Headway in Concussion Management:
From Diagnosis to Guidance

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Disclosure

I have no financial interests or relationships to disclose.

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Additional Disclosure

REFERENCES TO OFF-LABEL USAGE(S) OF PHARMACEUTICALS OR INSTRUMENTS

Other relevant relationships

- US Ski and Snowboard
- USA Hockey
- USA Figure Skating
- NFHS: SMAC/Grant awardee
- Board Member – Korey Stringer Institute
- NFL grant reviewer

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Learning Objectives

- Understand how to diagnose and manage a concussion and the role of concussion assessment tools
- Review the groups with elevated risk for concussion (SRC/traumatic)
- Consider topics for counseling

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Learning Objectives

Understand	Understand how to diagnose and manage a concussion and the role of concussion assessment tools
Review	Review the groups with elevated risk for concussion (SRC/traumatic)
Consider	Consider topics for counseling

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You Can't Escape

Image from Wikimedia Commons

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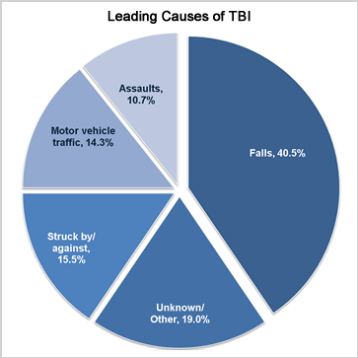
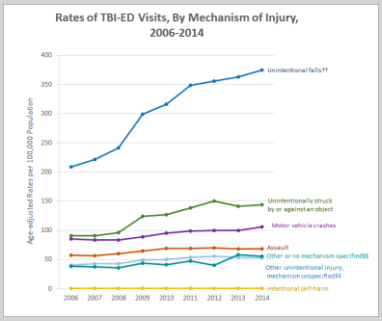
RATES OF TBI-RELATED ED VISITS HOSPITALIZATION AND DEATH – 2006-2014





https://www.cdc.gov/traumaticbraininjury/data/rates.html

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Sports vs Traumatic Concussion

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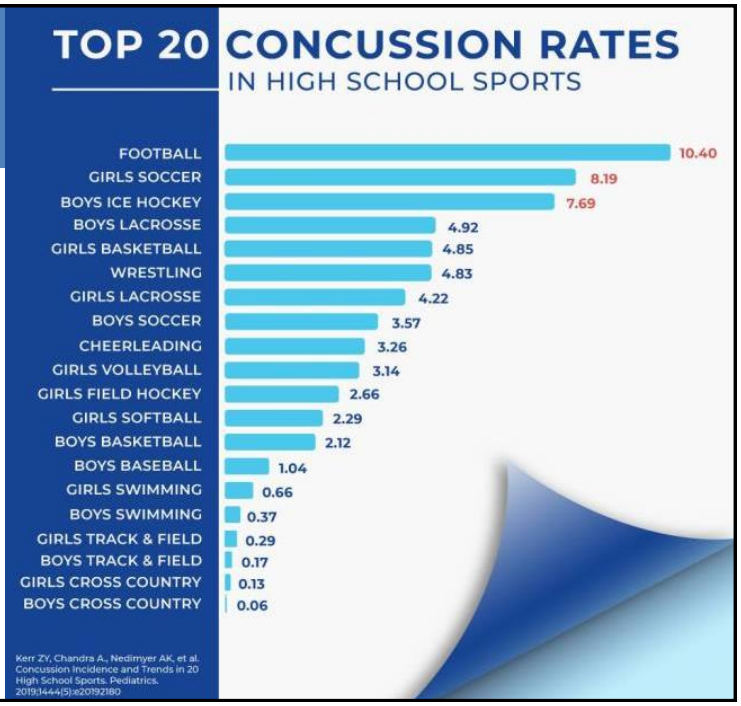
AN EXPERIMENT

Image from Mayo Media Asset Management



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Traumatic Brain Classification

Image from personal collection of Dr. Raukar

Type of Injury	GCS
Mild	13 - 15
Moderate	9-12
Severe	3-8

Mild Head Injury

Minimal	Minor
No LOC	LOC
No Neurologic Alteration	Amnesia
No disorientation	

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Imaging - Adults

	New Orleans criteria	Canadian CT head rules
CT if any criteria present	• Headache • Vomiting (any) • Age > 60 years • Drug or alcohol intoxication • Seizure • Trauma visible above clavicles • Short-term memory deficits	• Dangerous mechanism of injury* • Vomiting ≥ 2 times • Patient > 65 years • GCS score < 15.2 h postinjury • Any sign of basal skull fracture • Possible open or depressed skull fracture • Amnesia for events 30 min before injury
Need for neurosurgical intervention	Sensitivity: 99–100% Specificity: 10–20%	Sensitivity: 99–100% Specificity: 36–76%
Clinically significant intracranial injury	Sensitivity: 95–100% Specificity: 10–33%	Sensitivity: 80–100% Specificity: 35–50%
Limitations	GCS = 15 Adult patients > 18 years with blunt head trauma wi 24 hours of presentation who had LOC, amnesia or disorientation but presented with a GCS = 15.	LOC, GCS 13-15 with Confusion or amnesia after the event **Exclusion criteria** • Anticoagulant use or bleeding disorder • Age <16 years • Seizure

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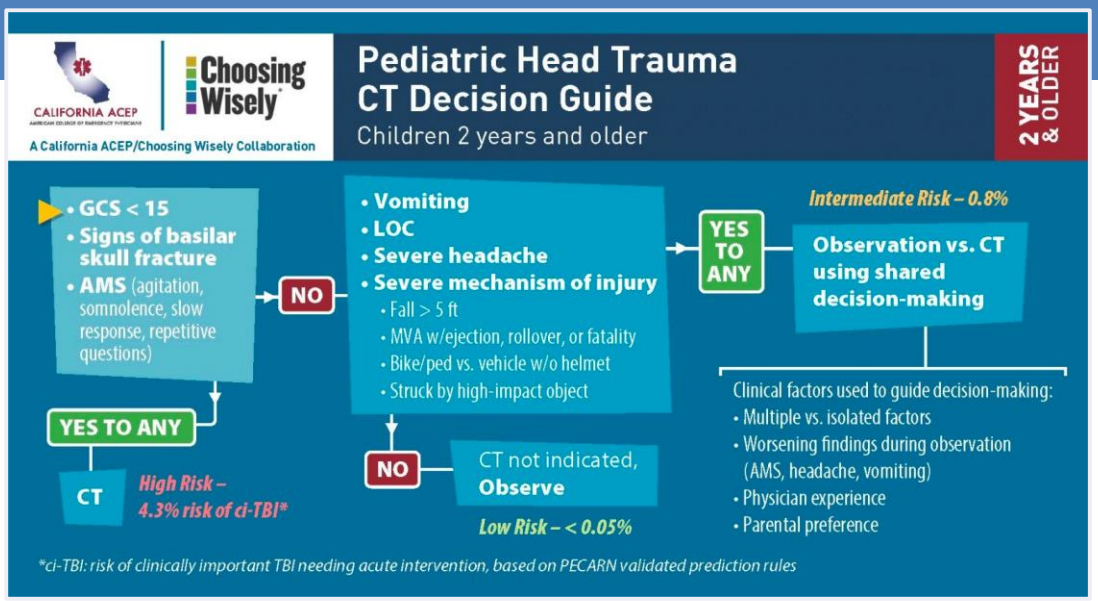
https://californiaacep.org/page/PECARN



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Key Components of the Acute Assessment

- Take history and determine events surrounding the injury
- Assess for risk of intracranial injury
- Possibly obtain heat CT +/- C spine when necessary
- CT negative → Counseling

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Definition - 2001

Concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include:

1. Concussion may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an "impulsive" force transmitted to the head.
2. Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.
3. Concussion may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.
4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course; however, it is important to note that, in a small percentage of cases, post-concussive symptoms may be prolonged.
5. No abnormality on standard structural neuroimaging studies is seen in concussion.

Aubry M, Cantu R, Dvorak J, Graf-Baumann T, Johnston K, Kelly J, Lovell M, McCrory P, Meeuwisse W, Schamasch P; Concussion in Sport Group. Summary and agreement statement of the First International Conference on Concussion in Sport, Vienna 2001. Recommendations for the improvement of safety and health of athletes who may suffer concussive injuries. Br J Sports Med. 2002 Feb;36(1):6-10. doi: 10.1136/bjsm.36.1.6. PMID: 11867482; PMCID: PMC1724447.

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Definition - 2016

Sport related concussion is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilized in clinically defining the nature of a concussive head injury include:

1. SRC may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an "impulsive" force transmitted to the head.
2. SRC typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously. However, in some cases, signs and symptoms evolve over a number of minutes to hours.
3. SRC may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.
4. SRC results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course; however, it is important to note that, in a small percentage of cases, post-concussive symptoms may be prolonged.
5. The clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction, etc) or other comorbidities (eg, psychological factors or coexisting medical conditions).

