



## Concussion in the Adolescent/Teen Athlete: Overview, Advocacy and Life Long Lessons

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### Concussion Quiz – T / F

- A concussion is a brain injury.
- **TRUE**
- Concussions can occur in any organized or unorganized recreational sport, activity or even in the workplace.
- **TRUE**



### Concussion Quiz – T / F

- You cannot see a concussion and some athletes may not experience and/or report symptoms until hours or days after the injury.
- **TRUE**
- Concussions can be caused by a fall or bump or blow to the head or body.
- **TRUE**



### Concussion Quiz – T / F

- Sitting out for 1 week after a concussion is adequate time to recover before returning to play.
- **FALSE!**



### Concussion Quiz – T / F

- Following a coach's rules for safety and the rules of the sport, practicing good sportsmanship at all times, and using the proper equipment are all ways to prevent a concussion.
- **TRUE**
- Concussions can happen even if someone has not been knocked out or lost consciousness.
- **TRUE**

### Concussion Quiz – T / F

- Nausea, headaches, sensitivity to light or noise and difficulty concentrating are some of the symptoms of concussion.
- **TRUE**
- Athletes who have a concussion should not return to play until they are symptom-free and have received approval from a physician or appropriate health care professional.
- **FALSE!**

## Concussion Quiz – T / F

- A repeat concussion that occurs before the brain recovers from the first can slow recovery or increase the likelihood of having long-term problems such as Second Impact Syndrome
- **TRUE**



## Concussion – Not a “Ding”

- The most common head injury in sports (1.6-3.8 M cases/year, based on reporting)
- Concussion is a mild traumatic brain injury
  - ▣ 80-90% of concussions (overall statistics) resolve in 7-10 days
  - ▣ Recovery may be longer in children/adolescents
  - ▣ Neurocognitive recovery avg. 26 days (H.S. age)\*



\* UPMC Sports Center data (2008)

## Concussion – Not a “Ding”

- **Concussions ARE different from other types of sports injuries** — do NOT push through the pain
- No abnormality generally seen on imaging (CT/MRI)
- Acute clinical symptoms reflect a **functional disturbance**, rather than a structural injury (Zurich 3<sup>rd</sup> Int. Consensus Statement, 2008)

## Concussion in Sports - Data

- Many head injuries go undetected, esp. in younger athletes (Tommasone/McLeod, JATA, Oct. 2006)
- Athletes tend to **underreport symptoms**
  - ▣ “part of the game”
  - ▣ Fear of getting benched
  - ▣ Lack of work-up after the practice / game



## Concussion in sports

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>□ <b>Helmeted sports</b> <ul style="list-style-type: none"> <li>▣ Women's ice hockey<sup>1</sup></li> <li>▣ Football<sup>2</sup></li> <li>▣ Men's ice hockey<sup>3</sup></li> <li>▣ Men's lacrosse<sup>7</sup></li> <li>▣ Softball</li> <li>▣ Baseball</li> <li>▣ Skiing</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>□ <b>Non-helmeted sports</b> <ul style="list-style-type: none"> <li>▣ Wrestling</li> <li>▣ Soccer (M/W)<sup>4,5</sup></li> <li>▣ Women's lacrosse</li> <li>▣ Field hockey<sup>6</sup></li> <li>▣ Basketball (W/M)</li> <li>▣ Cheerleading</li> <li>▣ Gymnastics</li> <li>▣ Cycling</li> <li>▣ Diving</li> <li>▣ Martial arts (MMA)</li> <li>▣ Boxing</li> </ul> </li> </ul> |
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## Concussion in sports - data

- Head injuries account for **4.5% of all high school sports injuries** and 19% of non-fatal injuries in football
- High school football alone accounts for 250,000 brain injuries/year (McCrorry, Br. J. Sports Med 2004)
  - ▣ ~1 in 20 HS football players per season;
  - ▣ **9% incidence in NH HS athletes (DHMC/BIANH Concussion Pilot Project 2008-2010)**
  - ▣ Nearly **one-fifth** of 160 NFL players surveyed by The Associated Press from Nov. 2-15, 2009 replied that they have hidden or played down the effects of a concussion

## Concussion in Sports - Data

- Evidence to suggest that **younger athletes may be at higher risk** for concussions (Halstead, **Pediatrics**, Sept. 2010)
- Head injury in younger players may impair developing brain
- **Females at higher risk** for sustaining a concussion than males in the same sport - especially at lower levels of competition (more reporting, weaker neck muscles)

## Feb. 2010 NFHS Policy Change

### 2010-11 Spirit Rules Changes

2-1-15: An athlete who exhibits signs, symptoms or behaviors consistent with a concussion (such as loss of consciousness, headache, dizziness, confusion, or balance problems) **shall be immediately removed from the contest and shall not return to play until cleared by an appropriate health-care professional.** (Please see NFHS Suggested Guidelines for Management of Concussion on page 73).

