

**3/19/12**

**PRESENTA-**

**TION:**

**ALASKA**

**BRAIN**

**INJURY**

**NETWORK**

<TARGET><BILL></BILL><SUBJECT>3-19-12 PRESENTATION  
ALASKA BRAIN INJURY  
NETWORK</SUBJECT><COMM>SHSS27</COMM></TARGET>

*SENATE COMMITTEE*

**HEALTH & SOCIAL SERVICES**

**Committee**

**AGENDA**

MONDAY, MARCH 19, 2012 - 1:30 PM

BUTROVICH ROOM #205

**1:30 PM – Call to Order**

Time:

Members Present: (PLEASE TURN OFF CELL PHONES)

**OTHER BILLS PREVIOUSLY SCHEDULED/HEARD**

• **SB5 – DENALI KIDCARE – ADOPT LS0057\I**

(Senator Bettye Davis)

• **PRESENTATION - ALASKA BRAIN INJURY NETWORK**

(Dr. Heather Macomber, Board Member)

**ADJOURNMENT:**

**H&SS Committee: Sen. Bettye Davis, Chair; Sen. Johnny Ellis,  
Sen. Fred Dyson, Sen. Kevin Meyer, Sen. Dennis Egan**

*ImPACT*  
*Sports Concussion Management*

Heather Macomber, PhD



**Alaska Neuro**

ASSOCIATES

# Learning Objectives

- Define sports concussion and describe symptoms
- Describe ImPACT Post-Concussion system and research
- Describe ImPACT assessment protocol for ASD
- Describe sideline assessment for coaching and/or medical staff
- Review standard concussion management guidelines

# Sports Concussion Definition

At the 2004 International Symposium on Concussion in Sport, the following definition and criteria for concussion was adopted:

*“Sports concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces”*

# Sports Concussion Characteristics

- Approximately 90% of sport-related concussions occur without loss of consciousness (LOC)
- An athlete who sustains concussion is 4-6 times more likely to sustain a second concussion
- 10% of all contact-sport athletes sustain concussions yearly
- 63% of all concussions occur in football
- Estimated that up to 20% of football players will sustain a concussion per season

# Sports Concussion Data

- An estimated 1.6 - 3.8 million sports-related concussions occur each year in the US, leading the CDC to conclude that sports concussions have reached an "epidemic level"
- For those 15-24 years old, sports are the 2<sup>nd</sup> leading cause of traumatic brain injury (motor vehicle crashes are 1<sup>st</sup>)
- According to research by *The New York Times*, at least 50 youth football players (high school or younger) from 20 different states have died or sustained serious head injuries on the field since 1997
- According to the CDC, during 2001-2009 athletes ages 5-18 years increased 62% to a total of 2.6 million sports-related emergency department (ED) visits annually, of which 6.5% (173,285) involved a traumatic brain injury, including concussion. The rate of TBI visits increased 57%, likely due to increased awareness of the importance of early diagnosis of TBI

# Mechanisms of Concussion

## Concussions: Causes and Recovery

A concussion is a change in mental status caused by a blow to the head, neck or upper body. Symptoms may include confusion, amnesia, nausea, dizziness, blurred vision or loss of consciousness.

### How it Happens

There are two types of injuries that can lead to concussions.



#### IMPACT

When the head slams into a hard surface, the skull stops abruptly while the brain,

floating in cerebral fluid, continues to move and is shaken and sometimes bruised when it finally hits the skull.



#### SPIN

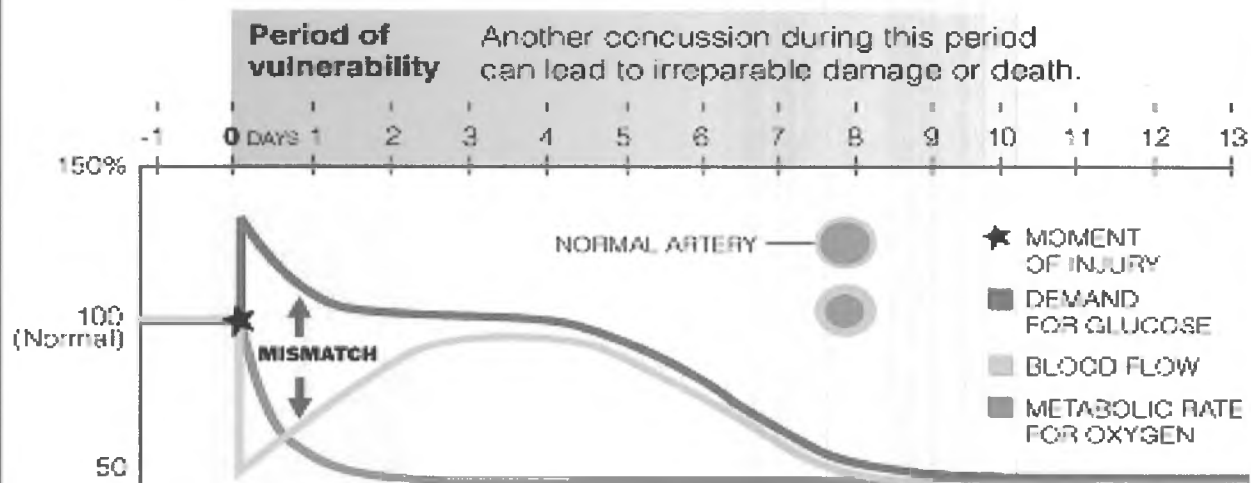
A blow to the head can cause the head to snap rapidly. When the head stops abruptly, the brain

