

Sports-Related Concussion Management:

A comprehensive approach for return to
social, academic, and athletic activity



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Objectives

- Define Concussion
- Understand the appropriate use of diagnostic testing
- Understand the many issues that a concussion can have on a student
- Recognize possible treatment and management strategies

In the Media

- Concussion Study in Young Players
 - Posted by **Rebecca Black** on October 30th, 2010
- Tackling helmet safety head on: Some football helmets are better than others when it comes to preventing concussions
 - May 10, 2011|By Karen Kiley | Reporter
- Hockey Canada taking serious look at head shots
 - By Rita Mingo, Postmedia News May 27, 2011
- The Death of Wouter Weylandt: Tragedy Strikes the Giro D'Italia
 - By Ian Doward: Featured Columnist) on May 9, 2011
- Footy Concussion Report Round 10
 - Posted by Dustin Fink on May 26, 2011

Questions to IBSC Members

- Is this the “newest hot topic”? Several years ago it was steroids.
- Is this a way to target popular sports that some see as too aggressive and violent?
- Is this partially driven by equipment companies who wish to create more products?
- How prevalent do you think this issue is in your school?

Concussion Identification

- Which athlete has a orthopedic injury?

A



B



Concussion Identification

- Which athlete needs stitches?

C

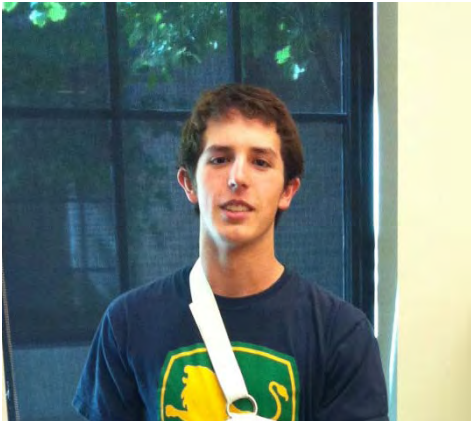


D



Concussion Identification

- Which athlete has a concussion?



Concussion Identification

- Concussions can be a “hidden injury.”
- In the past, we could only trust athletes to report symptoms.
- Is there a way to objectively measure the injury outside of the acute symptoms?

Incidence

- United States
 - 1.5 million Americans sustain TBI each year
 - 75% are MTBI
 - 1 Million TBI treated in emergency department each year
 - MTBI's cost \$17 Billion USD year
- UNITED KINGDOM
 - 700,000 visit Emergency Room each year
 - 90% Minor
 - In the UK, 40-50% of people with head injuries are children
 - Children treated each year with MTBI = 315,000

Definition of Concussion

- The word originates in the Latin stem of *concutere*, to dash together or to shake violently.
- Early Definition: 1942 - Concussion results in momentary LOC, mild confusion and automatism with amnesia with complete recovery within a few days.