National Federation of State  
High School Associations



## NHIAA Concussion Guidelines 2010

- Similar to NFHS policy

## 4/29/10 NCAA Policy Change

"Institutions shall have a concussion management **plan on file** such that a student-athlete who exhibits signs, symptoms or behaviors consistent with a concussion **shall be removed** from practice or competition and **evaluated** by an athletics healthcare provider with **experience in the evaluation and management of concussion.** Student-athletes diagnosed with a concussion **shall not return** to activity for the remainder of that day. Medical clearance shall be determined by the team physician or their designee according to the concussion management plan.

In addition, student-athletes must sign a statement in which they accept the **responsibility for reporting their injuries and illnesses to the institutional medical staff, including signs and symptoms of concussions.** During the review and signing process student-athletes should be presented with educational material on concussions."

## CDC – School Nurse memo (May, 2010)

- Recommends a **concussion action plan** for schools to create and implement
  - Remove the athlete from play
  - Ensure that the athlete is evaluated by a health care professional experienced in evaluating for concussion
  - Inform the athlete's parents or guardians about the possible concussion and give them the fact sheet on concussion.
  - Keep the athlete out of play the day of the injury and until a health care professional, experienced in evaluating for concussion, says they are symptom-free and it's OK to return to play
- **Educate** parents, teachers, coaches, and students about concussion

[www.cdc.gov/concussion/sports/response.html](http://www.cdc.gov/concussion/sports/response.html)

## 5/20/10 US House of Rep. Hearings

- House Committee on Education and Labor
  - Focused on how head injuries affect **"the student in student-athletes"**
  - Discussion centered on girls
  - Focused on **off-field management** in the classroom
  - Government Accountability Office report on High School Concussions— 400,000 concussions in HS athletes (2005-2008)

[www.nytimes.com/2010/05/21/sports/football/21concussions.html?fta=y](http://www.nytimes.com/2010/05/21/sports/football/21concussions.html?fta=y)

## 5/20/10 US House of Rep. Hearings

- 14 y/o Sarah Rainey, in testimony, 5 weeks after sustaining a concussion playing soccer:
  - "...I am a little perturbed by the C.D.C.'s concussion slogan, 'It's better to miss one game than a whole season.' I understand their intent, but I think they minimize the seriousness of concussions by making it sound like you just need to take a game off and then you'll be good to go."



[www.nytimes.com/2010/05/21/sports/football/21concussions.html?fta=y](http://www.nytimes.com/2010/05/21/sports/football/21concussions.html?fta=y)

## 5/23/10 NFL Memo

- NFL Commissioner, Roger Goodell sent letters to governors of 44 states requesting legislation similar to Lystedt law (WA)
  - "Given our experience at the professional level, we believe a similar approach is appropriate when dealing with concussions in all youth sports. That is why the NFL and its clubs urge you to support legislation that would better protect your state's young athletes by mandating a more formal and aggressive approach to the treatment of concussions."



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

## H.R. 1347 (Concussion Treatment and Care Act of 2010)

- Passed House of Representatives 9/29/10
- Introduced by Rep. Bill Pascrell (D-NJ) on March 5, 2009 (Ryne Dougherty case)
- Would direct HHS to establish concussion management guidelines in school aged children for identification, treatment, and return to play issues
- Would allow grants for computerized neuropsych testing (pre and post injury)

## H.R. 6172: Protecting Student Athletes From Concussions Act

- Rep. George Miller (CA)—Committee on Education and Labor (9/23/10)
- Sets minimum standards for K-12 schools for concussion safety and management, including education of students, parents and school personnel (McGrath, JATA, 9/2010)
- Tied to federal education funding for school districts; addresses academic issues in concussed student athletes

## New Hampshire SB 95—Study of Youth Sports Concussions (2011)

- Sponsored by Senator Matthew Houde (P) and 6 other State Senators
- Passed the NH Senate Feb. 23, 2011
- Establishes a Commission to study 'youth sports concussions and other concussions received while at school'
- House debate/hearings pending

## Concussion - Neurophysiology

- Immediate biochemical changes begin after impact
  - Efflux of  $K^+$ , glutamate (Giza, JATA, 2001)
  - Influx of  $Ca^{2+}$
  - Suppression of neuronal activity
- Period of "hypermetabolism" takes place in state of diminished cerebral blood flow
  - The brain NEEDS to rest in order to recover!