continues to rotate, potentially causing cell damage.

# Neurometabolic Changes of Concussion

## The Crisis and the Healing

At the moment of injury, the brain goes through an initial period of crisis followed by an undetermined period of healing. The rate of recovery varies according to the severity of the injury.



After the injury, the arteries constrict, causing reduced blood flow to the brain and lowering the rate that oxygen is metabolized. The demand for glucose also rises to provide cell energy for healing. But the high demand for glucose cannot be met by the constricted arteries. This mismatch creates a metabolic crisis.

As the cells slowly repair themselves, the demand for glucose eases and blood flow returns to normal as vessels become less constricted. But the brain remains in a state of metabolic depression, a quiet state akin to rest, for a long period before returning to normal.

Sources: David A. Hovda, Ph.D.,  
U.C.L.A. Brain Injury Research Center

# Why Concussion Management is Important...



- Prevent against cumulative effects of injury
  - Cumulative neurobehavioral deficits
  - Lowered threshold to injury
- Concussion management allows players to return quickly and safely to play
- Sideline assessment helps identify when to seek immediate medical attention (ER visit)

# Why Concussion Management is Important...

- Second Impact Syndrome
  - Additional concussion while still in recovery
- **NOTE: Second hit does not need to be severe**
  - Second impact has been shown to occur up to 14 days post-injury or when athlete returns to play before resolution of symptoms
- **Catastrophic increase in intracranial pressure**
  - Vasomotor paralysis, edema, massive swelling, herniation, death
- **Most often occurs in athletes <21 years old**
  - Neurochemical processes appear to differ in developing brain

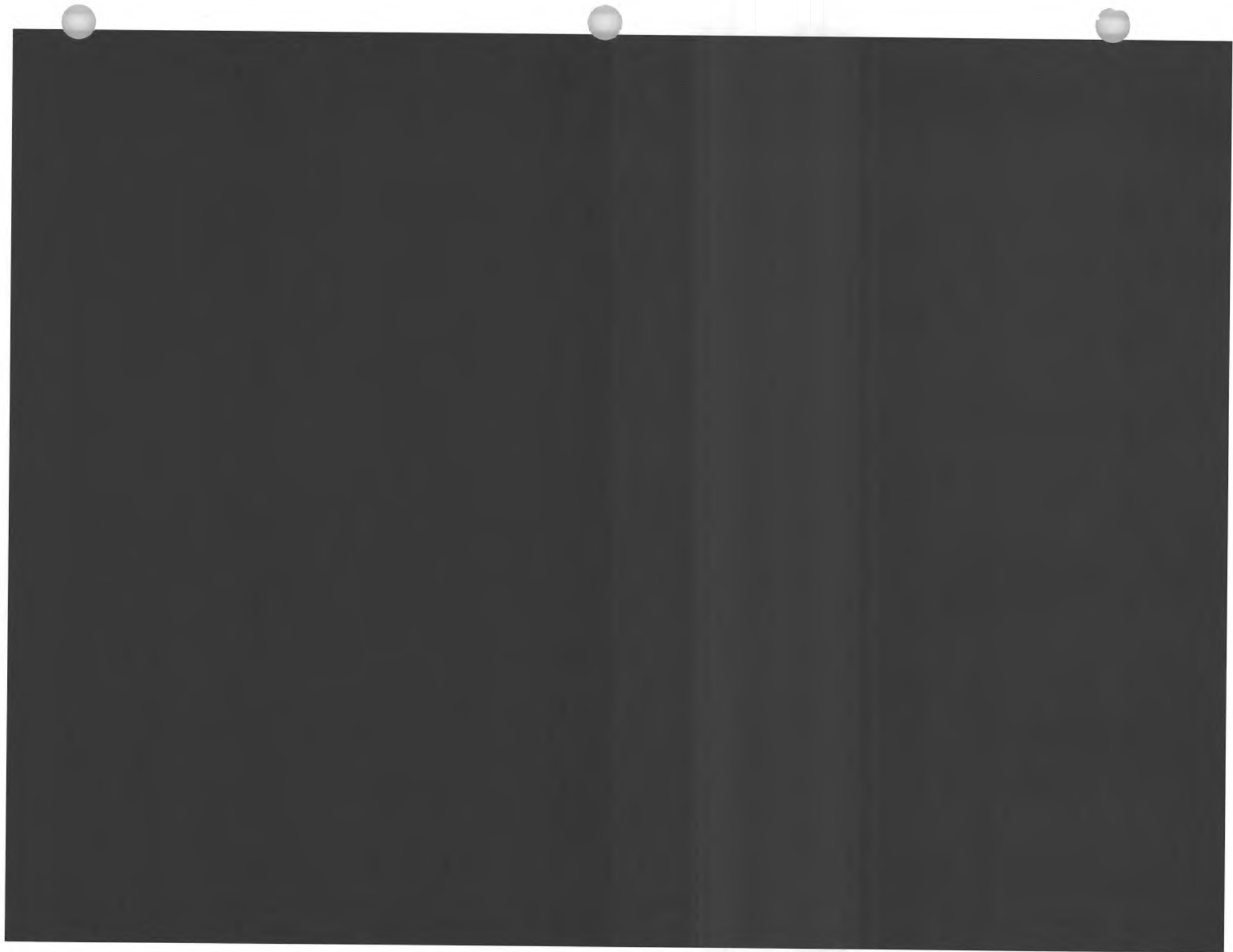
# Why Concussion Management is Important...

