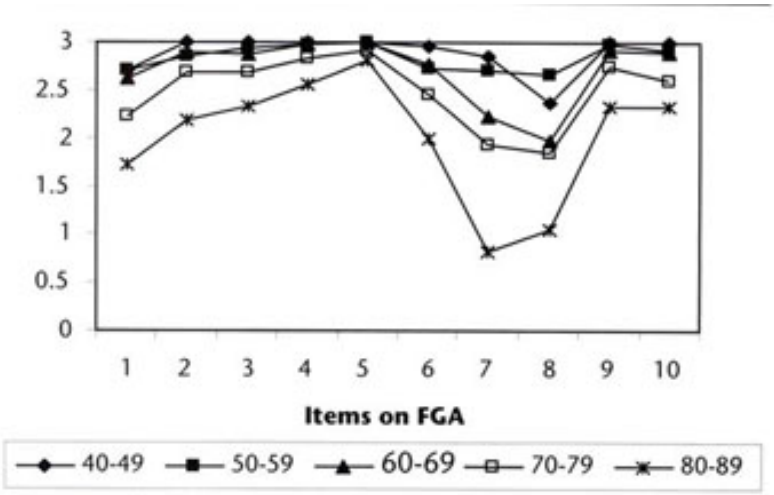


Figure 3.
Mean score of each Functional Gait Assessment (FGA) item by decade. On the Y axis, scores for each item can range from 0 (severe impairment) to 3 (normal). On the X axis are the 10 items of the FGA: 1=gait on level surface, 2=change in gait speed, 3=gait with horizontal head turns, 4=gait with vertical head turns, 5=gait with pivot turn, 6=step over obstacle, 7=gait with narrow base of support, 8=gait with eyes closed, 9=ambulating backward, 10=steps.

Subjective Visual Vertical (Bucket Test)

Trial	Report degrees off zero and direction (in relation to patient) the top of the line was tilted when vertical was perceived.			
	Initial line position: top of line to patient's left		Initial line position: top of line to patient's right	
	Degrees off zero	Direction tilted R/L/S	Degrees off zero	Direction tilted R/L/S
1				
2				
3				
4				
5				
Mean/Mode	Mean & SD:	# Right: # Left: # Straight:	Mean & SD:	# Right: # Left: # Straight:
Totals	Total # off to Right: Left: Straight:			

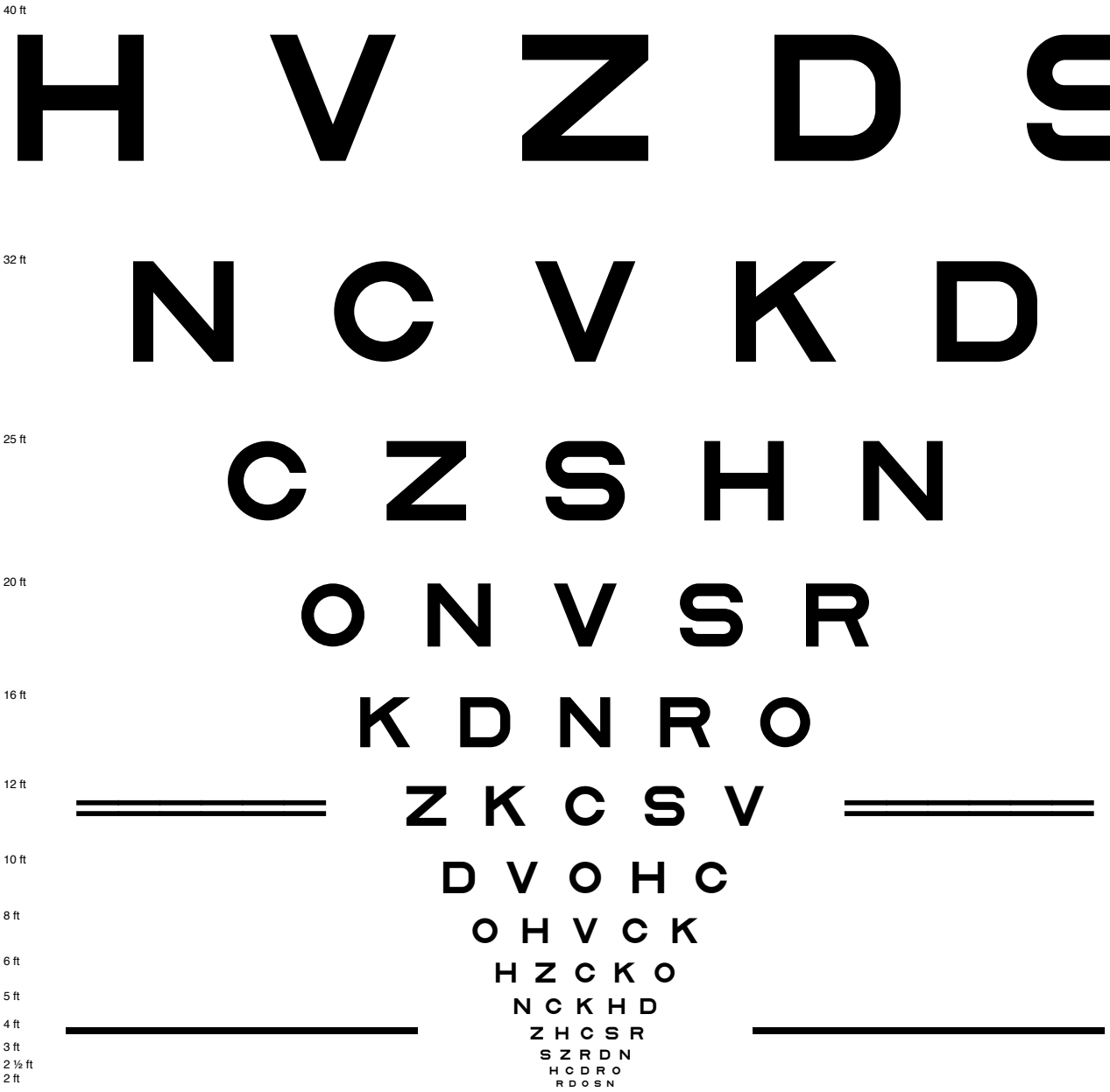


Chart prepared by Alex Eulenberg, 15 Jun 2009, based on the standard established by the National Eye Institute's Early Treatment Diabetic Retinopathy Study (ETDRS). Sloan font courtesy of Denis Pelli.

This chart and more available at *I-SEE.org*