*Journal of Athletic Training* 2001;36(3):228–235

## Concussions - Signs & Symptoms

- Cannot rely on athlete to report all symptoms
- Parents, teammates, coaches, athletic trainers must also be aware and speak up
- On- and off-field assessment and re-assessment necessary
- Check for other injuries
  - Head, neck, dental
  - Facial, neurologic



## Concussions Signs & Symptoms

- Physical—headache, balance problems, nausea, light sensitivity
- Cognitive—mentally foggy, difficulty concentrating, confusion
- Emotional—irritability, sadness, nervous
- Sleep—drowsy, altered sleep pattern
- 22 signs/symptoms

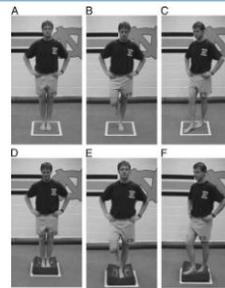


## Concussions - Evaluation

- Assessment and treatment must be individualized to the athlete
- **Sideline assessment:**
  - SCAT2 (Sport Concussion Assessment Tool 2)
  - Maddocks Score (5 qs about current match/game)
  - Standardized Assessment of Concussion (immediate AND delayed recall; McCrea, Kelly; Neurology 1997)
  - Balance testing (BESS): 3 standing tests
    - All can be compared to pre-season testing
- To determine if a concussion has occurred, not for return to play that game



## Balanced Error Scoring System (BESS)



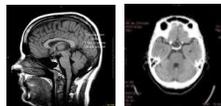
## Concussions - Evaluation

- Athlete should be evaluated by trained medical personnel as soon as possible; remove from play
- Cannot rely on the athlete to accurately report all symptoms; may be delayed 24H
- Neurocognitive testing—computer based
  - Pre-season baseline (hopefully)
  - 2-3 day post-injury re-assessment
  - Follow-up until scores return to baseline, usually weekly
  - Symptom resolution **not directly** related to cognitive recovery
  - ImPACT®, Headminder®, CogSport®, ANAM®



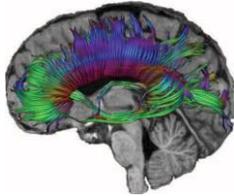
## Concussions - Evaluation

- Brain CT/MRI should be employed whenever suspicion of an intracerebral bleed or structural lesion exists (from Zurich Consensus Statement, 2008); CT preferred in first 24-48 hours
- Normal CT and MRI in >99% of mTBI
  - Emerging role for diffusion tensor imaging (DTI), MR SPECT, and Functional MRI (fMRI)

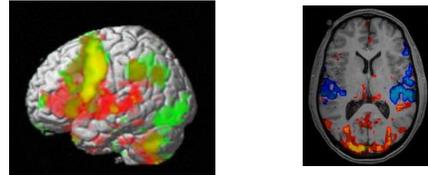


Neurosurgery 2008; 62:1286–1296

## Diffusion Tensor Imaging (DTI)



## Functional MRI (fMRI)



## ImPACT™ testing

- Immediate Postconcussion Assessment and Cognitive Testing
- 20 minute neurocognitive test battery (6 modules)
- Validated to measure the cognitive effects of sports-related concussion
- Currently used by:
  - NFL, NHL, MLB, USA Hockey, MLS
  - US Army, US Navy, Cirque du Soleil
  - 500+ Colleges/Univ; 1500+ High Schools



## What ImPACT™ Is

- A clinically useful and **reliable/valid** concussion management program.
- A **tool to help** determine recovery from injury.
- A **tool to help** manage concussion-(e.g. return to exertion, return to academics).
- A **tool to help** communicate post-concussion status to coaches, parents, clinicians.