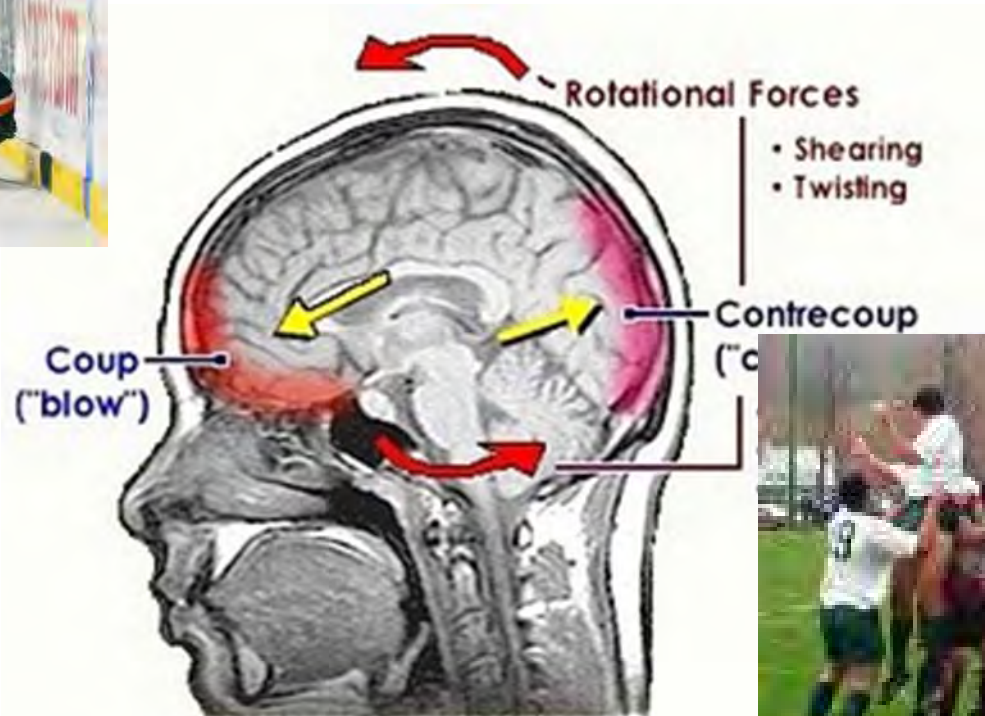
Concussion: The history of clinical & pathophysiological concepts and misconceptions
McCrory & Berkovic

The Evolving Definition of Concussion

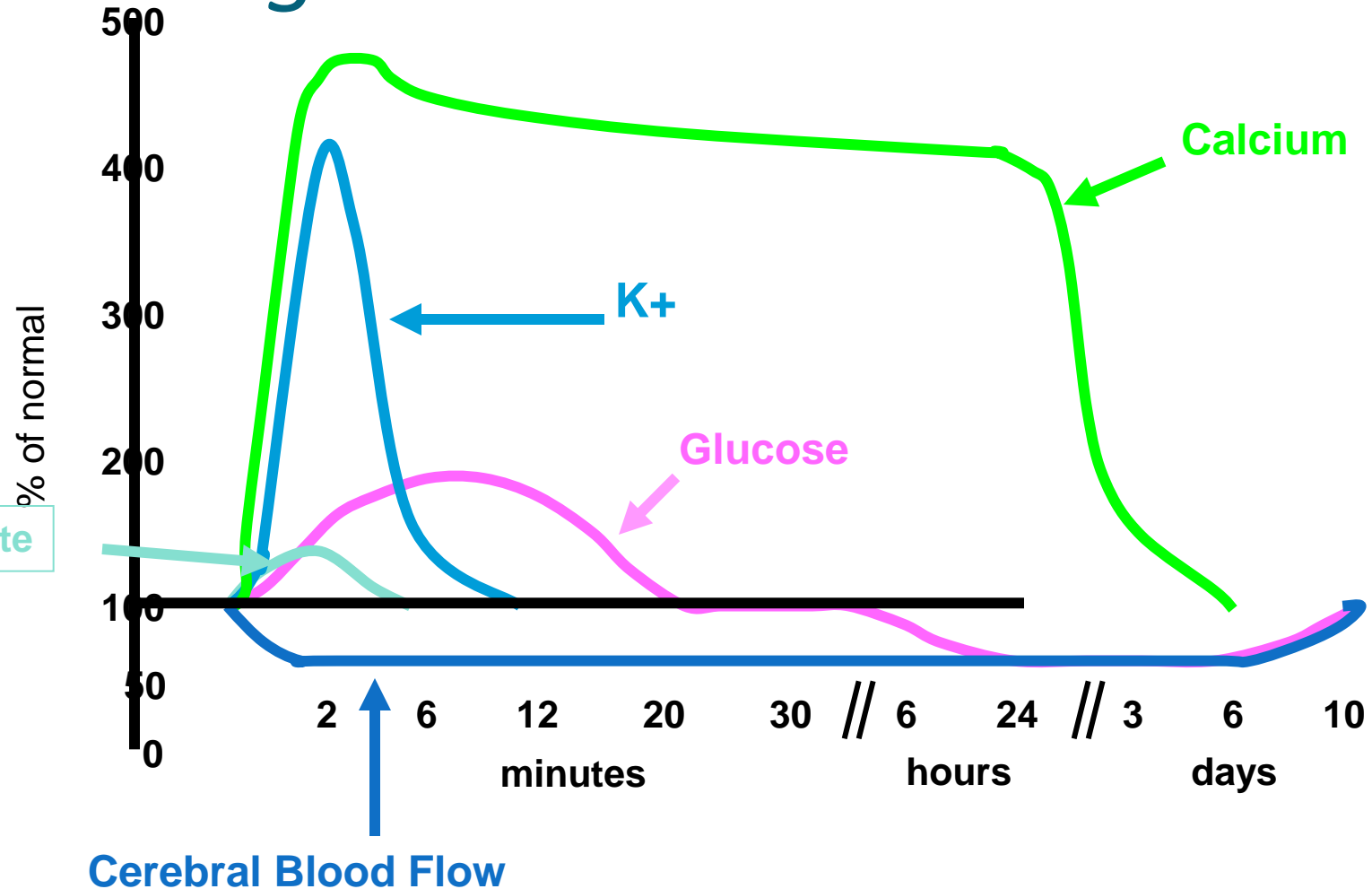
- A concussion (or mild traumatic brain injury) is a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head. Disturbance of brain function is related to neurometabolic dysfunction, rather than structural brain injury, and is typically associated with normal structural imaging findings (CT Scan, MRI). Concussion may or may not involve a loss of consciousness. Concussion results in a constellation of physical, cognitive, emotional, and sleep-related symptoms. Symptoms may last from several minutes to days, weeks, months, or even longer in some cases.”