## Increased risk of concussion:

- players with 1 previous: 1.5x risk
- players with 2 previous: 2.8x risk
- players with 3+ previous concussions, are 3.5x more susceptible to concussion than a player with no concussion history

## High school athletes with $\geq 3$ concussions are at increased risk for the following with subsequent concussion:

- LOC (8-fold greater risk)
- anterograde/post-traumatic amnesia/PTA (5.5-fold greater risk)
- confusion (5.1-fold greater risk)



# Common Immediate Post-Concussive Symptoms

## Physical

- Dizziness
- Headaches
- Nausea
- Light Sensitivity
- Visual Problems
- Balance Difficulties

## Emotional

- Tearful
- Withdrawn
- Impulsive
- Nervous
- Irritable
- Sad

## Cognitive

- Forgetful
- Distractible
- Poor concentration
- "Foggy"
- Amnesia
- Slowed thinking
- Disorganized

## Sleep Problems

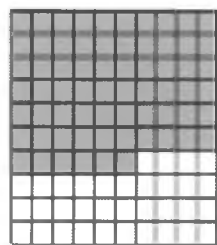
- Insomnia
- Excessive sleep
- Constantly tired
- Sleeping less

# Can an athlete's self-report be trusted?

## Keeping the Injuries to Themselves

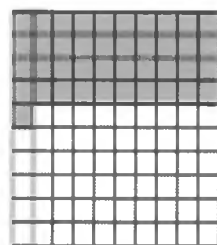
High school football players often do not report concussions, according to a 2004 study presented in the Clinical Journal of Sports Medicine. The survey of 1,532 varsity players in Wisconsin revealed that 47 percent of players who sustained concussions continued to play without reporting the injuries to anyone. They listed their principal reasons:

*Did not think a concussion was serious enough to report.*



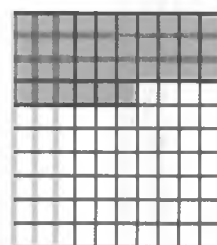
**66%**

*Did not want to leave the game.*



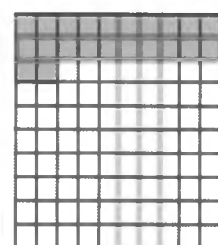
**41%**

*Did not realize a concussion was sustained.*



**36%**

*Did not want to let down their teammates.*



**22%**

# Can an athlete's self-report be trusted?

“Anonymous questionnaires that ask specifically about concussions have reported rates among high school football players at about 15% each season; when the word concussion is omitted and a description of symptoms is provided instead, close to 50% of players say they had one, with 35% reporting two or more.” *New York Times*, Nov 14, 2007

# Former AAN Concussion Guidelines

- Tremendous variability
- Up to 14 different scales
- Assumes same standard for all age groups
- Poor job distinguishing “mild” concussion
- Assigns too much importance to LOC
- Management guidelines not based on cognitive test data are arbitrary



# NEW CONCUSSION MANAGEMENT GUIDELINES

CIS Group, Vienna (2001), Prague (2004)

## *“Cornerstones of Management”*

- Removal of symptomatic athletes from play
- Restriction from play while symptomatic
- Graduated return to play (following exertion)
- *Neurocognitive testing*
- Recognition of differences in children