Aubry M, Cantu R, Dvorak J, Graf-Baumann T, Johnston K, Kelly J, Lovell M, McCrory P, Meeuwisse W, Schamasch P; Concussion in Sport Group. Summary and agreement statement of the First International Conference on Concussion in Sport, Vienna 2001. Recommendations for the improvement of safety and health of athletes who may suffer concussive injuries. Br J Sports Med. 2002 Feb;36(1):6-10. doi: 10.1136/bjsm.36.1.6. PMID: 11867482; PMCID: PMC1724447.

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UPDATE!

Discussio

Amsterdam 2022 process: a summary of the methodology for the International Consensus on Concussion in Sport

Kathryn J Schneider ,[1] Jon Patricios ,[2] Willem Meeuwisse,[3] Geoff M Schneider,[4] Alix Hayden,[5] Zahra Premji ,[6] Osman Hassan Ahmed ,[7,8] Cheri Blauwet ,[9,10] Steven Broglio ,[11] Robert C Cantu,[12,13] Gavin A Davis ,[14,15] Jiri Dvorak ,[16] Ruben J Echemendia ,[17] Carolyn Emery ,[18] Grant L Iverson ,[19,20] John J Leddy ,[21] Michael Makdissi,[22,23] Michael McCrea ,[24] Michael McNamee,[25,26] Margot Putukian ,[27] Keith Owen Yeates ,[28] Amanda Marie Black ,[29] Joel S Burma ,[29] Meghan Critchley,[1] Paul Eliason ,[1] Anu M Räisänen ,[30] Jason Tabor ,[1] Clodagh Toomey,[29,31] Paul E Ronksley,[32] J David Cassidy[33]

ABSTRACT

The purpose of this paper is to summarise the consensus methodology that was used to inform the International Consensus Statement on Concussion in Sport (Amsterdam 2022). Building on a Delphi process to inform the questions and outcomes from the fifth international conference, the Scientific Committee identified key questions, the answers to which would help encapsulate the current science in sport-related concussion and help guide clinical practice. Over 3½ years, past three decades. The number of peer-reviewed publications in scientific journals has continued to increase, especially in recent years. This highlights the need for ongoing and updated recommendations for the integration of new evidence into clinical practice.

The Concussion in Sport Group (CISG) has published two summary and agreement statements[1 2] and three consensus statements on SRC,[3–5] the

methodology for the Amsterdam 20 International Consensus on Concussi in Sport and the resulting consen statement.

THE CONSENSUS METHODOLOGY

The Amsterdam 2022 Internatio Consensus on Concussion in Sport use consensus conference methodology wh is outlined below. The consensus proc included identification of research qu tions, preparation of 10 systematic revie (cite all systematic reviews), the op consensus conference (2 days), clo expert panel consensus meeting (EPC (1 day), and a meeting to determine format for practical tools for the ide fication, evaluation, and management SRC (1 day). In addition to this me odology paper, each of the 10 syste atic reviews, the International Consen Statement on Concussion in Sport, and 'tools' (Sport Concussion Assessment T 6 (SCAT6), Child SCAT6, Sport Conc sion Office Assessment Tool 6 (SCOAT Child SCOAT6, and Concussion Recog tion Tool 6 (CRT6)) will be published separate documents (cite all documents

Formation of the organising and scientific committees

For transparency in the consensus dev

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Almost Updated Clinical Definition - 2022

- Sport-related concussion is a traumatic brain injury caused by a direct blow to the head, neck or body resulting in an impulsive force being transmitted to the brain that occurs in sports and exercise-related activities. This initiates a neurotransmitter and metabolic cascade, with possible axonal injury, blood flow change and inflammation affecting the brain. Symptoms and signs may present immediately, or evolve over minutes or hours, and commonly resolve within days, but may be prolonged.
- No abnormality is seen on standard structural neuroimaging studies (computed tomography or magnetic resonance imaging T1- and T2-weighted images), but in the research setting, abnormalities may be present on functional, blood flow or metabolic imaging studies. Sport-related concussion results in a range of clinical symptoms and signs that may or may not involve loss of consciousness. The clinical symptoms and signs of concussion cannot be explained solely by (but may occur concomitantly with) drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction) or other comorbidities (such as psychological factors or coexisting medical conditions).

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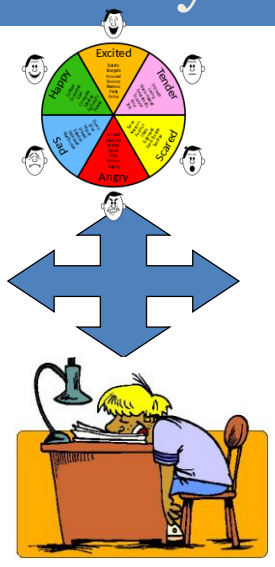
Signs and Symptoms



Images from Wikipedia

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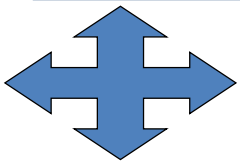
Signs and Symptoms

Somatic Symptoms
Headaches
Visual Problems
Dizziness
Noise/Light Sensitivity
Nausea
Vomiting
Numbness/Tingling
Balance disturbances

Emotional
More emotional
Sadness
Nervousness
Irritability



Cognitive Symptoms
Difficulty concentrating
Difficulty remembering
Fogginess
Feeling slowed down

Sleep Disturbance
Difficulty falling asleep
Sleeping more/less than usual
Drowsiness
Fatigue

Images from Wikipedia

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B. Symptom Check List* Since the injury, has the person experienced any of these symptoms any more than usual today or in the past day?
Indicate presence of each symptom (0=No, 1=Yes). ***Lovell & Collins, 1998 JHTR***

PHYSICAL (10)		COGNITIVE (4)		SLEEP (4)	
Headache	0 1	Feeling mentally foggy	0 1	Drowsiness	0 1
Nausea	0 1	Feeling slowed down	0 1	Sleeping less than usual	0 1 N/A
Vomiting	0 1	Difficulty concentrating	0 1	Sleeping more than usual	0 1 N/A
Balance problems	0 1	Difficulty remembering	0 1	Trouble falling asleep	0 1 N/A
Dizziness	0 1	**COGNITIVE Total (0-4)** _____		**SLEEP Total (0-4)** _____	
Visual problems	0 1	**EMOTIONAL (4)**			
Fatigue	0 1	Irritability	0 1		
Sensitivity to light	0 1	Sadness	0 1		
Sensitivity to noise	0 1	More emotional	0 1		
Numbness/Tingling	0 1	Nervousness	0 1		
PHYSICAL Total (0-10) _____		**EMOTIONAL Total (0-4)** _____			
(Add Physical, Cognitive, Emotion, Sleep totals) Total Symptom Score (0-22)			_____		

Exertion: Do these symptoms worsen with:
Physical Activity __Yes __No __N/A
Cognitive Activity __Yes __No __N/A

Overall Rating: How different is the person acting compared to his/her usual self? (circle)

Normal 0 1 2 3 4 5 6 Very Different

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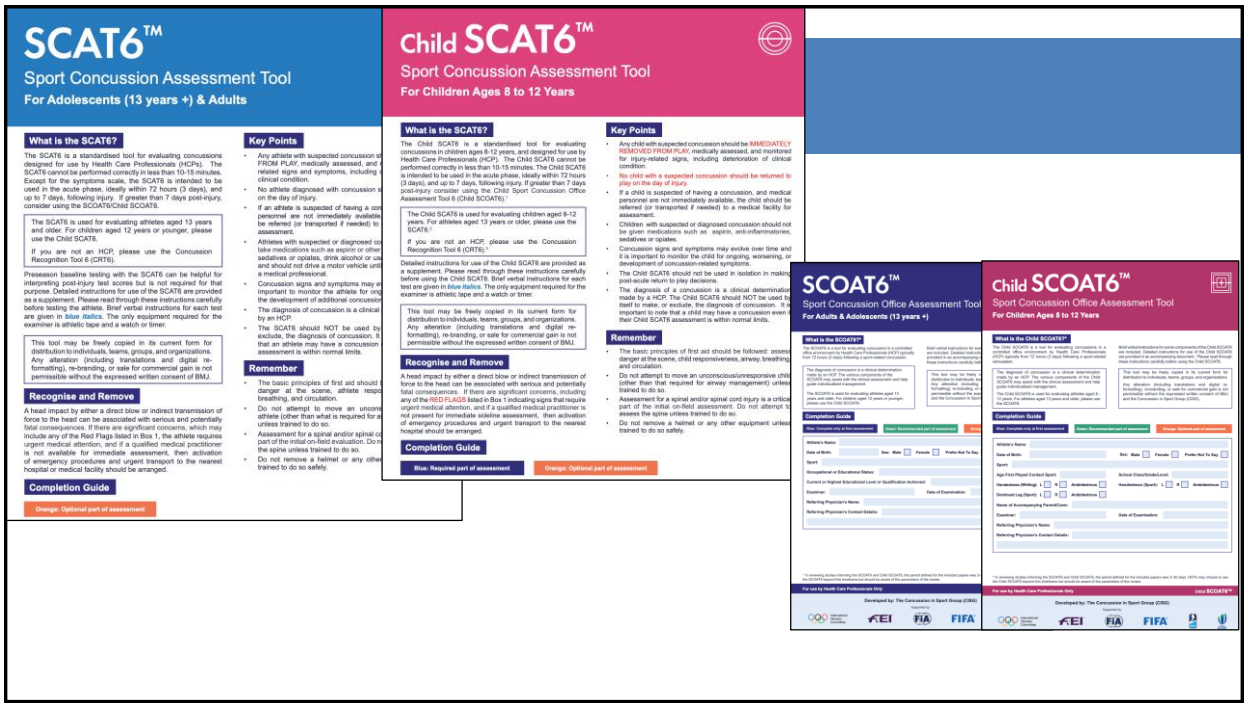

