

**Concussion is a brain injury.
Like any injury it needs to be
diagnosed and treated.**

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About this talk

- I want to outline some brain pathology post mild traumatic brain injury and why some injury mechanisms may be associated with second concussion syndrome.
- I'll present information on managing concussion.
- I'll present information on concussion diagnostic methods.
- We'll talk about treatment strategies.

Why Am I Giving This Talk?

- I'm a certified Athletic Trainer, a retired EMT and ambulance book author.
- I'm part of the concussion management center in the University of Cincinnati.
- I see the college football players with mTBI.
- My research involves what happens when the brain is injured including bleeding events.

Football and Concussion



Football Players are at risk for concussion and second impact syndrome. Teams average 5 to 10 per season.

Sports / Football Fact



- In 1905, President Theodore Roosevelt threatened to outlaw football
 - 18 college football players were killed
 - 159 seriously injured (including paralysis)
- Ultimately contributed to the development of the forward pass.
- The football helmet was developed to stop SKULL FRACTURE. It does that very well.
 - It was NOT designed to prevent concussion.

Frequency of occurrence of postconcussion symptoms (Rivermead Postconcussion Symptoms Questionnaire).

	All patients (n=86) (%)	Women (n=59) (%)	Men (n=27) (%)
Headache	73.5	51.0	40.72
Dizziness	61.7	40.0	34.9
Nausea/vomiting	29.1	30.0	16.3
Sleep disturbance	84.9	42.0	45.3
Fatigue	90.7	57.0	53.5
Irritability	66.3	54.0	50.0
Feeling depressed	55.8	41.0	40.7
Feeling frustrated	55.8	40.0	44.5
Poor memory	67.1	51.0	53.5
Poor concentration	88.2	50.0	52.3
Noise sensitivity	59.5	45.0	34.9
Blurred vision	55.8	31.0	32.6
Sensitivity to light	51.2	41.0	44.2
Double vision	26.2	13.0	16.3
Restlessness	69.0	35.0	48.8
Taking longer to think	74.1	41.0	48.8

A little background on Concussion

- A concussion = a Mild Traumatic Brain Injury (mTBI). An injury has in fact occurred to the brain.
- The definition of a concussion is poorly defined. We tend to use, trauma induced alteration in mental status and or activity.
- The CDC says, "A concussion is a type of traumatic brain injury, or TBI, caused by a bump, blow, or jolt to the head that can change the way your brain normally works."

Coup Contrecoup

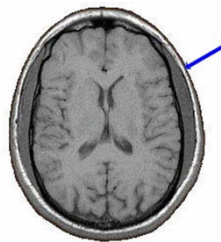
Brain Injuries
Initial impact

Brain Injuries
Contrecoup effect



Contrecoup

- "contrecoup injuries occur at areas distant from the point of impact as a result of shock waves travelling across the brain causing stress/cavitation effects."



<http://www.ijntonline.com/Dec09/abstracts/04.PDF>

http://www.neurostaff.org/disc_en.htm

Diagnostic Tests for Concussion Symptoms

- Questions – Q&A
- Balance
- Executive Function
- Coordination
- Cranial Nerves
- Visual tests
- Vestibular
- Others
- A full neuro exam, neuropsych exam takes 2 plus hours

Scat, ImPACT, BESS and King Divic

- These are commercial tests that have marketing around them. You can use them, but you are the one making the decision. These are NOT FDA approved or cleared for diagnostics of anything.
- Feel free to use them, but they all claim that your medical decision is yours alone. Not the tests'.

The screenshot shows the top portion of the ImPACT website. At the top, there is a navigation bar with links for Home, About, Products, Training, Support, and Purchase. Below this is a blue banner with the ImPACT logo on the left and the text "Find a Care Provider" on the right. The main content area features a large heading: "ImPACT is the most-widely used and most scientifically validated computerized concussion evaluation system." To the right of this text is a photograph of a young boy in a blue shirt celebrating. Below the heading is a list of references and a quote.