Aubry, Cantu, Dvorak, Graf-Baumann, Johnston, Kelly, Lovell, McCrory, Meeuwisse, Schasmasch, 2001. *Clinical J. Sports Med.*

# The Unique Role of Neuropsychology

- Specific training in cognitive assessment in general and brain injury in particular
- Identify pre-existing cognitive/learning disorders that could result in misdiagnosis
- Identify co-existing psychiatric issues that affect recovery
- Identify poor effort/invalid test performances
- Capable of successfully managing atypical recovery
- Familiarity with a wide array of providers when additional care is needed
- Of the two recognized professions that are trained to evaluate for brain injury, neurologists typically refer patients to neuropsychology to assess concussion/mTBI



# ImPACT

**Immediate Post-Concussion Assessment and  
Cognitive Testing**  
*Computerized Neurocognitive Testing*

**Mark Lovell, Ph.D.-UPMC Dept. of Orthopedic Surgery**

**Micky Collins, Ph.D.-UPMC Dept. of Orthopedic Surgery**

**Joseph Maroon, M.D.-UPMC Dept. of Neurological Surgery**



# What is ImPACT?

## Post-Concussion Evaluation & Management



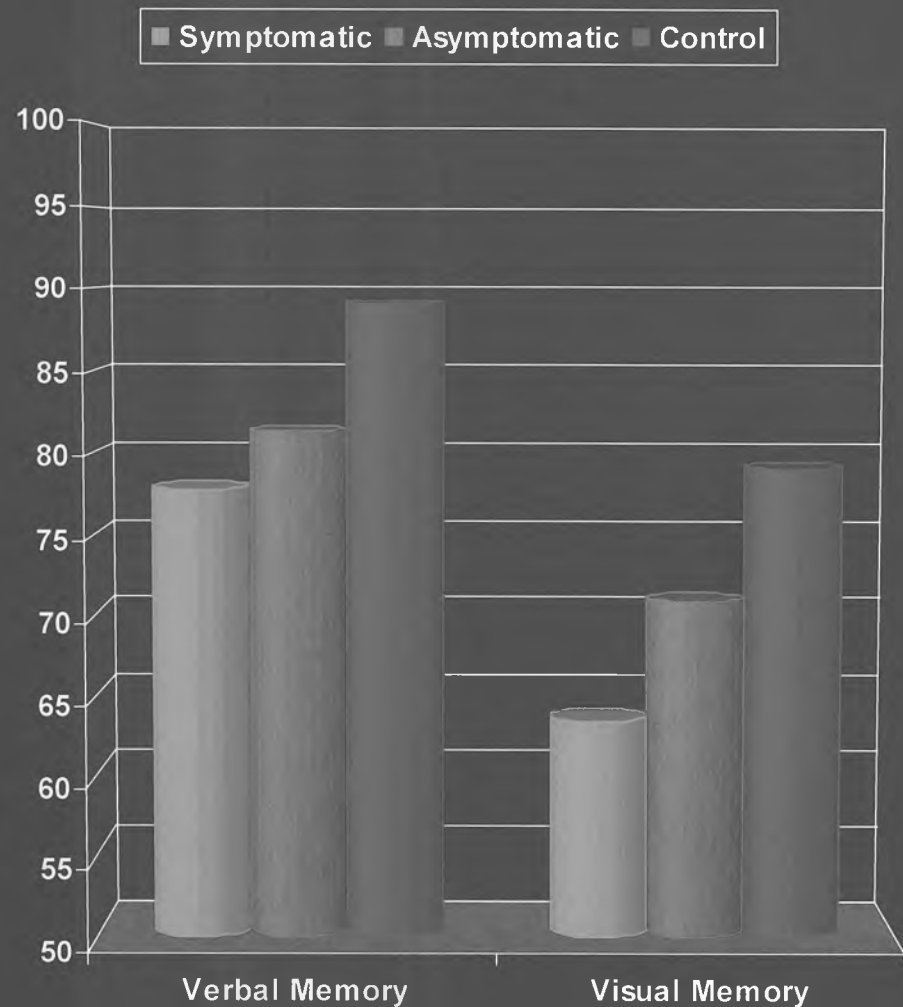
- Demographic/Concussion history questionnaire
- Concussion Symptom Scale
  - 21 Item 5-point scale (e.g. headache, dizziness, nausea, etc.)
- Multiple neurocognitive measures
  - Measures domains of memory, working memory, attention, reaction time, mental speed
- Detailed clinical report
  - Outlines demographic, symptom, neurocognitive data
  - Computer scored