CDC Physicians Toolkit; 2006

Mechanism of Injury

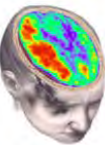


Neurometabolic Cascade Following Cerebral Concussion



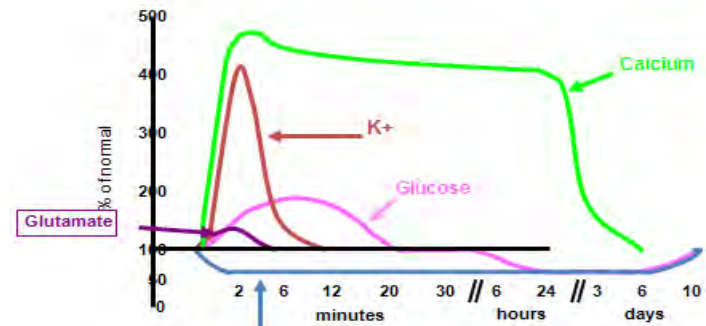
(Giza & Hovda, 2001)

UCLA Brain Injury Research Center



Academic Activity

- Concussion on Academics
 - Difficulty learning new concepts
 - Difficulty in taking notes (vestibular function)
 - Difficult with recall of previously learned materials
- Academics affect on concussion
 - Increased Symptoms
 - Post Concussion Syndrome
 - Delays healing by increasing the energy needs



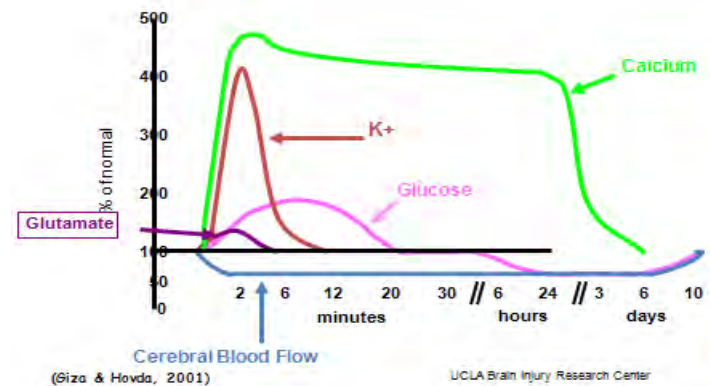
Cerebral Blood Flow
(Giza & Hovda, 2001)