Home About Products Training Support Purchase

Find a Care Provider

ImPACT is the most-widely used and most scientifically validated computerized concussion evaluation system.

- Gardner A, Shores EA, Batchelor J, Honan CA. Diagnostic efficiency of ImPACT and CogSport in concussed rugby union players who have not undergone baseline neurocognitive testing. *Appl Neuropsychol Adult.* 2012;19(2):90-7.

"These results do not validate this approach as a useful method of managing sports-related concussion."

**Neuro diagnostics have advanced:
What is useful?**

- Useful neuro diagnostics normally needs to cover multiple systems:
 - Cognitive, Executive function, motor, sensory, sensory, etc.
- A full nuero exam can take 2 hours – that is not necessary for a RTP or Pull from Play Evaluation.
- Having baselines help. So you may choose to do a repeat ImPACT test. But they need to be useful, accessible and quantifiable and you are the one making the decision, not ImPACT.
- Know what neuro systems you want to evaluate.

Some Neuro Exam Options

1. Scat, ImPACT, BESS (multiple, motor, sensory, memory)
2. Vision and Reading (King Divic) (sensory)
3. Tongue (motor)
4. Eye tracking (motor and sensory)
5. Finger to nose (motor and sensory)
6. Convergence, Divergence (Sensory/Motor)
7. Balance, Gait (sensory and motor)
8. Manual dexterity (motor – symmetry too)
9. Memory (Executive Function)
10. Pupil reflexes Visual threat (sensory and motor)
11. Orthostatic BP and HR (autonomic)
12. QnA: Dizziness, tinnitus, vision, headache, nausea, vomiting, tingling, ability to concentrate, memory, anger, temper.

The good the bad the ugly of neuro diagnostics

- The good; there are multiple options, increased awareness and new ones coming out.
- The bad; some tests are quantitative, some are not. You need clinical experience to make assessments. Know your athlete.
- The ugly; many tests being put forth as diagnostic are NOT FDA approved or cleared. Which means; you are on your own (YOYO).

Balance Testing

- BESS: balance error scoring system
- Balance testing assesses motor and vestibular systems.
- Materials Needed.
 - two testing surfaces are need to complete the BESS test: floor/ground and foam pad.
 - Floor/Ground: Any level surface is appropriate.
 - Foam Pad (Power Systems Airex Balance Pad 81000)
- <http://www.sportsconcussion.com/pdf/management/BESSProtocolNATA09.pdf>




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



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



Tandem Stance: Standing heel to toe on a firm surface with the non-dominant 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.

Score Card

Balance Error Scoring System (BESS)
(Guskiewicz)

Balance Error Scoring System - Types of Errors	SCORE CARD: (# errors)	FIRM Surface	FOAM Surface
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.	BESS TOTAL:		

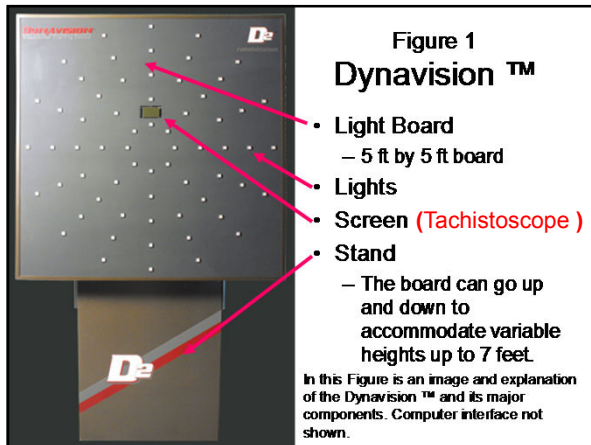
Which foot was tested: Left Right
(i.e. which is the non-dominant foot)

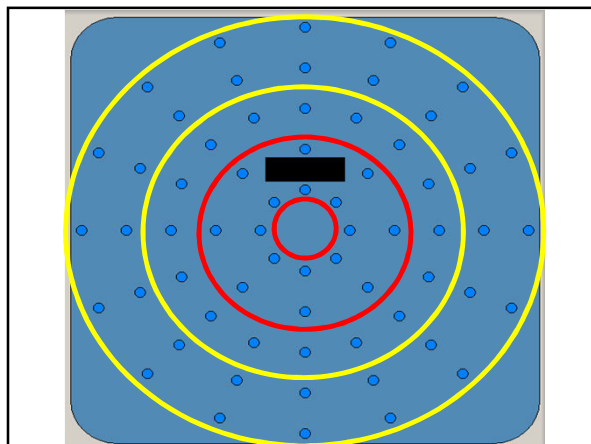
What do some normal tests look like?