# Who's using ImPACT?

- Army, Navy
- NFL, MLB, NBA, NHL
- All MLB umpires
- USA Olympic Training Center
- Cirque du Soleil
- U.S. Soccer Federation
- U.S. Ski Team
- NFL Europa, South African Rugby
- More than 300 colleges and universities
- More than 1,000 school districts

# UNIQUE CONTRIBUTION OF NEUROCOGNITIVE TESTING TO CONCUSSION MANAGEMENT

Testing reveals cognitive deficits in asymptomatic athletes within 4 days post-concussion



N=215, MANOVA  $p < .000000$  (Lovell et al., *AJSM*, In Press 2006)

# ImPACT “Bell-Ringer” Study

- 64 high school athletes with “mild” concussion and no loss of consciousness
- Two groups compared in terms of outcome
  - Athletes with <5 min of signs/symptoms recovered completely within 7 days
  - Athletes with 5-15 min of signs/symptoms had cognitive deficits at 7 days

Lovell, Collins, Iverson, Field, Podell, Cantu, Fu; J Neurosurgery; 98:296-301,2003

Lovell, Collins, Iverson, Johnston, Bradley; Amer J Sports Med; 32:47-54,2004

# Post-Traumatic Migraine

PTM symptoms following sports concussion are related to a greater decline in cognitive performance and increased symptoms

- Post-traumatic headache is most common symptom
- Headaches occurs more often with mild brain injury than with more severe TBI (Yamaguchi et al, 1992)
- Headache with photosensitivity, phonosensitivity, and/or nausea likely leads to prolonged recovery

# Cumulative Effect of Concussion

- 867 Male High School and College Athletes
  - Mean age 17.7 years
  - 86.7% football, 10% hockey, 2.3% soccer
- No long-term effects of one or two prior concussions
- Evidence exists that  $\geq 3$  concussions is associated with ongoing adverse effects in some athletes (Collins et al, Guskiewicz et al, Iverson et al)

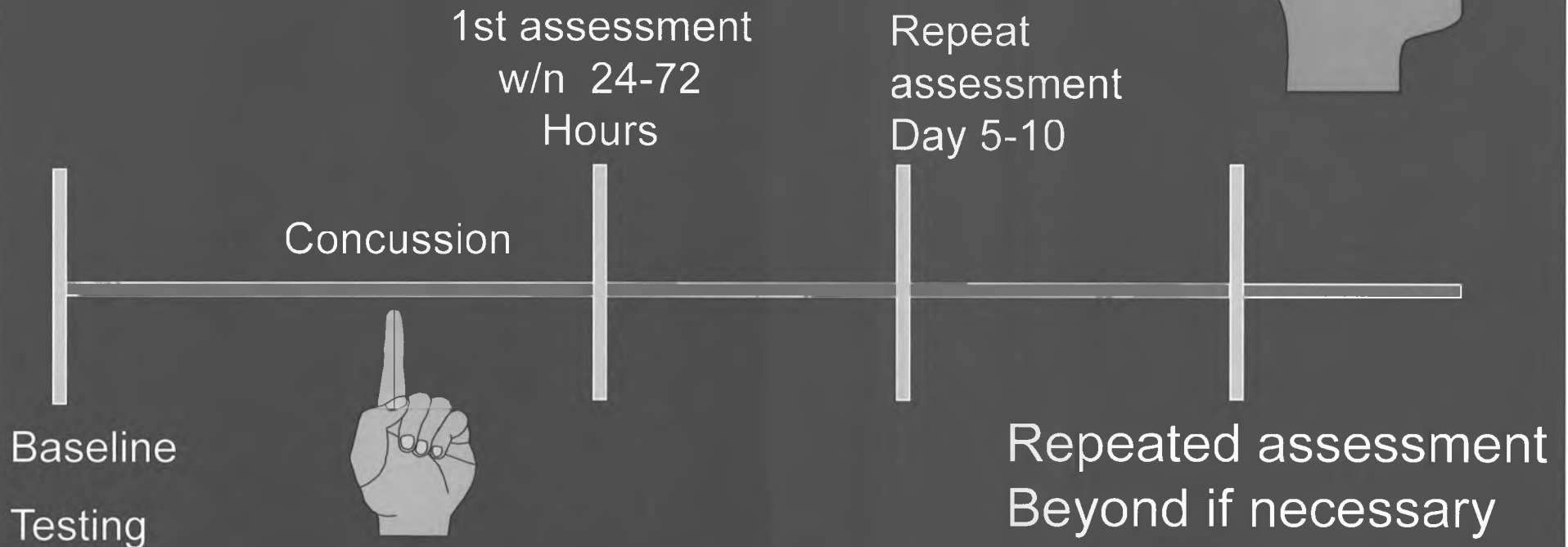
# Additional ImPACT Research

- Concussed high school athletes have slower recovery from neurocognitive & other symptoms than college athletes (Field, Collins, Lovell et al. J. Pediatrics, April 2003).
- Amnesia is up to 10X better than loss of consciousness in predicting deficits on ImPACT following concussion (Collins et al., Clinical Journal of Sport Medicine, July 2003)
- Symptom of “fogginess” highly predictive of neurocognitive deficits and prolonged recovery as measured by ImPACT (Iverson, Lovell, Collins et al, JINS, 2004)
- “General” mouthguard use demonstrated no effect in reducing neurocognitive/symptom deficits related to sports concussion (Mihalik, Pardini, Guskiewicz, Collins, Lovell et al. Dental Traumatology, In Press)