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Diagnosis (SAC/SCAT)

ORIENTATION Score: ____ / 5

What month is it?	0 ☐ 1 ☐
What is the date?	0 ☐ 1 ☐
What day of the week is it?	0 ☐ 1 ☐
What year is it?	0 ☐ 1 ☐
What time of day is it? (*w/in 1 hour*)	0 ☐ 1 ☐

IMMEDIATE MEMORY Score: ____ / 15

Form A	Form B	Form C	Form D
Elbow	Candle	Baby	Monkey
Apple	Paper	Monkey	Penny
Carpet	Sugar	Perfume	Blanket
Saddle	Sandwich	Sunset	Lemon
Bubble	Wagon	Iron	Insect

	Trial 1	Trail 2	Trail 3
Word 1	0 ☐ 1 ☐	0 ☐ 1 ☐	0 ☐ 1 ☐
Word 2	0 ☐ 1 ☐	0 ☐ 1 ☐	0 ☐ 1 ☐
Word 3	0 ☐ 1 ☐	0 ☐ 1 ☐	0 ☐ 1 ☐
Word 4	0 ☐ 1 ☐	0 ☐ 1 ☐	0 ☐ 1 ☐
Word 5	0 ☐ 1 ☐	0 ☐ 1 ☐	0 ☐ 1 ☐

NEUROLOGIC SCREENING

Loss of Consciousness: *(occurrance, duration)*
Retrograde Amnesia
Antegrade Amnesia
Strength
Sensation
Coordination

CONCENTRATION: *Digits Backwards* Score: ____ / 5

Form A		
4-9-3	6-2-9	0 ☐ 1 ☐
3-8-1-4	3-2-7-9	0 ☐ 1 ☐
6-2-9-7-1	1-5-2-8-5	0 ☐ 1 ☐
7-1-8-4-6-2	5-3-9-1-4-8	0 ☐ 1 ☐
Form B		
5-2-6	4-1-5	0 ☐ 1 ☐
1-7-9-5	4-9-6-8	0 ☐ 1 ☐
4-8-5-2-7	6-1-8-4-3	0 ☐ 1 ☐
8-3-1-9-6-4	7-2-4-8-6-5	0 ☐ 1 ☐
Form C		
1-4-2	6-5-8	0 ☐ 1 ☐
1-8-3-1	3-4-8-1	0 ☐ 1 ☐
4-9-1-5-3	6-8-2-5-1	0 ☐ 1 ☐
3-7-6-5-1-9	9-2-6-5-1-4	0 ☐ 1 ☐

Months in Reverse Order
Dec_Nov_Oct_Sept_Aug_ Jul_Jun_May_Apr_Mar_Feb_Jan
0 ☐ 1 ☐

DELAYED RECALL Score: ____ / 5

Word 1	0 ☐ 1 ☐
Word 2	0 ☐ 1 ☐
Word 3	0 ☐ 1 ☐
Word 4	0 ☐ 1 ☐
Word 5	0 ☐ 1 ☐

SCORE TOTALS

Orientation	= ____ / 5	Overall Score
Immediate Memory	= ____ / 15	/ 30
Concentration	= ____ / 5	
Delayed Recall	= ____ / 5	

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SUBTLE VARIABLE

SELF-REPORT

DIAGNOSIS IS HARD

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Image from Creative Commons

Cognitive Exam

- Attention, Memory, Concentration
- Have a conversation

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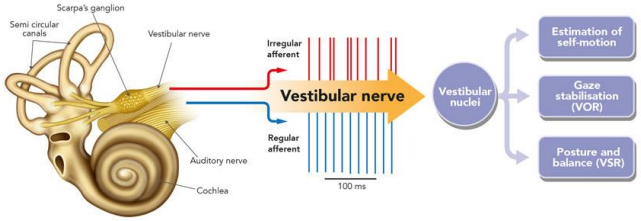
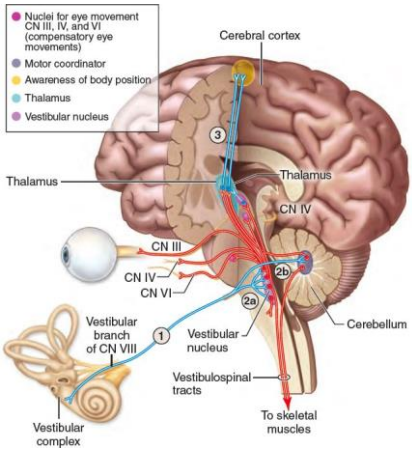
The Vestibular System





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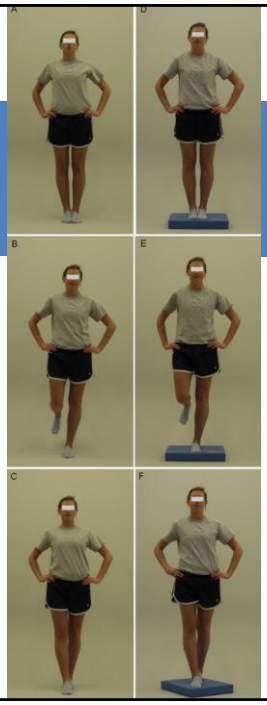

Balanced Error Scoring System BESS/mBESS Testing

Errors

1. Moving the hands off the hips
2. Opening the eyes
3. Hip flexion or abduction > 30°
4. Lifting the forefoot or heel off the testing surface
5. Remaining out of position for >5 seconds

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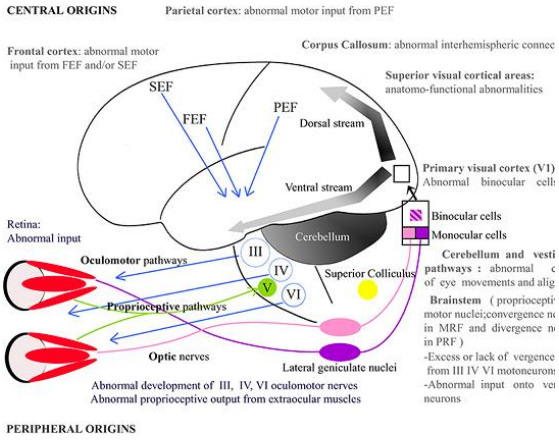
Vision Testing

Convergence

Image from personal collection of Dr. Raukar



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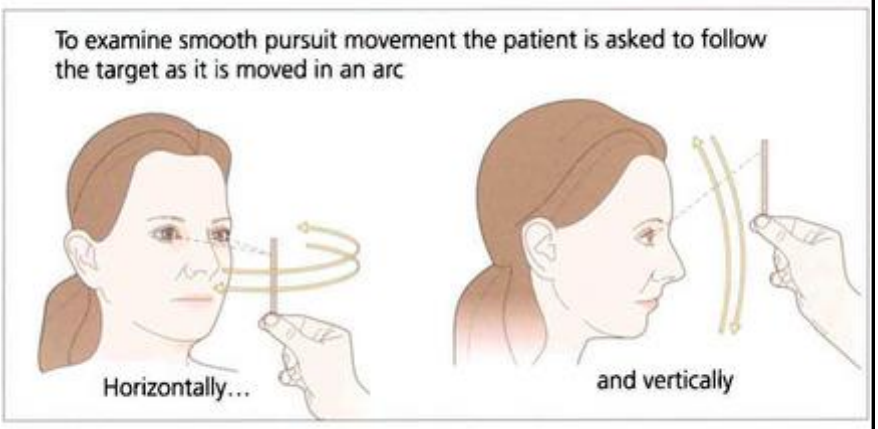
Vision Testing - Smooth Pursuit