- **Convergence:** Track object to bridge of nose or less than 4 inches with good convergence. Diplopia less than 4 inches is normal.
- **Suppression:** exophoria with no diplopia.
- **Divergence:** Capture image less than 6 inches.
- **Balance:** No pronator drift, No loss of pronation, No wobble, lean or loss of balance, Symmetric arm control.
- **Turns:** Closed eye turns good body control with turns, turns within 330 and 390 degrees in both directions. Good use of both feet with symmetry.

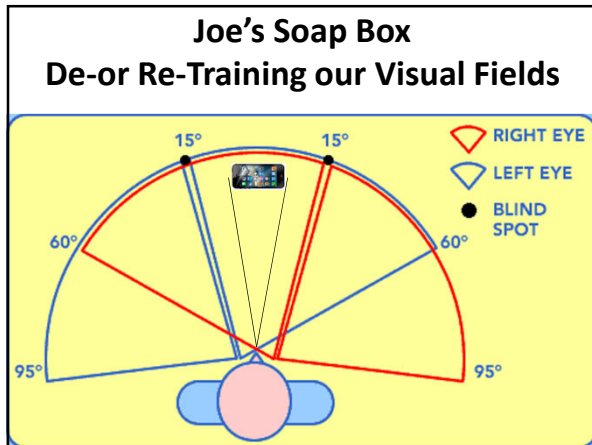
Normal Tests Continued

- **Manual dexterity:** Consistent frequency. Symmetry with both hands.
- **Eye Tracking:** Good ocular motor control. Smooth pursuit all visual fields. Symmetric eye tracking. No nystagmus.
- **Finger top nose:** Good eye hand control. Smooth motor movement and velocity. Good left / right hand symmetry on left and right side. No nystatmus. No missies. No systematic misses.
- **Orthostatics:** No change in HR or BP. Less than 10 mmHg changes in BP. No reported dizziness. Less than 10% change in HR.
- **Memory:** Acceptable short term and intermediate term memory.









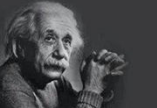






The Day That Albert Einstein Feared Has Arrived!

 <p>Out with Friends</p>	 <p>A day at the Beach</p>	 <p>Cheering your Bearcats</p>
 <p>Out on a Date</p>	 <p>Enjoying the Sights</p>	 <p>Dinner with the Family</p>



"I fear the day that technology will surpass our human interaction. The world will have a generation of idiots"
Albert Einstein

Conclusion

- A traumatic brain injury is an injury to the brain.
- We can diagnose it and provide an environment to promote healing and recovery.
- More work, research and understanding, is needed to keep people safe and get them better faster.

Acknowledgements

- Everybody.
- UC athletics, athletes, sports medicine, nova care, department of orthopedics, neurology, neurosurgery, CCHMC.
- Questions:

Some Resources

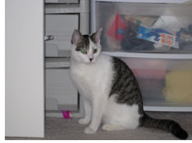
- <http://www.cdc.gov/concussion/sports/recognize.html>
- http://www.legislature.state.oh.us/bills.cfm?ID=129_HB_143
- <http://www.youtube.com/watch?v=ijgXd1-PKWk>
- http://stroke.nih.gov/documents/NIH_Stroke_Scale.pdf
- <http://www.hindawi.com/journals/rerp/2012/528265/>
- http://www.sportsconcussion.com/pdf/management/BESS_ProtocolNATA09.pdf

Acknowledgements

Clovis



Libby



Winston