# Clinical Protocol

## Neurocognitive Testing



# Baseline (Pre) Testing

- The best point of comparison is the student's own baseline scores
- Typically, the first step is a sports physical and ImPACT baseline at the beginning of the season
- Establishes a “starting point” for students with a prior history of concussions
- Helps accelerate return to play for students with learning disability
- Allows neuropsychologists to track the student's path back to their “normal” level

# Sideline Assessment

- For signs of severe head trauma--Send directly to ER if you observe:
  - Any loss of consciousness, fixed pupil, vomiting, can't stand, can't respond, can't move limbs, immediate severe head pain
- For students without signs of severe head trauma, use the ImPACT sideline assessment tool:
  - Look for listed concussion signs
  - Ask athlete about listed concussion symptoms

## Principles of Sideline Assessment

- Take athlete away from distracting activity and people
- Try to maintain their full attention
- Speak in loud and clear voice
- Have athlete perform all tasks listed on card
- If they fail any questions, the protocol says that they cannot return to play--refer to nurse
- No “do-overs” or hints--if they cannot do these simple tasks, then they are not safe to be on the field



## The Best Approach To Concussion Management

### Concussion Signs and Symptoms Evaluation

#### Signs observed by staff

- appears to be dazed or stunned
- is confused about assignment
- forgets plays
- is unsure of game, score, or opponent
- moves clumsily
- answers questions slowly
- loses consciousness (*even temporarily*)
- shows behavior or personality change
- forgets events prior to hit (*retrograde*)
- forgets events after hit (*anterograde*)

#### Symptoms reported by athlete

- headache
- nausea
- balance problems or dizziness
- double or fuzzy vision
- sensitivity to light or noise
- feeling sluggish
- feeling "foggy"
- change in sleep pattern
- concentration or memory problems

**Symptoms may worsen with exertion.**

**Athlete should not return to play until symptom-free.**

### On-field Cognitive Testing

#### Orientation

---

**Ask the athlete the following questions.**

What stadium is this?

What month is it?

What city is this?

What day is it?

Who is the opposing team?

#### Anterograde amnesia

---

**Ask the athlete to repeat the following words.**

Girl, dog, green

#### Retrograde amnesia

---

**Ask the athlete the following questions.**

What happened in the prior quarter/period?

What do you remember just prior to the hit?

What was the score of the game prior to the hit?

Do you remember the hit?

#### Concentration

---

**Ask the athlete to do the following.**

Repeat the days of the week backward (starting with today).

Repeat these numbers backward:

63 (*36 is correct*)      419 (*914 is correct*)

#### Word list memory

---

**Ask the athlete to repeat the three words from earlier.**

(*Girl, dog, green*)

**Any failure should be considered abnormal.**

**Consult a physician following a suspected concussion.**

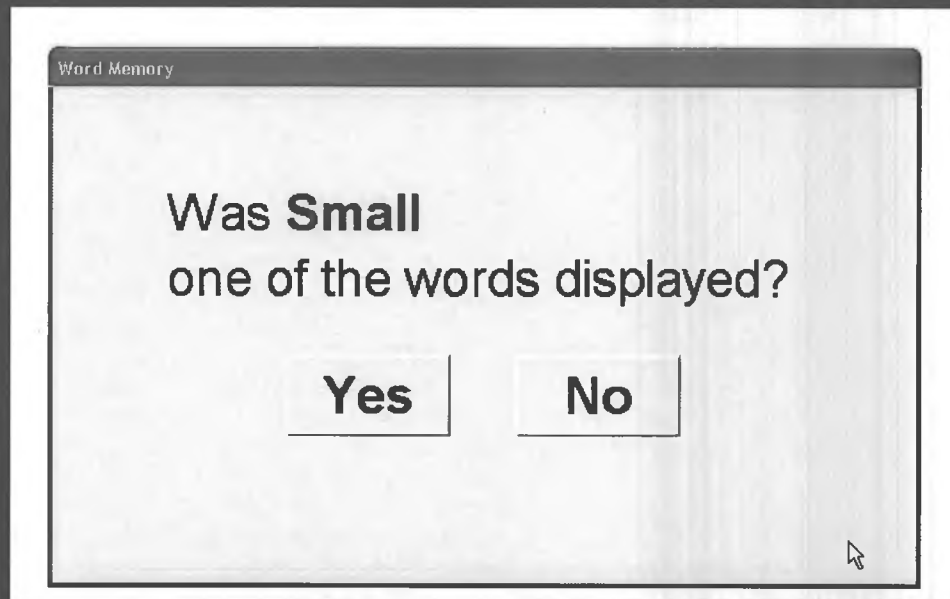
## Module 1 (Word Memory)



The Best Approach To Concussion Management

There are five different forms of the word list.