UCLA Brain Injury Research Center



Social Activity

- Concussion on Social Activity
 - Mood and emotional changes
 - Social isolation
- Social Activity on Concussion
 - Increased symptoms with social activity
 - Increased workload on brain
 - Sensitivity to noise and light
 - Post Concussion Syndrome



Athletic Activity

- Concussion on Physical Activity
 - Isolation
 - Removed from sport
- Athletic Activity on Concussion
 - Increased symptoms during activity
 - Danger Zone
 - Cumulative effects of concussion
 - Post Concussion Syndrome
 - Second Impact Syndrome



Second Impact Syndrome



PBS Video Frontline

- Football High: Bigger and Faster, But Safer?
 - <http://video.pbs.org/video/1880045332>

Why do we have a Concussion Management Plan?

- Concussions affect many areas of student life
- There is a significant number of MTBI each year
- Improper management can lead to serious consequences: physical, academic, and social
- Medical community is trying to catch up with the large amount of research

Concussion Management Plan

- Needs to provide guidance to your medical team
 - Needs to include a physician
- Each concussion is different
 - Should use an individualistic approach
- Should be a team based approach
 - Communication is key

St. Mark's School of Texas

Concussion Management Plan

OVERVIEW

- All students years 7-12 required to have a baseline neuropsychological test
- No Homework on night of suspected injury
- No school the next day
- Post-injury ImPACT test 48-72 hours
- Appointment with a physician
 - Sets academic accommodations
- A student with a suspected concussion cannot return to physical activity until he has clearance from a physician and is symptom-free with rest and exertion.

Concussion Management Goals

Areas of focus

- Sideline (Acute) Management
 - Identify a concussion
 - Rule out intracranial pathology
 - Emergency Room Referral
 - CT or MRI
- Post Injury Management
 - Prevent Academic Difficulty / Stress
 - Prevent Post Concussion Syndrome
 - Prevent Cumulative Affect of Injury
 - Prevent Second Impact Syndrome

Acute Management

- Goals
 - **Identify possible concussion**
 - Use standardized concussion evaluation
 - SCAT₂
 - Sideline concussion card
 - Balance Error Scoring System (BESS)
 - Evaluate Cranial Nerves
 - **Determine if a more serious injury is suspected**
 - Cerebral Contusion
 - Malignant Brain Edema Syndrome
 - Epidural Hematoma
 - Subdural Hematoma

St. Mark's School of Texas
Athletic Training
Concussion Home Instructions

Athlete _____ Date of injury _____ Sport _____

Home phone _____ Parent/guardian name _____

Your son has sustained a head injury while participating in _____. In some instances, the signs of a concussion do not become obvious until several hours or even days after the injury. Please be especially observant for the following signs and symptoms.

1. Headache (especially one that increases in intensity*)
2. Nausea and vomiting*
3. Difference in pupil size from right to left eye, dilated pupils*
4. Mental confusion/behavior changes
5. Dizziness
6. Memory loss
7. Ringing in the ears
8. Changes in gait or balance
9. Blurry or double vision*
10. Slurred speech*
11. Noticeable changes in the level of consciousness (difficulty awakening, or losing consciousness suddenly)*
12. Seizure activity*
13. Decreased or irregular pulse OR respiration*

* Seek medical attention at the nearest emergency department.

The best guideline is to note symptoms that worsen, and behaviors that seem to represent a change in your son. If you have any question or concern at all about the symptoms you are observing, contact your family physician for instructions, or seek medical attention at the closest emergency department. Otherwise, you can follow the instructions outlined below.