Finger 3 ft from pt
1.5 ft L and R
2 seconds each way
Then up/down



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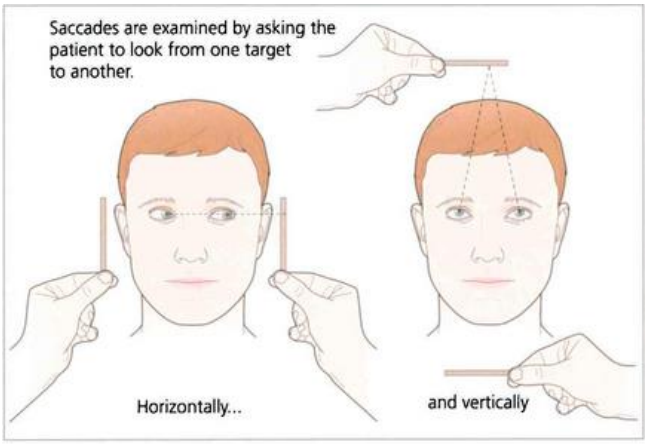
Vision Testing- Saccades

2 Fingers 3 ft from pt
1.5 ft L and R
Eyes move back and forth
10 times
Then up/down (30° up and down)



From Wikimedia Commons

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Somatic Symptoms
Headaches
Visual Problems
Dizziness
Noise/Light Sensitivity
Nausea
Vomiting
Numbness/Tingling
Balance disturbances

Emotional
More emotional
Sadness
Nervousness
Irritability

Cognitive Symptoms
Difficulty concentrating
Difficulty remembering
Fogginess
Feeling slowed down

Sleep Disturbance
Difficulty falling asleep
Sleeping more/less than usual
Drowsiness
Fatigue

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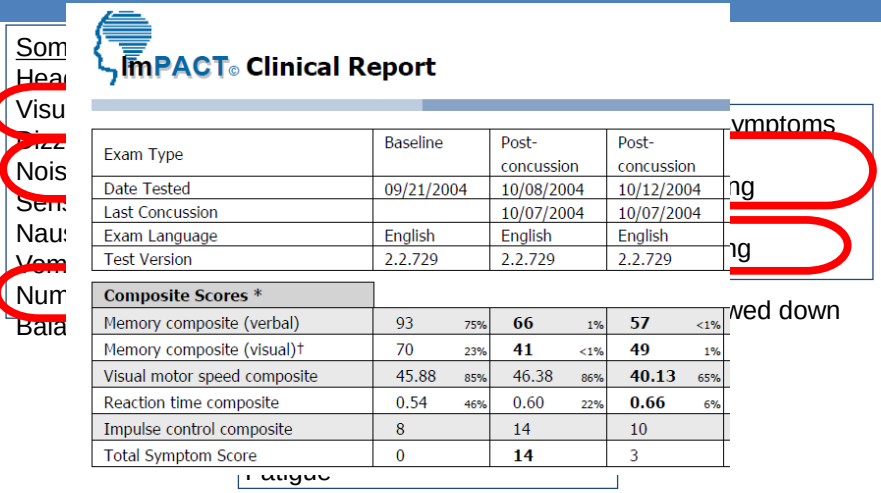

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Key Components of the ED Assessment

- Take history and determine events surrounding the injury
- Assess for risk of intracranial injury and obtain heat CT +/- C spine when necessary

Assess for risk factors for a prolonged recovery
Set expectations with appropriate counseling

- IF CT negative…consider concussion and do a focused exam.
- Assess Symptoms/ROS
- Balance testing
- Vision testing – Convergence, Smooth pursuit, Saccades
- Focused Neurologic Exam (Cognitive – attention, memory, concentration)

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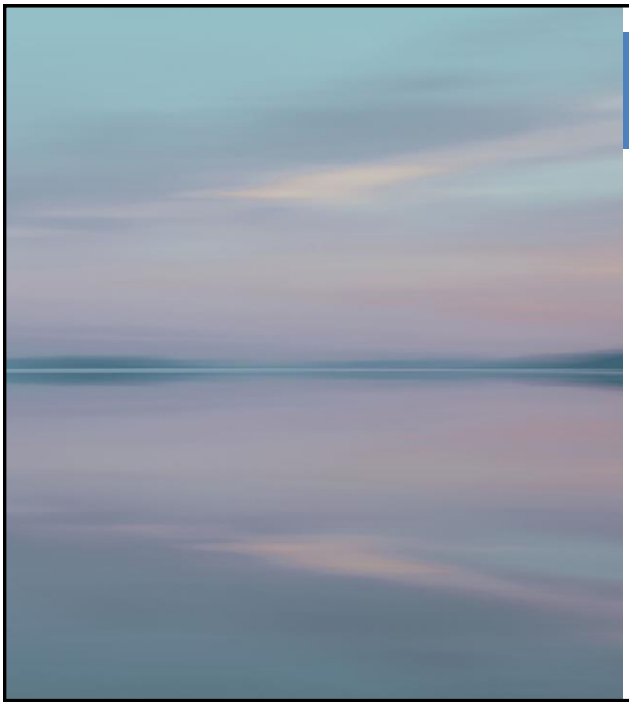

- Wearable technology
- Biomarkers

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Long Term Management & Counseling

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Concussion Is a Functional Injury with "Individual Expression"

Images obtained from Wikipedia

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Biomechanical Mechanism

- Three components
  - Contact
  - Linear acceleration
  - Rotational acceleration

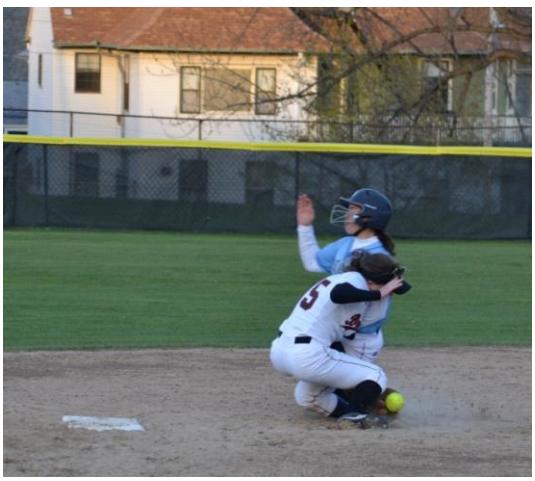

Image from personal collection of Dr. Raukar

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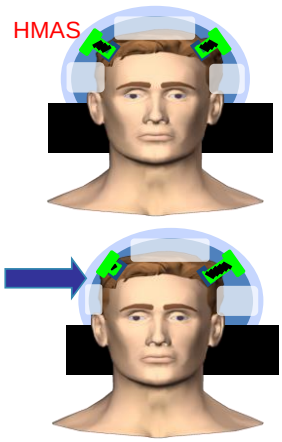
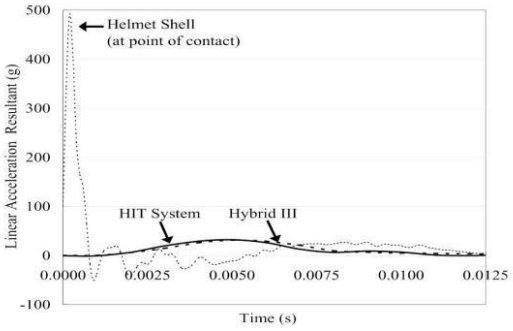
Head *(not Helmet)* Acceleration



Courtesy: Virginia Tech



- HMAS (head-mounted accelerometer system)
- Design decouples accelerometers from helmet shell and ensures consistent head/accelerometer contact

Manoogian et al. *Biomedical Sciences Instrumentation* (2006)

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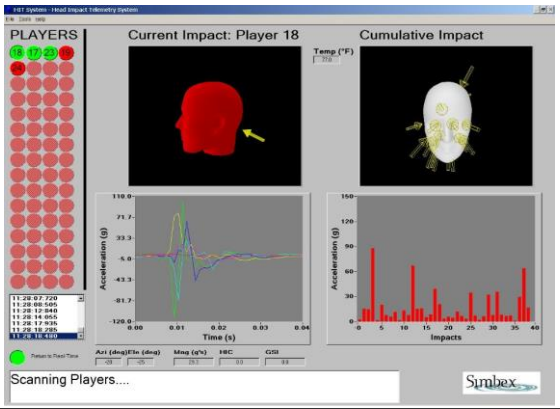
Head Impact Telemetry System (HIT System)

- 6 linear accelerometers
- Real-time w/ alerts
- 64 players per base unit
- 1000 Hz
- All practices and games

Head Impact Exposure (HIE)

- magnitude (accelerations)
- frequency (number)
- location (helmet)



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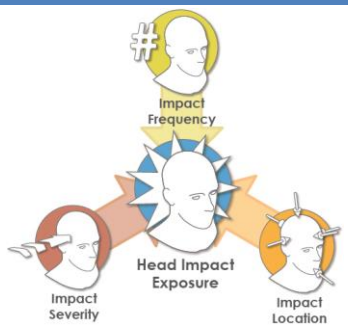
Head Impact Biomechanics in Sports
What Have We Learned?