*Recall Condition: Following the administration of all other test modules (approximately 20 minutes), the subject is again tested for recall*



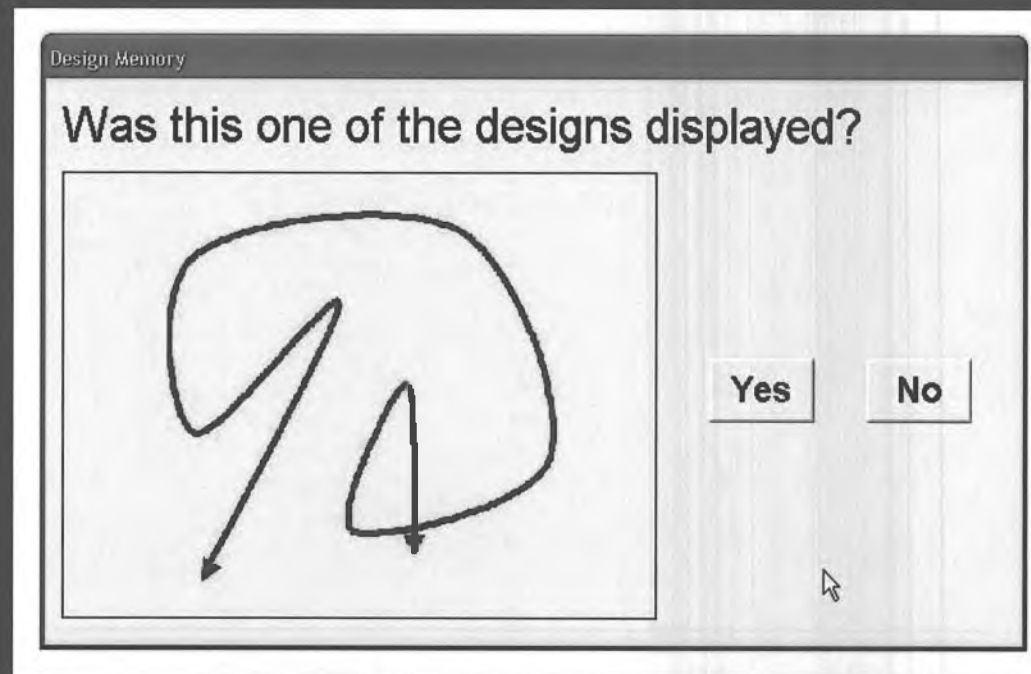
## Module 2 (Design Memory)



The Best Approach To Concussion Management

There are five different forms of this task

*Recall Condition: Following the administration of all other test modules (approximately 20 minutes), the subject is again tested for recall*



# ASD Post-Injury Protocol

- Student is injured and has signs/symptoms
- Coach pulls student from activity and completes sideline assessment
- If protocol is positive:
  - Coach alerts Nurse
  - Nurse meets with student, refers for ImPACT assessment
  - Neuropsychologist evaluates student and manages post-concussion recovery and return to play decision
  - Student's post-concussive "team" works together for fastest and safest possible return to play

# Return to Play Protocol

- Students are not returned to play on the day of injury if they have any signs or symptoms of concussion.
- The following guidelines are for symptomatic students:
  - Rest until symptom free
  - No physical or mental activity if symptoms are present, including headaches
  - Light physical/mental activity at first
  - If symptom free with light physical/mental activity, increase intensity of activity and re-test
  - Repeat until athlete is symptom-free with physical/mental exertion
- A concussed player is a POOR player

## When Used by Properly Trained Professionals, ImPACT will...

- Determine severity of concussion
- Provide valuable information to the athlete, parents, athletic trainers, physicians
- Provide information on academic deficits associated with concussion
- Determine safe return to play
- Reduce liability for school districts

# “Team” Collaboration

- Coordination between parents, coaches, nurses, teachers, counselors, and the student is critical
- Team approach keeps everyone informed about the student’s recovery process, so adjustments can be made for academic work, physical activity, and level of rest/general activity at home
- Allows for multiple parties to monitor and supervise the student’s recovery process. Good concussion management is the result of a good team effort.