It is OK to:

- Use acetaminophen (Tylenol) for headaches
- Use ice pack on head & neck as needed for comfort
- Eat a light diet
- Go to sleep
- Rest (no strenuous activity or sports)

There is NO need to:

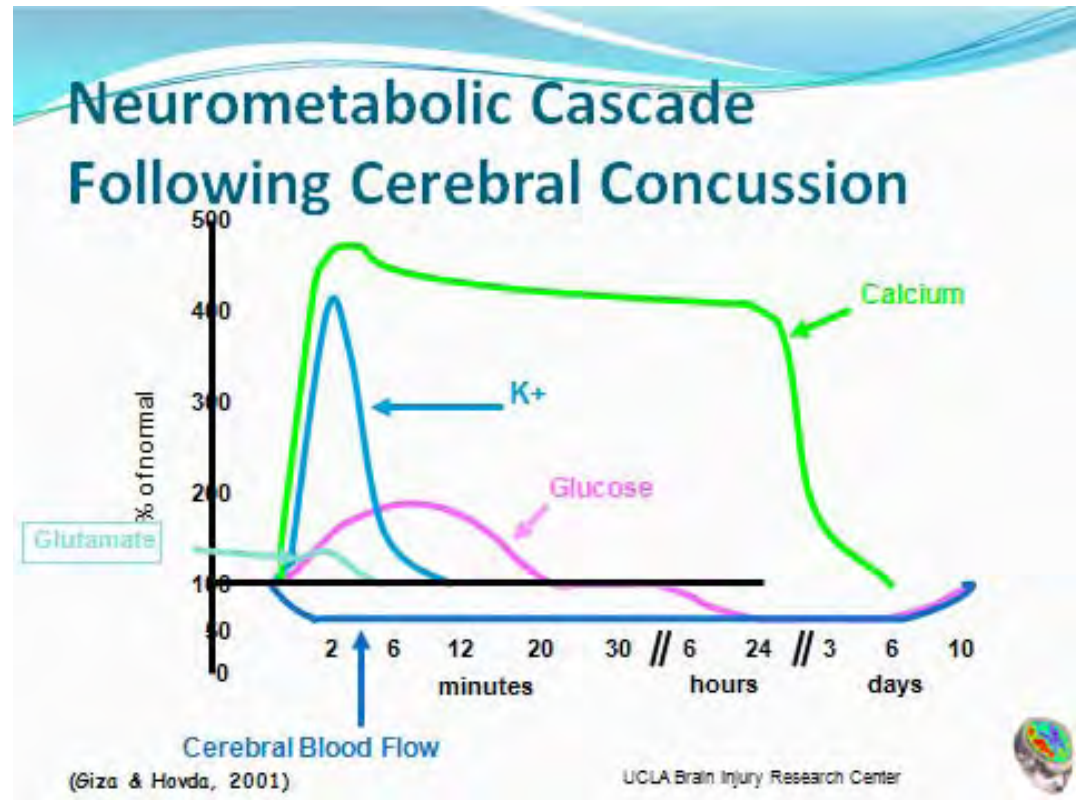
- Check eyes with a flashlight
- Wake up every hour
- Test reflexes
- Stay in bed

Do NOT:

- Drink alcohol
- Drive while symptomatic
- Exercise or lift weights
- Take ibuprofen, aspirin, naproxen or other non-steroidal anti-inflammatory medications

Why limit Social and Academic activity?