1. What is Head Impact Exposure (HIE) and severity?
2. How do measures of HIE correlate with cases of diagnosed concussion – is there an "injury threshold"?
3. Is there an association between HIE and signs and symptoms of concussion?



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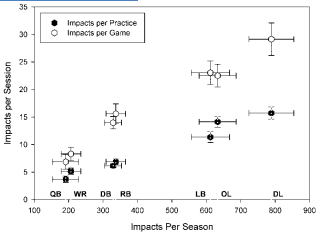
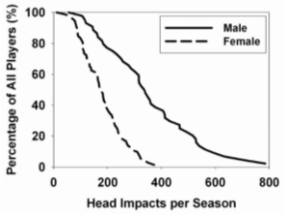
HIE: Impact Frequency
Number of Head Impacts Per Practice, Game and Season

IVY League Rule Change

- **~10% of all college football players sustain > 1000 impacts in a season[1]**
  - Individual football players with **2,000+ head impacts in a *single season***
- **Football players sustain > 3x impacts in games than practices**
  - Significant difference in HIE among player positions
- **Male college hockey players sustain 2x more head impacts than females[2]**





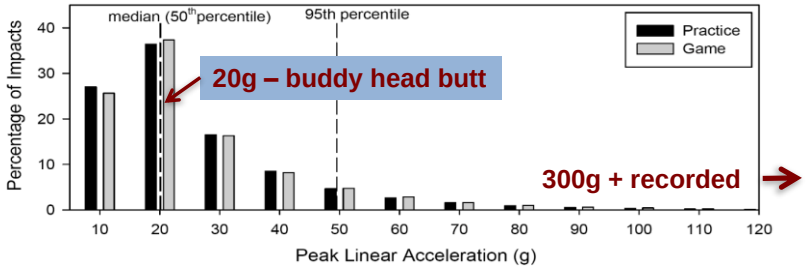
Kickoffs were moved up from the 35-yard line to the 40 and touchbacks from the 20-yard line to the 25.

Reduce number of contact days

[1] Crisco et al., *J Athletic Training* (2010)
[2] Brainard et al., *Med & Science in Sports and Exercise* (2011)

40

HIE: Impact Severity Collegiate Football



- Impacts skewed toward lower severity
- 50% of all impacts < 20.0g and 1,187rad/s^2
- Distribution of impact severity **does not** significantly change between games and practices

Crisco et al., Journal of Applied Biomechanics (2011)

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Head Impact Biomechanics in Sports
What Have We Learned?

1. What is Head Impact Exposure (HIE) and severity?
2. How do measures of HIE correlate with cases of ***diagnosed concussion*** – is there an "injury threshold"?
3. Is there an association between HIE and ***signs and symptoms*** of concussion?

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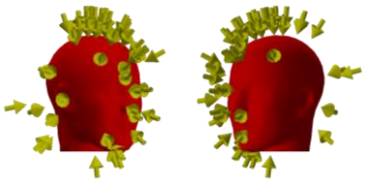
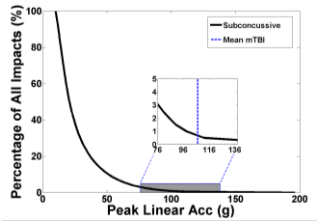
Diagnosed Concussion Events

120+ *Diagnosed Concussions Recorded with HIT System*





- **Number of impacts higher on concussion days**
  - *Dx-Day*: 21.0 [12.0 – 36.8]
  - *Non Dx-Day*: 13.8 [9.4 – 18.9]
- **Occur most frequently to the Front**
  - Front (46%), Top (25%), Side (16%), Back (13%)
- **Mean magnitude > top 0.5% of all impacts sustained**
  - 103 ± 34 g
- **> 8,000 (0.4%) impacts with higher magnitude NOT associated with injury … what are we missing??**

Beckwith et al., *FIC on Traumatic Brain Injury* (2011)
Beckwith et al., *World Congress of Brain Injury* (2012)
Beckwith et al. Med Sci Sports Exerc *(2013)*

43

Reebok Checklight Provides a "Smart Cap" for Concussion Testing

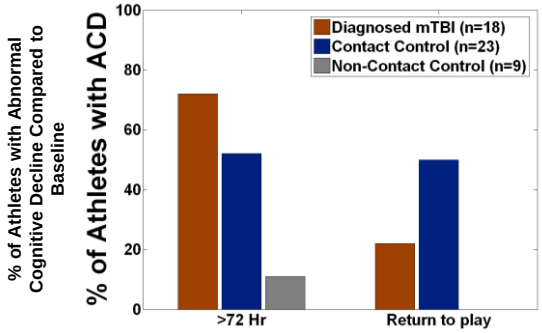
44

Head Impact Biomechanics in Sports
What Have We Learned?

1. What is Head Impact Exposure (HIE) and severity?
2. How do measures of HIE correlate with cases of ***diagnosed concussion*** – is there an "injury threshold"?
3. Is there an association between HIE and ***cognitive measures*** in the absence of diagnosed concussion?

45

Un-Diagnosed Concussion?
Cognitive Testing Indicates Potential Under-reporting



Athletes exposed to head contact but **not diagnosed w/ concussion**
- 52% had abnormal cognitive decline at 72hr interval
- 50% at follow-up (7+ days) – still playing and having head impacts

Beckwith et al. *World Congress of Brain Injury (2010).*McAllister et al. *Neurology* (2012).

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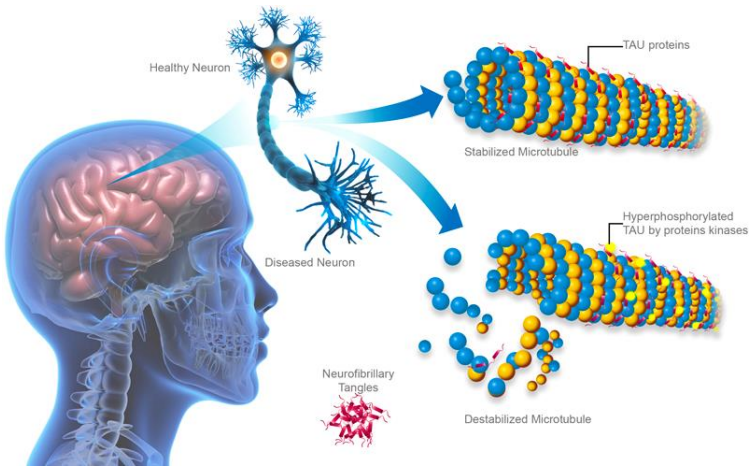
5(?) Problems with Variable Penetrance

47

1. Abnormally Deposited Tau Protein



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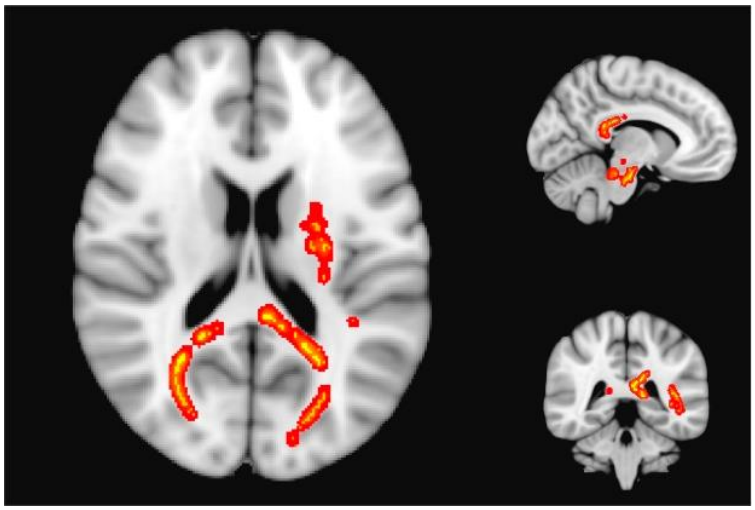
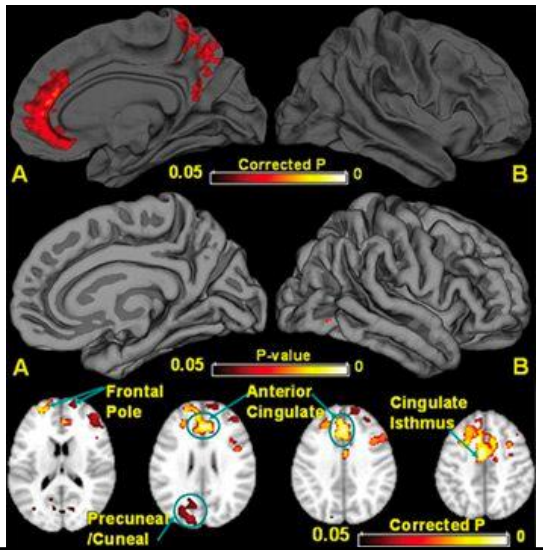
2. Alterations in Myelin