Keys to Interpreting ImPACT™ and Case Studies; Collins, M; webinar, 2009

## What ImPACT™ Is Not

- A substitute for medical evaluation/ treatment or more extensive neuro-psychological testing
- A stand-alone assessment program
- Effective if clinician is naïve to specifics and complexities of data.



Keys to Interpreting ImPACT and Case Studies; Collins, M; webinar, 2009

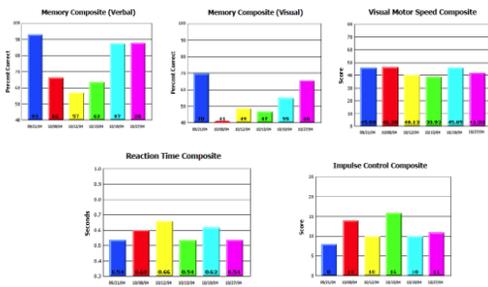
## Reason for NC/NP testing

- Reasoning and problem solving ability
- Ability to understand/express language
- Working memory and attention
- Short-term and long-term memory
- Processing speed
- Visual-spatial organization
- Visual-motor coordination
- Planning, synthesizing, and organizing a



<http://emedicine.medscape.com/article/317596-overview>

## ImPACT™ Modules



## ImPACT™ Report

Exam Type	Baseline	Post-concussion	Post-concussion	Post-concussion	Post-concussion	Post-concussion
Date Tested	09/21/2004	10/08/2004	10/12/2004	10/15/2004	10/19/2004	10/22/2004
Last Concussion	10/02/2004	10/02/2004	10/02/2004	10/02/2004	10/02/2004	10/02/2004
Exam Language	English	English	English	English	English	English
Test Version	2.2.729	2.2.729	2.2.729	2.2.729	2.2.729	2.2.729
<b>Composite Scores *</b>						
Memory composite (verbal)	93	66	57	63	87	88
Memory composite (visual)†	70	41	49	47	55	66
Visual motor speed composite	45.88	46.38	40.13	38.93	41.83	41.30
Reaction time composite	0.54	0.60	0.66	0.54	0.62	0.54
Impulse control composite	8	14	10	16	10	11
Total Symptom Score	0	14	3	1	0	0

\* Scores in bold type indicate scores that exceed the Reliable Change Index score (RCI) when compared to the baseline score. † Scores that do not exceed the RCI score may still be clinically significant. Percentile scores, if available, are listed in small type. Please consult your ImPACT User Manual for more details.  
† Clinical composite score is available only for exams taken in ImPACT version 2.0 or later.

## Parental Assessment of Concussion Symptoms

- At home: parental recommendations
  - Monitor for changes in personality, alertness, worsening headache, dizziness, nausea, vomiting, enlarged pupil
  - Do not need to keep waking the child up q2h
  - A child who was initially normal after a head injury who is extremely difficult to awaken may have a more serious head injury and should be evaluated by a doctor urgently/emergently

## Symptom Scores

Exam Type	Baseline	Post-concussion	Post-concussion	Post-concussion	Post-concussion	Post-concussion
Date Tested	09/21/2004	10/08/2004	10/12/2004	10/15/2004	10/19/2004	10/22/2004
Last Concussion	10/02/2004	10/02/2004	10/02/2004	10/02/2004	10/02/2004	10/02/2004
Exam Language	English	English	English	English	English	English
Test Version	2.2.729	2.2.729	2.2.729	2.2.729	2.2.729	2.2.729
<b>Symptom Scores</b>						
Headache	0	2	1	0	0	0
Nausea	0	0	0	0	0	0
Vomiting	0	0	0	0	0	0
Sleep Disturbance	0	0	0	0	0	0
Dizziness	0	1	0	0	0	0
Fatigue	0	2	0	0	0	0
Tonics being administered	0	2	0	0	0	0
Sleeping more than usual	0	0	0	0	0	0
Sleeping less than usual	0	2	0	0	0	0
Drowsiness	0	0	0	0	0	0
Sensitivity to light	0	0	0	0	0	0
Sensitivity to noise	0	1	0	0	0	0
Irritability	0	2	0	0	0	0
Balance	0	0	0	0	0	0
Nervousness	0	0	0	0	0	0
Feeling more emotional	0	0	0	0	0	0
Numbness or tingling	0	0	0	0	0	0
Feeling slowed down	0	1	0	0	0	0
Feeling mentally foggy	0	1	1	1	1	0
Difficulty concentrating	0	0	1	1	0	0
Difficulty remembering	0	0	0	0	0	0
Visual problems	0	0	0	0	0	0
<b>Total Symptom Score</b>	<b>0</b>	<b>14</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>