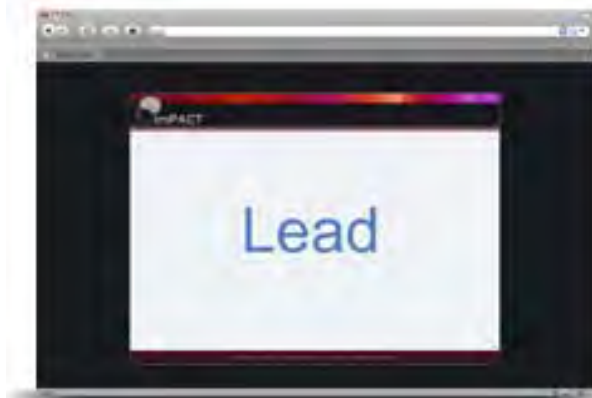
- Decreased blood flow to brain
- Decreased glucose available
- **Symptoms get worse with exertion** (math, note taking, stimulus)



Neuropsychological Testing

- Currently is the only objective way to identify a concussion.
- Has been used since the 1980's, but online versions have made it accessible to the general public.
- Has been scientifically shown to be reliable and valid in over 100 peer-reviewed journal articles.

ImPACT Test





Organization: St. Marks School of Texas
Date of Birth: 10/07/1994
Gender: Male
Handedness: Left

Age: 15
Height: 65 inches
Weight: 130 lbs

Native country/region: United States
Native language: English

Second language:
Years Speaking:

**Years of education completed
excluding kinder garden:** 8
Received speech therapy: No
**Attended special education
classes:** No

**Repeated one or more years of
school:** No
Diagnosed learning disability: No
**Problems with
ADD/hyperactivity:** No

Current sport: Basketball
Primary position/event/class: point guard

Current level of participation: High School
Years of experience at this level: 1

Number of times diagnosed with a concussion (excluding current injury): 1
Concussions that resulted in loss of consciousness: 0
Concussions that resulted in confusion: 0
Concussions that resulted in difficulty remembering events that occurred immediately after injury: 0
Concussions that resulted in difficulty remembering events that occurred: 0
Total games missed as a result of all concussions combined: 0

Concussion history:

**Treatment for headaches by
physician:** No
**Treatment for migraine
headaches by physician:** No
**Treatment for
epilepsy/seizures:** No
History of brain surgery: No

History of meningitis: No
**Treatment for
substance/alcohol abuse:** No
**Treatment for psychiatric condition
(depression, anxiety):** No

Diagnosed with ADD/ADHD:
Diagnosed with Dyslexia:

Diagnosed with Autism:
Strenuous exercise in the last 3 hours:

Exam Type	Baseline	Post-Injury 1	Post-Injury 2	Post-Injury 3	
Date Tested	11/11/2009	03/8/2010	03/17/2010	03/22/2010	
Last Concussion			03/05/2010	03/05/2010	
Exam Language	English	English	English	English	
Test Version	2.0	2.0	2.0	2.0	

Composite Scores	Percentile scores if available are listed in small type.							
Memory composite (verbal)	100	100%	87	66%	94	88%	99	99%
Memory composite (visual)	81	69%	83	75%	67	29%	86	84%
Visual motor speed composite	33.75	38%	35.55	48%	42.03	84%	41.35	80%
Reaction time composite	0.54	79%	0.55	75%	0.51	90%	0.43	100%
Impulse control composite	2		5		4		2	
Total Symptom Score	4		45		0		0	

Cognitive Efficiency Index: **0.54** **0.33** **0.47** **0.58**

The Cognitive efficiency Index measures the interaction between accuracy (percentage correct) and speed (reaction time) in seconds on the Symbol Match test. This score was not developed to make return to play decisions but can be helpful in determining the extent to which the athlete tried to work very fast on symbol match (decreasing accuracy) or attempted to improve their accuracy by taking a more deliberate and slow approach (jeopardizing speed). The range of scores is from approximately zero to approximately .70 with a mean of .34. A higher score indicates that the athlete did well in both the speed and memory domains on the symbol match test. A low score (below .20) means that they performed poorly on both the speed and accuracy component. If this score is a negative number, the test taker performed very poorly on the reaction time component.

Scores in **bold RED** type exceed the Reliable Change Index (RCI) when compared to the baseline score. However, scores that do not exceed to RCI index may still be clinically significant. Percentile scores if available are listed in small type.