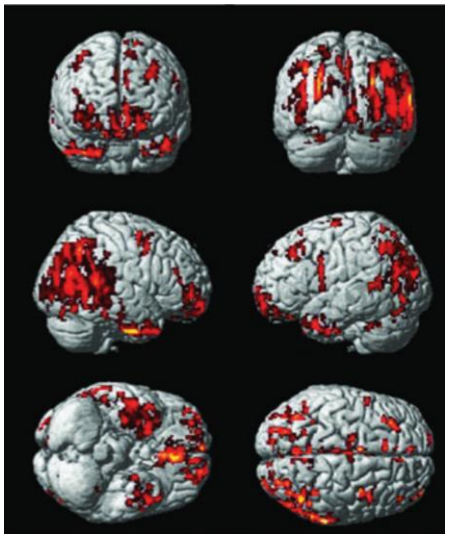
49

3. Atrophy



50

4. Change in Perfusion



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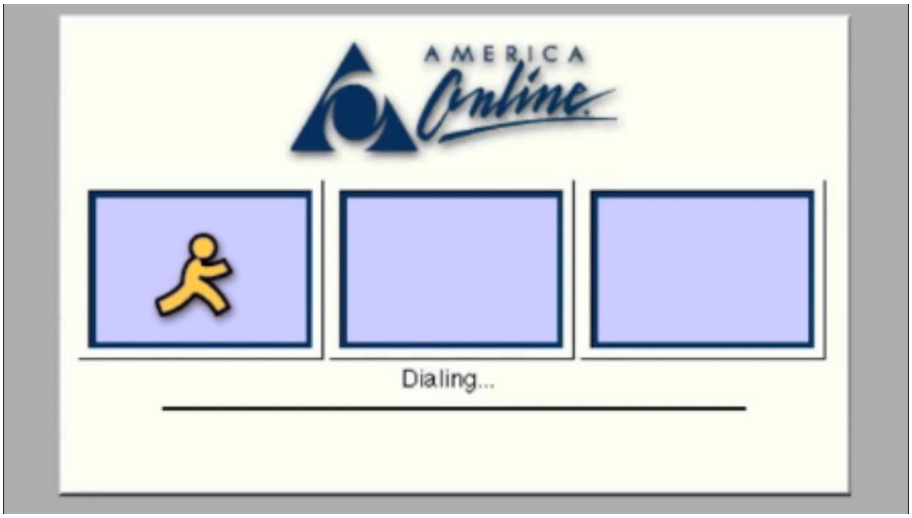
5. Delayed Connectivity



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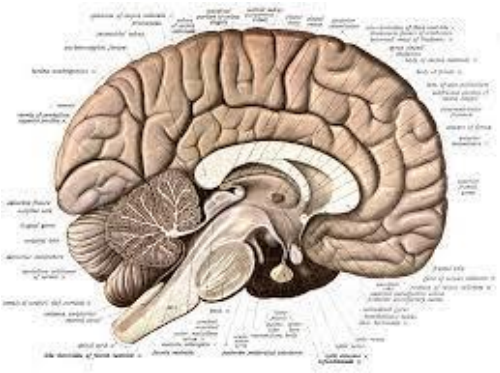
Cotton Candy on a Stick



Images obtained from Wikipedia

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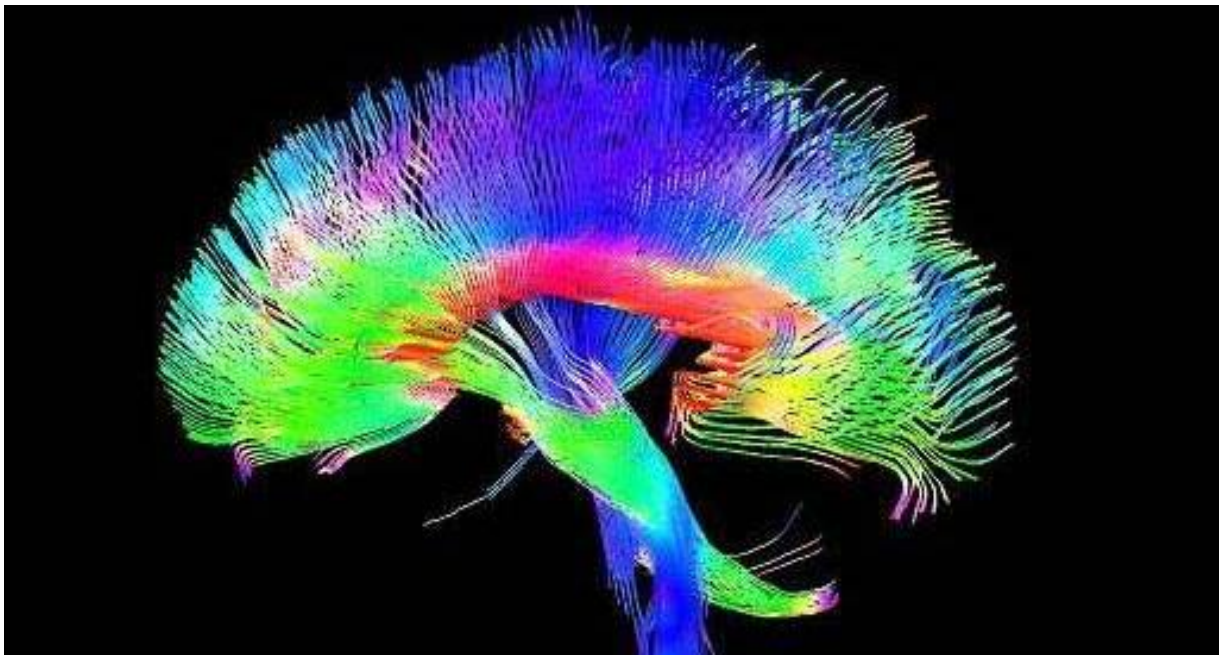

DTI Image of the axons in the brain. Image Credit: Google Creative Commons

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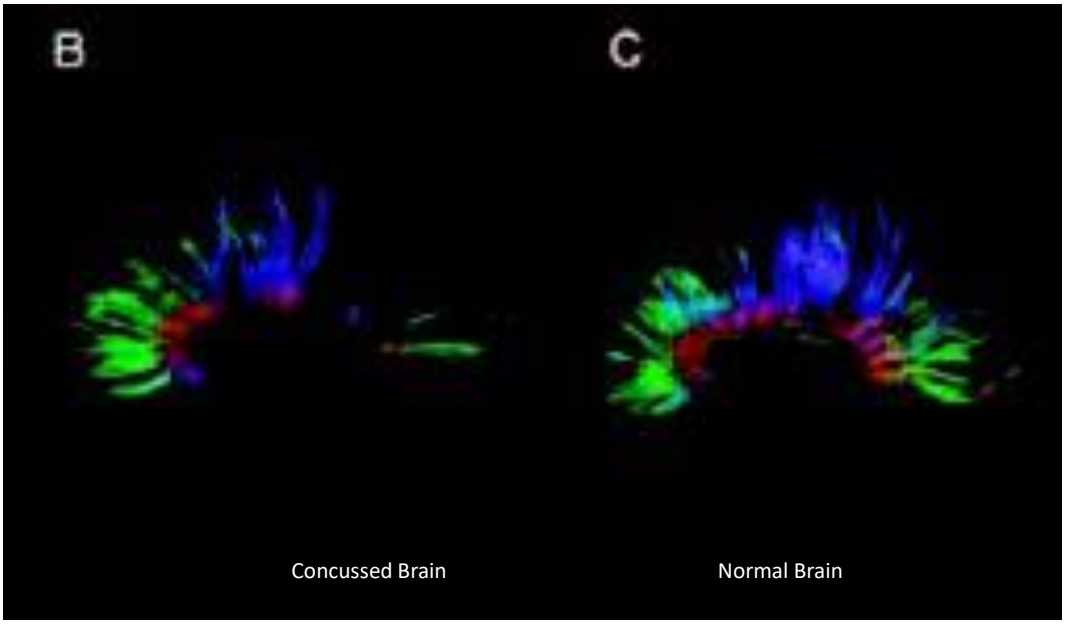

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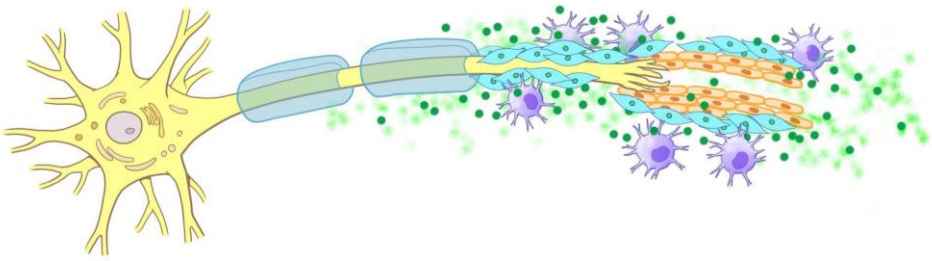
Axonal Injury