# Why Schools Choose ImPACT

- Concussions are one of the most serious medical problems at the high school level
- Proper management of concussion is the best form of prevention of serious injury
- To avoid litigation for improper concussion management
- Alerts teachers, nurses, and counselors to student's injury and helps create team approach to concussion management

# Current ASD Data

ASD Middle and High School students completed (July 2011 – present):

- 8,354 Baselines
- 30 Post-injury Tests

< 1% concussion rate is highly implausible

# Challenges to Program

- Under-reporting of concussions
  - Expected rate for football alone is 20%
  - Current reported rate is <1% (est. 0.008)
  - Hockey is slightly better at 2%
- Poor roll-out of program by schools
  - Limited or no information provided to parents
  - Some parents felt schools were overstepping bounds
  - Some coaching staff disagreed with program and have undermined effectiveness

# Challenges to Program

- Mixed messages from coaches/school personnel regarding need for removal or follow up
- Students underreporting injuries due to fear of prolonged/excessive restriction
- Teachers/support staff unwilling to meet students' needs or grant accommodations
- A few coaches directed students to re-take baselines to assess concussion themselves, despite having no training in this regard
- Students deliberately performing poorly on baseline, with the goal of being returned to play faster after concussion
- Baselines conducted in suboptimal conditions, resulting in low scores that do not reflect students' true ability

# Challenges to Program

- Financial and insurance constraints
  - Under-insured or uninsured students
  - High co-pays
  - Codes denied or insurance unwilling to pay for assessment
  - No additional financial source available to alleviate patients' financial burden (e.g., grants, waiver program)
  - In particular, Tricare has regular intervals in which they consistently deny pre-authorization for all evaluations, which prevents families from receiving needed services
  - No assistance available in rural areas due to inability to use/bill for telemedicine codes

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# Key Points

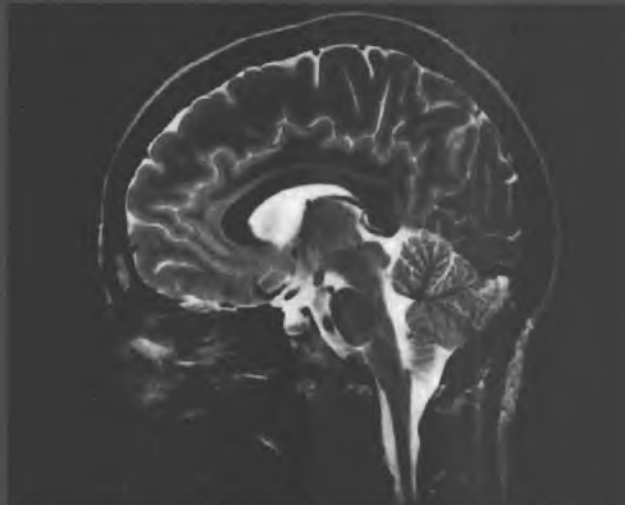
- Sports concussion is a hidden epidemic for student athletes
- A “bell-ringer” is a concussion
- Amnesia, headaches, and “fogginess” are better predictors for concussion related problems than loss of consciousness
- Concussed athletes should avoid physical/mental exertion while in the early stages of recovery
- Failure of sideline testing means that athletes do not return to play-following the protocol keeps them safe

# Key Points

- Always have someone with the concussed athlete after injury
- Send the athlete to the ER if you observe signs of severe head trauma (LOC, vomit, fixed pupils)
- Keep the injured athlete's "team" members well informed to make accommodations - this approach leads to a faster, safer recovery and return to play

*REMEMBER...*

**A CONCUSSION IS A  
BRAIN INJURY...TAKE IT  
SERIOUSLY!!!**



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**Alaska Neuro**

ASSOCIATES



ImPACT™

The Best Approach to Concussion Management

### Concussion Signs and Symptoms Evaluation

#### Signs observed by staff

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#### Symptoms reported by athlete

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- Feeling sluggish
- Feeling "foggy"
- Change in sleep pattern
- Concentration or memory problems

*Symptoms may worsen with exertion.  
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[www.impacttest.com](http://www.impacttest.com)

## On-field Cognitive Testing

### Orientation

---

*Ask the athlete the following questions.*

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What day is it?

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### Anterograde amnesia

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*Ask the athlete to repeat the following words.*

Girl, dog, green

### Retrograde amnesia

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### Concentration

---

*Ask the athlete to do the following.*

Repeat the days of the week backward (starting with today).

Repeat these numbers backwards:

63 (36 is correct) 419 (914 is correct)

### Word list memory

---

*Ask the athlete to repeat the three words from earlier.*

*(Girl, dog, green)*

*Any failure should be considered abnormal.  
Consult a physician following a suspected concussion.*