Hours slept last night		5	8	8.5	
Medication					

The information provided by this report should be viewed as only one source of information regarding an individual's level of [neurocognitive] functioning. Even though impact is based on demonstrated scientific principles and research, external factors such as improper test administration or improper test taking environment may result in inaccurate test results. These factors and others must be considered in making return-to-play decision. The information provided by this report is of a general nature and does not represent medical advice, a diagnosis, or prescription for treatment. Additionally, diagnostic or return to play decisions should not be based solely on the data generated by this report, but on an in-person evaluation made by a professional trained in concussion management in accordance with usual and standard medical practice. An individual suspected of suffering traumatic brain injury or concussion should immediately seek the advice of qualified and trained personnel for interpretation of test results and should be monitored closely for the emergence of symptoms. Impact is not responsible for



Word Memory					
Hits (Immediate)	12	12	11	12	
Correct distractors (immed.)	12	12	12	12	
Learning percent correct	100%	100%	96%	100%	
Hits (delay)	12	9	9	12	
Correct distractors (delay)	12	12	12	11	
Delayed memory pct. correct	100%	88%	88%	96%	
Total percent correct	100%	94%	92%	98%	
Design Memory					
Hits (Immediate)	12	11	11	12	
Correct distractors (immed.)	9	9	11	11	
Learning percent correct	88%	83%	92%	96%	
Hits (delay)	10	12	12	12	
Correct distractors (delay)	11	8	10	12	
Delayed memory pct. correct	88%	83%	92%	100%	
Total percent correct	88%	83%	92%	98%	
X's and O's					
Total correct (memory)	9	10	5	9	
Total correct (interference)	114	114	125	134	
Avg. correct RT (interference)	0.52	0.5	0.43	0.38	
Total incorrect (interference)	2	5	4	2	
Avg. incorrect RT (interfer.)	0.5	0.39	0.39	0.33	
Symbol Match					
Total correct (visible)	27	27	27	26	
Avg. correct RT (visible)	1.38	1.52	1.4	1.25	
Total correct (hidden)	9	6	8	9	
Avg. correct RT (hidden)	1.94	2.46	1.56	1.85	
Color Match					
Total correct	9	9	9	9	
Avg. correct RT	0.64	0.65	0.62	0.49	
Total commissions	0	0	0	0	
Avg. commissions RT	0	0	0	0	
Three Letters					
Total sequence correct	5	5	5	5	
Total letters correct	15	15	15	15	
Pct. of total letters correct	100%	100%	100%	100%	
Avg. time to first click	2.43	1.74	1.92	2.25	
Avg. counted	13	14.4	18	17.4	
Avg. counted correctly	13	14.2	17.6	16.4	



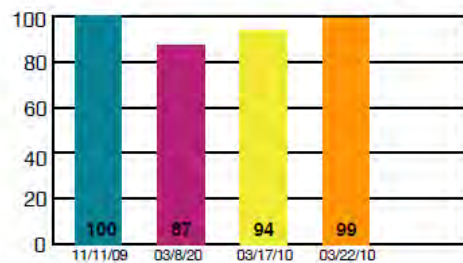
ImPACT™ Clinical Report



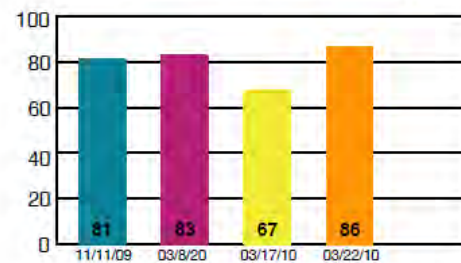
Headache	0	3	0	0	
Nausea	0	0	0	0	
Vomiting	0	0	0	0	
Balance Problems	0	3	0	0	
Dizziness	0	4	0	0	
Fatigue	0	4	0	0	
Trouble falling asleep	0	3	0	0	
Sleeping more than usual	0	6	0	0	
Sleeping less than usual	0	2	0	0	
Drowsiness	1	6	0	0	
Sensitivity to light	0	0	0	0	
Sensitivity to noise	0	0	0	0	
Irritability	0	0	0	0	
Sadness	0	0	0	0	
Nervousness	0	0	0	0	
Feeling more emotional	0	0	0	0	
Numbness or tingling	0	3	0	0	
Feeling slowed down	0	3	0	0	
Feeling mentally foggy	0	0	0	0	
Difficulty concentrating	0	1	0	0	
Difficulty remembering	0	4	0	0	
Visual problems	3	3	0	0	
Total Symptom Score	4	45	0	0	