## Medication Use in Concussions

- No medications will directly “cure” a concussion—THE KEY IS DECREASED ACTIVITY AND COGNITIVE REST!
- Medication can be used for prolonged symptoms such as headache, sleep disturbance or anxiety
  - Amantadine for cognitive performance
  - Elavil qhs for sleep disturbance/depression
  - Acetaminophen for headaches initially
  - NSAID's should be avoided initially

## Concussion Modifiers

- Prior history of concussion
- Prolonged LOC
  - More than 1 minute
- Convulsions/tonic posturing
- Co-existing diagnoses
  - ADHD
  - Depression
  - Learning disabilities
  - Migraines



## Symptomatic Recovery Period

- No exercise
- Cognitive rest
- The brain needs increased blood flow to heal, at the same time that the blood vessels are contracted
- Each case is individual
- Neurocognitive recovery



## Concussions – Cognitive Rest

- In adolescents, **cognitive rest** is crucial to avoid provocation of the symptoms and allow healing
  - Based on individual case/assessment
  - Interaction between athlete, parents, athletic trainer, physician, teachers, school nurse (academic accommodation)
- Cognitive rest includes **avoidance of overstimulation**:
  - Text messaging
  - TV/movies ('Battling Seizure Robots')
  - Video games
  - Computer use
  - Decreased school participation temporarily if necessary



## Concussions - Return to Play

- Many different opinions
- No "rules" for returning to play / practice
- Guidelines exist:
  - Cantu
  - Colorado
  - AAN
  - International Consensus Statements: Vienna (2001), Prague (2004), Zurich (2008)



## Concussions - Return to Play

1. **Asymptomatic Time Frame at Rest—how long?** (normal neurocognitive scores vs. 7 days—NJSIAA 8/10)

2. Graded Stages of Exercise:

- Light aerobic exercise (non-contact)
- Sport-specific exercise (non-contact)
- Non-contact training drills
- Full-contact practice
- Return to game play



From Zurich Sports Concussion Consensus Statement, 2008 (PM&R, May 2009)

- If symptoms occur at any stage, the athlete must stop activity, wait 24 hours, and re-attempt exercise AT THE PREVIOUS ASYMPTOMATIC STAGE



**Return to Play (cont.)**

## Concussions - Return to Play

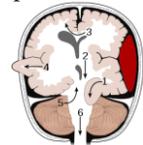
- British Journal of Sports Medicine (May 2009)
  - There is **no research on RTP guidelines for child athletes** following sport-related concussion
  - Child/adolescent athletes **take longer to recover from concussions** than adults – RTP decisions must be individualized
  - There are **no child-specific (< age 10) assessment tools** for concussion (Pediatric ImpACT™ coming Spring 2011)
  - **No concussed child/adolescent athlete should be allowed to RTP the same day**

## What Can Happen if You Return Too Soon? (Sports Jeopardy!)



## Second Impact Syndrome (1984-Saunders/Harbaugh JAMA)

- Rare consequence of head injury
  - Most common in age 18 and under
- Rapid increase in intracranial pressure
- Death in **2-5 minutes**
  - Mortality rate ~50%
  - Morbidity rate ~100%
- Unknown incidence
  - 35-70 probable cases in US between 1980-2009 (1-3 per year)

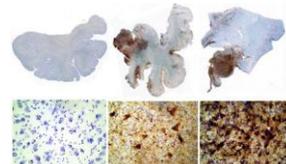


## Second Impact Syndrome

- Prevention:
  - An athlete who is symptomatic must not participate in a contact/collision sport **until all cerebral symptoms have subsided**
  - Preferably not until at least **10-14 days after resolution** of symptoms AND resolution of neurocognitive deficits

## Effects of Multiple Concussions

- Chronic Traumatic Encephalopathy (CTE)
- Chronic Traumatic Encephalomyelopathy (CTEM)
- Dementia-like changes in the brain (Tau)
- Poor judgement, personality changes, substance abuse, domestic violence, suicide



## CTE/CTEM (cont.)

- Research at Boston U. (Dr. Ann McKee) and U. of Pittsburgh (Dr. Ben Omalu)
- Sports Legacy Institute (Chris Nowinski)—grant from NFL of \$1M
- J. Neuropath Exp Neurol 2009, 2010