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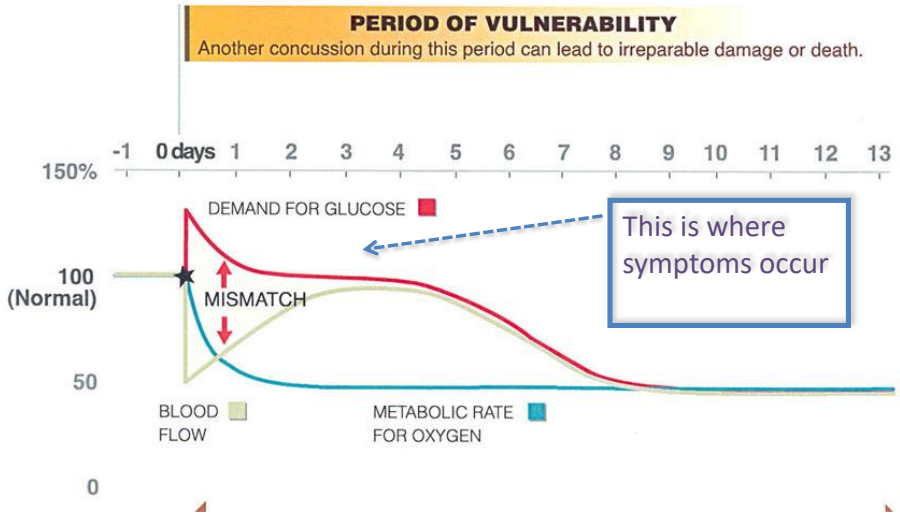
Symptoms Due to Metabolic Mismatch



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HOW MUCH DO YOU HAVE IN THE BANK?

Image from Wikipedia

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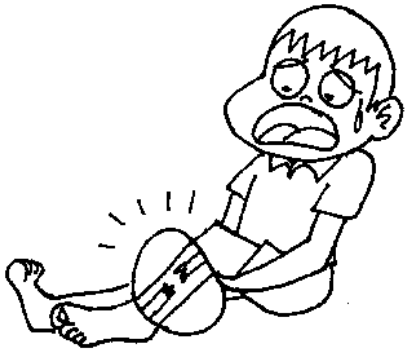
Concussion Is a Process – Not an Event



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EARLY GOALS

- Protect brain vulnerability
- Basis for cognitive and physical rest

From Wikimedia Commons

60

From Wikimedia Commons

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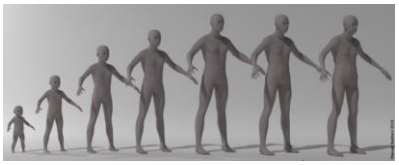
What Affects the Rate of Recovery?



From Wikipedia Commons

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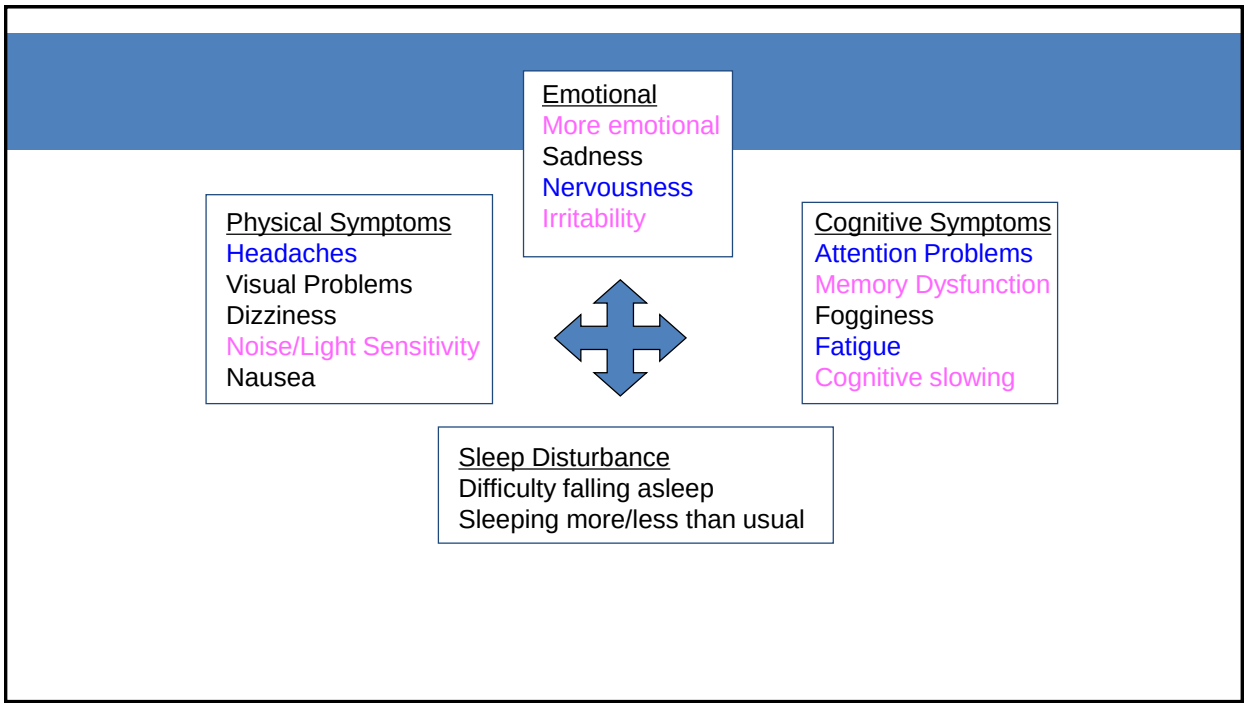
Incidence Is Higher in Women

63

What Else?

- Neck Musculature
- Susceptibility
- Reporting

64



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Outcome

- Females
  - More symptoms
  - More severe symptoms
    - Simple and complex reaction time compared to their own baselines
  - Greater academic impact
    - Cognitively impaired 1.7 times more often than males

RECOVERY IS LONGER IN WOMEN

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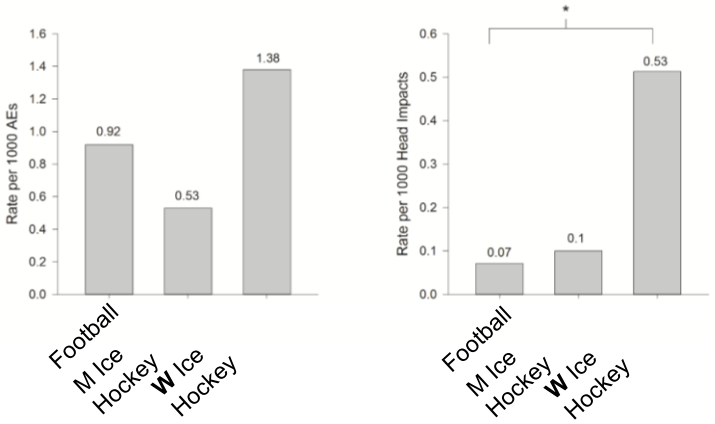
Concussion Rates by Sex

Females experience a significantly higher rate of concussion per head impact



Women's Ice Hockey: **1** mTBI every **1,883** impacts
Football: **1** mTBI every **14,085** impacts

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Acceleration for All Impacts

	Linear	Rotational
Football	117 +/- 43	7062 +/- 3362
M Hockey	71. +/- 14	5313 +/- 15
W Hockey	43 +/- 11	4029 +/- 11

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Recovery Confounders Age

- Younger athletes take longer to heal
  - Developing brain is more sensitive to the excitatory NT and the cascade that follows

69

Recovery Confounders -Age

3-5 days

5-7 days

10-14 days

Images obtained from Wikipedia

70

Recovery Confounders - Concussion History

History of 3 concussions

- More severe on field presentation
- Delayed recovery times
- Threefold increase for future concussion
- Long term neurological deficits/decline in cognitive performance

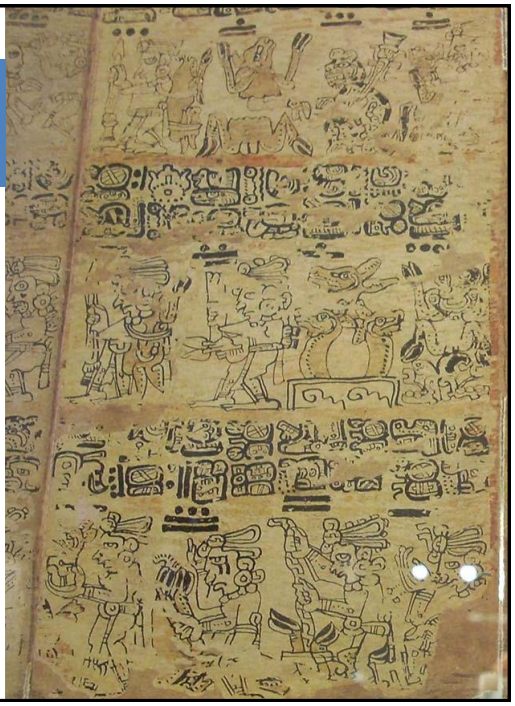

Image obtained from Wikipedia

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Recovery Confounders Comorbid Conditions