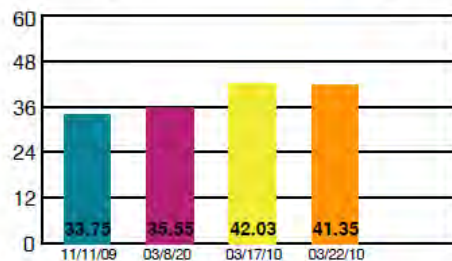
Memory Composite (Verbal)



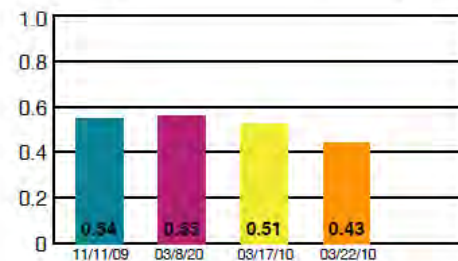
Memory Composite (Visual)



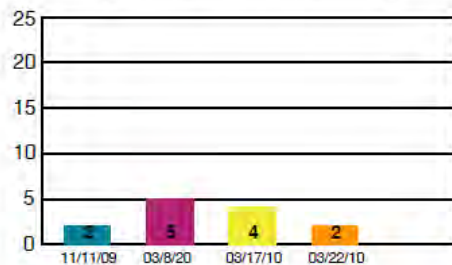
Visual Motor Composite



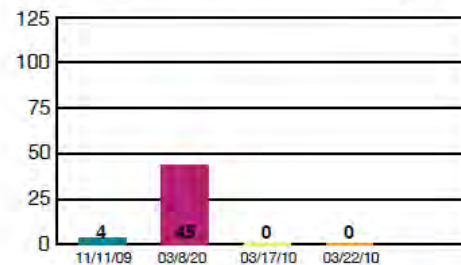
Reaction Time Composite



Impulse Control Composite



Symptom Score



Social Modifications

- Limit cognitive activity
 - No school or social events
 - Cannot attend games or practices
 - No electronics
 - Computer, cell phones, TV, video games, music
 - Limit light
 - Refrain from activity that makes symptoms worse
 - When symptoms abate, return to social activities is acceptable
 - Avoid: concerts, loud events, light shows, or situations with a lot of stimulus

Academic Modifications

- Made on a case by case basis
- General rules:
 - Full rest until symptom free
 - Progress back to school
 - Half days
 - Scribe for note taking
 - Homework and assessments made up on individual basis and decided by teachers with input from heads of school, nurse, and academic advisor .

RTP Progression

Once a student has returned to full school days and is symptom free, he can begin the physical exertion phase.

- No activity – do not progress to step 2 until asymptomatic
 - Light aerobic exercise – walking, stationary bike
 - Sport-specific training (e.g., skating in hockey, running in soccer)
 - Non-contact training drills
 - Full-contact training
 - Game play
-
- Note: If the athlete experiences post-concussion symptoms during any phase, the athlete should drop back to the previous asymptomatic level and resume the progression after 24 hours.



ImPACT Test

- Tool that physicians can utilize in making return-to-play decisions
- Cornerstone of concussion management
- Does not substitute for a thorough clinical evaluation

Discussion