## Ben Roethlisberger



## The Hangover



## Time Running Out on Big Ben?

- 4 concussions since 2006 (3 on field, 1 non-helmeted motorcycle accident)
- 242 sacks
- 2 sexual assault charges
- 4 game regular season NFL suspension (\$2 million)



## Sports Equipment

- Mouthguards
  - NO studies to show decreased concussion incidence (Contu, London, Ontario Hockey Concussion Summit, January 2009); (Mihalik, Dent. Traumatol Feb 2007)
  - Help prevent dental injuries - still recommended
  - No evidence of ANY difference between custom made vs. 'boil and bite' types (McCrorry, Br. J. Sp. Med 4/2001)
- Helmets-New padding materials, placement of pads
  - Riddell Revolution® Speed, Xenith X1®, Schutt™ION4D



## Hockey Helmets

- The Messier Project—Cascade M11 helmet



## Head Impact Telemetry System (HITS—Simbex LLC)

- Multiple accelerometer array, measure linear and angular head G forces (>60G)
- Used in high school and college sports, military; data from UNC



## The Hits No One Is Noticing (Sports Illustrated 11/1/10)



## Purdue University Concussion Study

- 21 high school football players from Jefferson High School (Lafayette, Ind.)
- Preseason ImPACT™, fMRI
- HITS® accelerometers in helmets
- 3 players diagnosed with concussion clinically (14%)
- 4 players with abnormal HITS data and fMRI, no clinical concussion noted (19%)
- <http://www.purdue.edu/newsroom/research/2010/101007NaumanFootball.html>

## Headbanger Nation

- Time magazine (1/31/11): 'Health Special: Kids and Concussions'



## X2 Impact Mouthguard (Seattle)



## Office Based Tools for Physicians

- CDC 'Heads Up: Brain Injury In your Practice'
- Acute Concussion Evaluation Forms (ACE)



**ACUTE CONCUSSION EVALUATION (ACE)**  
PHYSICIAN/CLINICIAN OFFICE VERSION  
Gerard Gioia, PhD\* & Micky Collins, PhD\*  
\*Children's National Medical Center  
\*University of Pittsburgh Medical Center



## Academic Issues for Concussed Student Athletes (McGrath, JATA, Sept. 2010)

- Follow grades, homework completion, school testing issues (early detection with very low <1% neurocognitive scores?)
- Consider Section 504 plans if needed, neuropsych exam, academic accommodations
- Medical letters to College Board (Services for Students with Disabilities) for extra testing time on SAT/ACT/AP exams



## The Role of the School Nurse in Concussion Management

- Role in the school based concussion team
- Daily evaluation of concussed students
- Graded Symptom Scale checklist
- Interaction with school athletic trainer
- Interaction with team physician and/or concussion specialist
- Contact with teachers, parents and community health providers

## Advocacy Opportunities and Concussion Awareness

- Contact school Athletic Directors
- Recreational league presidents
- Coaching Associations
- State Interscholastic Athletic Associations
- State Medical Societies
- State Brain Injury Associations
- School Nurse Associations
- State legislators re: concussion laws

## Advocacy Opportunities

- Newspaper/online articles
- Radio
- Local TV news
- Sporting events (cheerleading competitions, high school 'Meet the Coaches' night)

## Community Based Concussion Program



## Case Studies

- 15 y/o Football player
- 15 y/o Field Hockey player
- 17 y/o Nordic Ski jumper

## 15 Y/O Football Player—Defensive End

- 1 Concussion age 14 (freshman)-Nov. 2009
- Baseline tested August 2009
- Never retested after first concussion ('end of the season, according to the athletic trainer)
- Second concussion Sept. 2010; (5'10", 168 lbs)
- Took 7 weeks for neurocognitive data to return to baseline; academic accommodations needed



## 15 Y/O Football player (cont.)

- Baseline scores varied between 16% (reaction time) and 63% (visual memory)
- Post injury scores 1 month later varied between 21% (reaction time) and <1% (verbal memory), with a symptom score of 63
- After 7 weeks, scores were between 40% (verbal) and 96% (reaction time); symptom score of 7