- Migraine headaches
- Attention deficit disorder
- Sleep disturbances
- Depression
- Anxiety
- Mood disorders

Figure 9: St. Bethlehem Hospital in London (Bedlam), which opened in 1247, was the first institution dedicated to the care and treatment of the mentally ill

Image from Wikipedia

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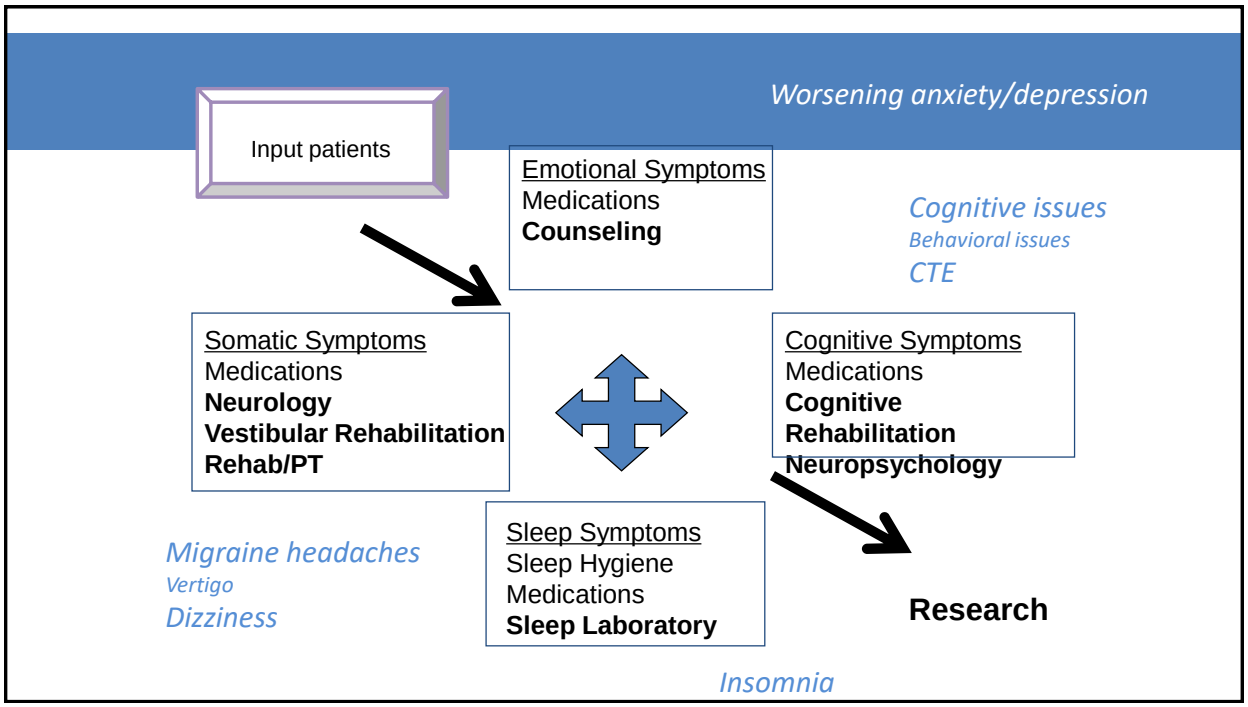

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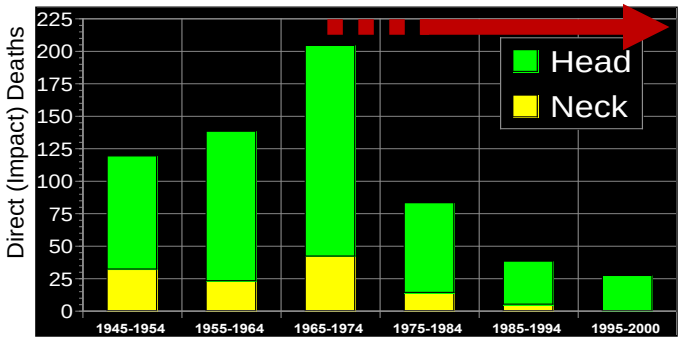
Prevention

- Helmet performance standards (1970s)
- Rule changes and coaching techniques (1970s)



Mueller et al.

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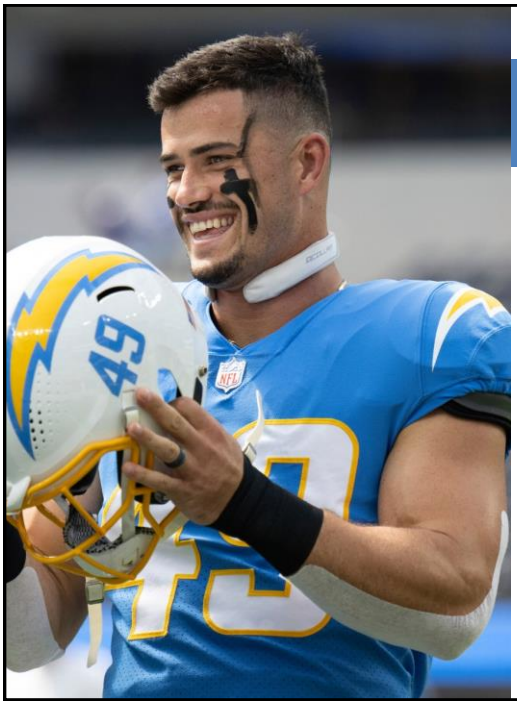
Prevention

Guardian Cap

Image from personal collection of Dr. Raukar

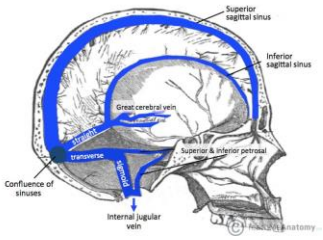
Mouthguards

75



Q Collar

"Helmets protect the skull, it's time to protect the brain"



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Long Term Consequences

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Alzheimer's Disease

- 2005 – UNC - Chapel Hill - data from more than 2,550 retired professional football players
- 61% >1 concussion during their career
- 24% had ≥ 3
- Earlier onset of Alzheimer' s disease among these men than the general male population

78

Memory Disorders

- University of Michigan's Institute for Social Research at the request of the NFL
- 1,063 retired NFL players completed a survey

- Younger players (30 to 49 years) had a rate of 1.9%
  - 19 times that of the national average of 0.1%.
- 6.1% of players age 50 and older had been diagnosed with a dementia-related condition
  - Five times the national average of 1.2%

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Sports Legacy Institute/BU/CTE

- Developed in 2007
- Is the CTE research center
- In 12 months, they had brains from 18 deceased contact athletes
  - Ages 18-83
  - 17 had CTE

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The NFL Response

- 39 rule changes in 5 years
- Institution of Concussion Protocols
- Unaffiliated neurotrauma consultants
- Eye in the sky (injury spotters)
- >$20,000,000 research grants annually

81

Suicide

- Overall U.S. male population
  - 19.2 per 100,000 in 2009

- Rate in NFL active/former players
  - 1987-2004: 6.1/100,000
  - 2
    1

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Summary

- Diagnosis
  - Bump on the head + Symptoms +/- Negative CT = Concussion
  - Neurologic Exam
  - Balance/BESS testing
  - Visual stimulation
- Treatment
  - NOTHING
  - No meds
  - No RTP/L/W
- Counseling
  - Most important

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QUESTIONS & DISCUSSION

85

Which of the Following Tools Is Most Commonly Used to Assess and Diagnose a Concussion in the Emergency Department?

A. Glasgow Coma Scale (GCS)
B. Sport Concussion Assessment Tool (SCAT)
C. NIH Stroke Scale (NIHSS)
D. Montreal Cognitive Assessment (MoCA)

CONTINUING EDUCATION COMPANY

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Which of the Following Groups Is at the Highest Risk for Sustaining a Concussion?

A. Middle-aged adults in sport-related activities
B. Teenage girl with a history of anxiety who sustained a concussion in an MVA
C. Elderly individuals engaging in low-impact activities
D. Office workers with sedentary lifestyles

Which of the Following Groups Is at Risk for a Prolonged Recovery?

A. Middle-aged adults in sport-related activities
B. Teenage girl with a history of anxiety who sustained a concussion in an MVA
C. Elderly individuals engaging in low-impact activities
D. Office workers with sedentary lifestyles

Which of the Following Is the Most Important Aspect of Home Care Advice for a Patient Recovering from a Concussion?

A. Complete bed rest for 7 days
B. Gradual return to physical and cognitive activity as tolerated
C. Immediate resumption of screen time and work tasks
D. Use of over-the-counter sleep aids to ensure uninterrupted rest

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