## 15 Y/O Field Hockey Player

- 1<sup>st</sup> concussion on school hiking trip Sept. 2010
- ImPACT™ tested 2 days later (no valid baseline)
- Cleared by school doctor to return to moderate exercise 1 week later, no repeat ImPACT test
- Suffers second concussion in first game back (hit in eye with field hockey ball)—CT head negative
- School athletic trainer does not do post injury ImPACT ('we are too busy with other athletes')
- Average academic student
- 5'2", 115 lbs



## 15 Y/O Field Hockey Player (cont.)

- First ImPACT in office—1 week after second concussion—visual memory and motor speed <1%, symptom score of 21; academic accom. initiated
- 1 month later—motor speed and reaction time <1%, visual and verbal memory 10-15%
- Cleared to begin light exercise by our office
- 2 weeks later, verbal memory up to 30%, reaction time 40%, cleared to progress from moderate to heavy exercise, no contact

## 17 Y/O Nordic Ski Jumper

- Crashes on last jump of State Finals Feb 2010
- CT head negative; CT neck shows hemangioma C4
- Sees multiple neurosurgeons for neck issue over next 3 months; no post concussion evaluation
- Seen in office 3 months after injury
- Ongoing fatigue, dizziness, difficulty concentrating
- Pre-existing hx of OCD, depression, anxiety
- On Abilify, Lexapro, Ritalin
- Worsened grades (A to C)



## 17 Y/O Nordic Ski Jumper (cont.)

- First ImPACT test May 2010—scores from <1% (verbal) to 44% (reaction time); symptom score 31
- Amantadine 100mg/200mg ordered; academic 504 plan ordered; SAT postponed; letter sent to College Board re: 100% extra time request
- Follow up 1 month later—verbal score now 56%, reaction time 54%, symptom score 26
- 6 weeks later, verbal score 63%, reaction time 59%, symptom score 5; off Amantadine
- Follow up Sept. 2010—all scores WNL; discussion held with family/student re: winter sports participation

## Who Should Treat Concussions?

- Amer. Acad. Peds (Sept. 2010): 'Physician with experience in concussion management'
- Amer. Acad. Neurology Position Statement on Sports Concussion (Oct. 2010): 'a neurologist or physician with proper training'
- CDC Heads Up: 'a Mild TBI specialist'
- Tufts Medical Center 'Good Medicine' (Fall 2010): "Patients who suffer from concussions and mild TBI should follow up with a neurosurgeon or neurologist"

## NFL Sideline Concussion Assessment

- New standardized assessment to begin in 2011
- Follows recommendations from Zurich Consensus Statement
- Symptom evaluation, balance testing, cognitive testing to be similar with all teams

## Concussion Conclusions

- Return to play protocol for child/adolescent:
  - **? 7 day** asymptomatic 'at rest' time frame (identical to NJSIAA Concussion Guidelines August 2010)
  - Stepwise protocol
    - Advancing to the **next stage every 1-2 days**
    - ImPACT back to baseline before contact occurs
  - This could mean a **return to play within 12-16 days** after the last symptom seen
  - Hopefully outside of the time frame for SIS risk
  - **What was acceptable for us is no longer applicable to our kids!**

## Concussion Conclusions

- All involved with the injured athlete need to be aware of the signs/symptoms—**BE HONEST ABOUT SYMPTOMS!!!!**
- Early and proper **evaluation by medical personnel** is crucial, as well as repeat assessment
- Follow the **step-wise return to play protocols**, and understand adult vs. adolescent/child differences
- Recovery can occur if proper precautions are taken
- **Crux of treatment** –symptom management, neurocognitive testing, balance assessment
- **There ARE more important things than sports—follow the academic issues closely**

## Concussion Conclusions

- **The point is not to stop playing**
- Try and **prevent injuries** when possible
- Need increased **awareness**
- Need **accountability**
  - Teammates, coaches, physicians
  - Siblings, friends, parents
- Know the consequences, take appropriate action
- **"It's about the athlete, not the team"**
  - Taylor Twellman, NE Revolution, #20; 5/14/10; 7<sup>th</sup> Annual Sports-Related Conference on Concussion & Spine Injury, Boston, MA



## Concussion Conclusions (cont.)

- "The minute I hear a clinician say, 'You've had a concussion, sit one week out, and you'll be fine', is the minute I realize the clinician has **no idea what they are talking about**"—Michael Collins, Ph.D., assistant director, Sports Medicine Concussion Program, UPMC (SI.com, Oct. 9, 2009-'Concussion information has improved but isn't exact science')
- **Demand the best information for yourself and your children**

UPMC Center for Sports Med 11/10/09



7<sup>th</sup> Annual Sports-Related Conference on Concussion & Spine Injury – 5/14/10



## Preston Plevretes (Nov. 5, 2005)



Courtesy of the Plevretes Family



## Preston Plevretes (cont.)

- 19 year old sophomore, linebacker at LaSalle University (Philadelphia, PA)
- Prior concussion 10/4/05
- Headaches, vision changes 10/8/05 in game, tells trainer
- Sees nurse practitioner at university health center, gets concussion test
- Goes to ER 10/11/05, CT negative

## Preston Plevretes (cont.)

- Returns to health center 10/12/05, denied headache; cleared to play 10/16/05
- Has ongoing headaches, tells friends early November 2005
- After injury 11/5/05, was unconscious, then combative on field prior to coma
- Emergency neurosurgery in Pittsburgh (SIS)
- La Salle settled lawsuit for \$7.5M Dec 2009 (failure to treat 1<sup>st</sup> injury properly)

## Zackery Lystedt (Oct 12, 2006)



## Zackery Lystedt (cont.)

- 13 year old, played football for Mount Tahoma Junior High School, Maple Valley, WA
- RB/CB—injured in first half, sat out 15 minutes, played second half, multiple tackles/hits, collapsed right after the end of the game, suffered SIS, emergent neurosurgery
- Town settled lawsuit for \$14.6M

## Zackery's Law (May 14, 2009, Olympia, WA)



## Zackery Lystedt law (HB 1824)

- Country's **strictest return-to-play requirement for athletes under 18** suspected of having a concussion
- **State of Washington**
  - Passed unanimously May 14, 2009
- Prohibits young athletes who show signs of having sustained a concussion from returning to play **without a licensed health-care provider's written approval**
  - Trained in the evaluation and management of concussion
- 11 states currently have concussion laws; NH is the **ONLY** state in New England without proposed legislation

<http://www.biawa.org/lystedt.htm>

- JH Rose High School, Greenville, NC



**Jaquan Waller (Sept 20, 2008)**

- Running back, junior, 16 years old
- Suffered a concussion in practice, was cleared to play 2 days later in a game, collapsed during the game after a tackle
- Died of SIS

**Jaquan Waller (cont.)**

## Ryne Dougherty (Oct. 15, 2008)

- Montclair High School, New Jersey



## Ryne Dougherty (cont.)

- 16 year old linebacker, junior, JV team
- Had a concussion 3 weeks earlier, prior to IMPACT testing by school
- IMPACT results were invalid (10/2/08), due to a disruptive teammate in the room
- Never retested, still had symptoms (headaches, blurred vision), cleared to play by PCP (w/o review of IMPACT); reinjured in game 10/13/08, died of SIS; family sues



**Owen Thomas**

- 21 Year Old U. Penn defensive end, co-captain; second team All-Ivy player 2009
- NO documented concussion history; began playing at age 9
- Committed suicide by hanging April 2010
- Parents donated brain to Boston University/SLI project; found to have CTE
- Mother testified at Congressional hearing Sept 2010

### Owen Thomas (cont.)



### Evan Coubal

- 6<sup>th</sup> grader from Muskego, WI (Bay Lane Middle School)
- 11 years old
- Concussion in youth football game Sept. 2010
- At recess in school 1 week later, hit head on football sled, taken to hospital
- Died 2 days later

### Evan Coubal (cont.)

## Remember The Titans

- 'Those who cannot remember the past are condemned to repeat it'--George Santayana, (*'The Life of Reason', Volume 1, 1905*), Spanish-American philosopher



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## Concussions - Resources

- Brain Injury Association of America: ([www.biausa.org](http://www.biausa.org))
- Brain Injury Association of NH: ([www.bianh.org](http://www.bianh.org))
- Sports Legacy Institute: ([www.sportslegacy.org](http://www.sportslegacy.org))
- ImPACT: ([www.impacttest.com](http://www.impacttest.com))
- [www.momsteam.com](http://www.momsteam.com)
- [www.cdc.gov/concussion/HeadsUp/youth.html](http://www.cdc.gov/concussion/HeadsUp/youth.html)
  - Heads Up toolkits for parents, coaches, physicians and athletes

Mahalo!

