



# Concussion Update 2016



**Michael J. Stuart MD**

Professor of Orthopedic Surgery, **Mayo Clinic**  
Chief Medical & Safety Officer, **USA Hockey**  
Medical Committee, **IIHF**

# Michael J. Stuart MD

April 29, 2016

## Financial Relationships

- Consultant- Arthrex

## Research Funding

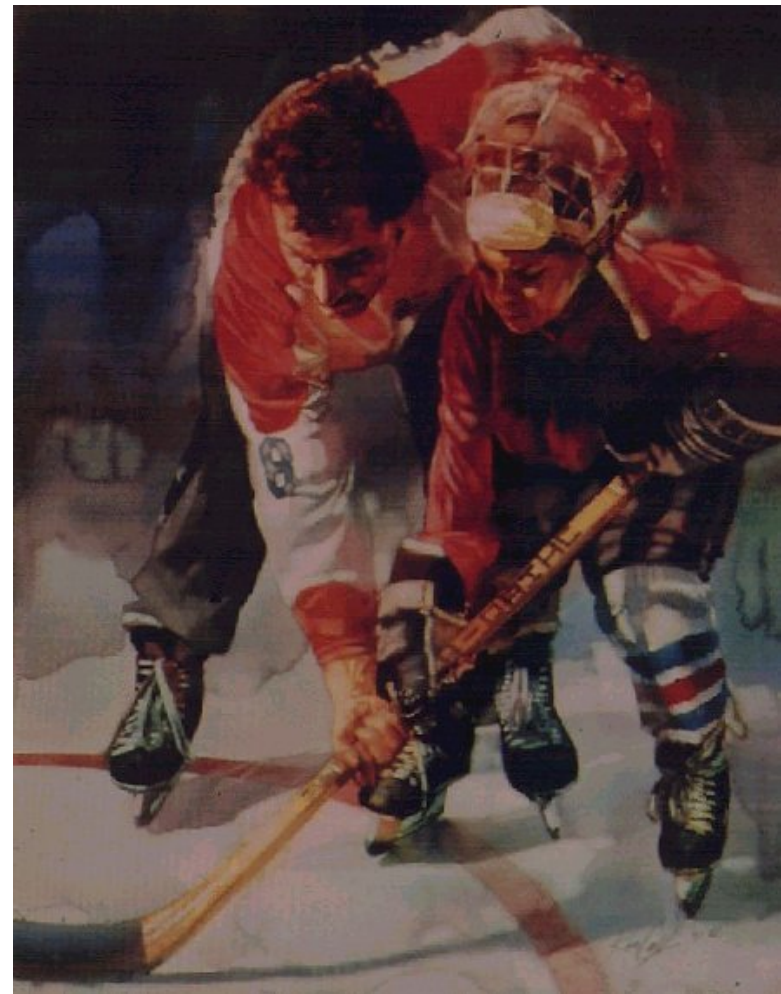
- Stryker
- USA Hockey Foundation

## Off Label Usage

- None



- **Thank you** for your dedication & for teaching this great sport to our athletes
- **Why** do coaches need to understand concussion?



... they play a very important role...  
in **prevention, diagnosis, initial management**  
& **return to play** decision-making



SPORTSMONEY | 8/15/2013 @ 12:50PM | 481 views

# Concussion Lawsuit Against NCAA Compelling

**The New York Times** | <http://nyti.ms/1w7f9C0>

HOCKEY | SPORTS BRIEFING | HOCKEY

## N.H.L. Concussion Lawsuits Consolidated

By JEFF Z. KLEIN | AUG. 19, 2014

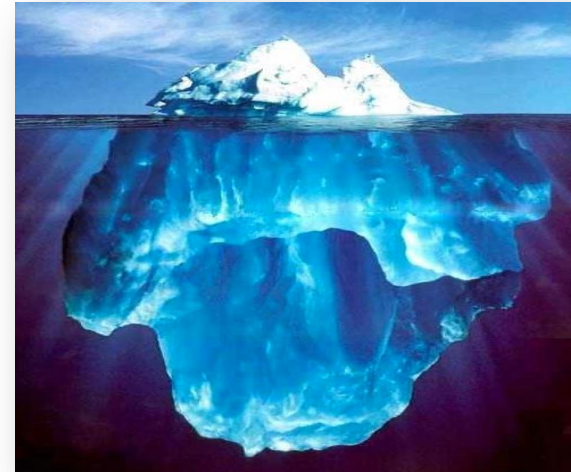
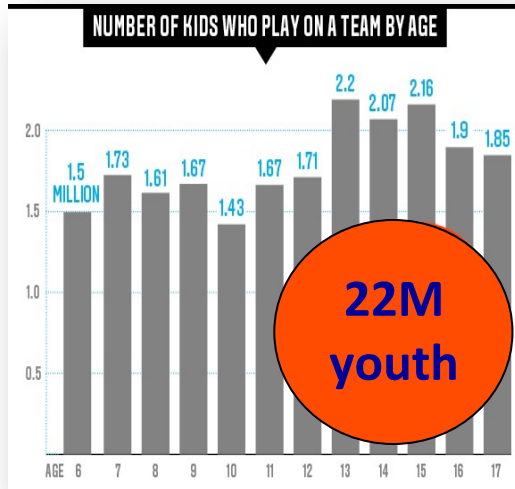
**The New York Times**

## Pro Football

WORLD | U.S. | N.Y. / REGION | BUSINESS | TECHNOLOGY | SCIENCE | HEALTH | SPORTS | OPINION

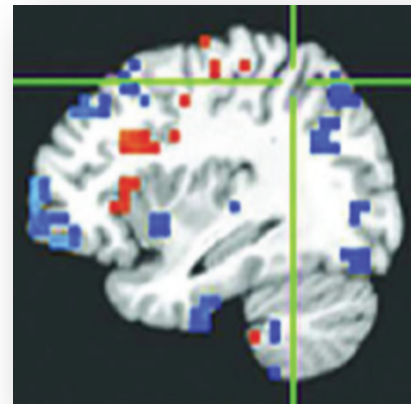
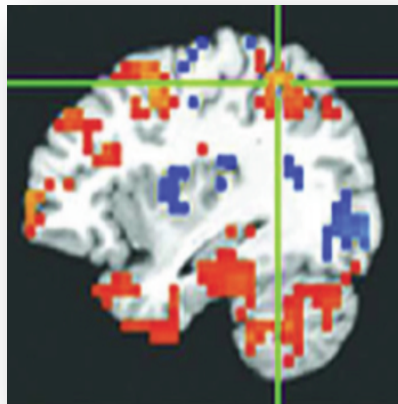
BASEBALL | N.F.L. | COLLEGE FOOTBALL | N.B.A. | COLLEGE BASKETBALL | HOCKEY | SOCCER

## N.F.L. Agrees to Settle Concussion Suit for \$765 Million



Huge population at risk

3.8M sport-related/year  
>50% *unreported*



Many concussions may be **'silent'**

# The “**Concussion**” Movie

- Raises *awareness* of the seriousness of concussion
- Graphically illustrates behavioral & cognitive problems- association with concussion is *not proven*
- We *all have the responsibility* of preventing, identifying and treating concussion through education & research
  - Concussion occurs in *sports, free play & accidents*
  - Recovery is variable: *individualize treatment*
  - Most athletes *recover completely* without any current evidence of long-term problems



# Objectives

- Discuss the **pathogenesis** of concussion
- Utilize the current tools to make a **diagnosis**
- Develop an approach to the after-injury **management** of concussion
- Implement **return-to-learn** & **return-to-play**
- Understand possible long-term **consequences**
- Outline **prevention** strategies

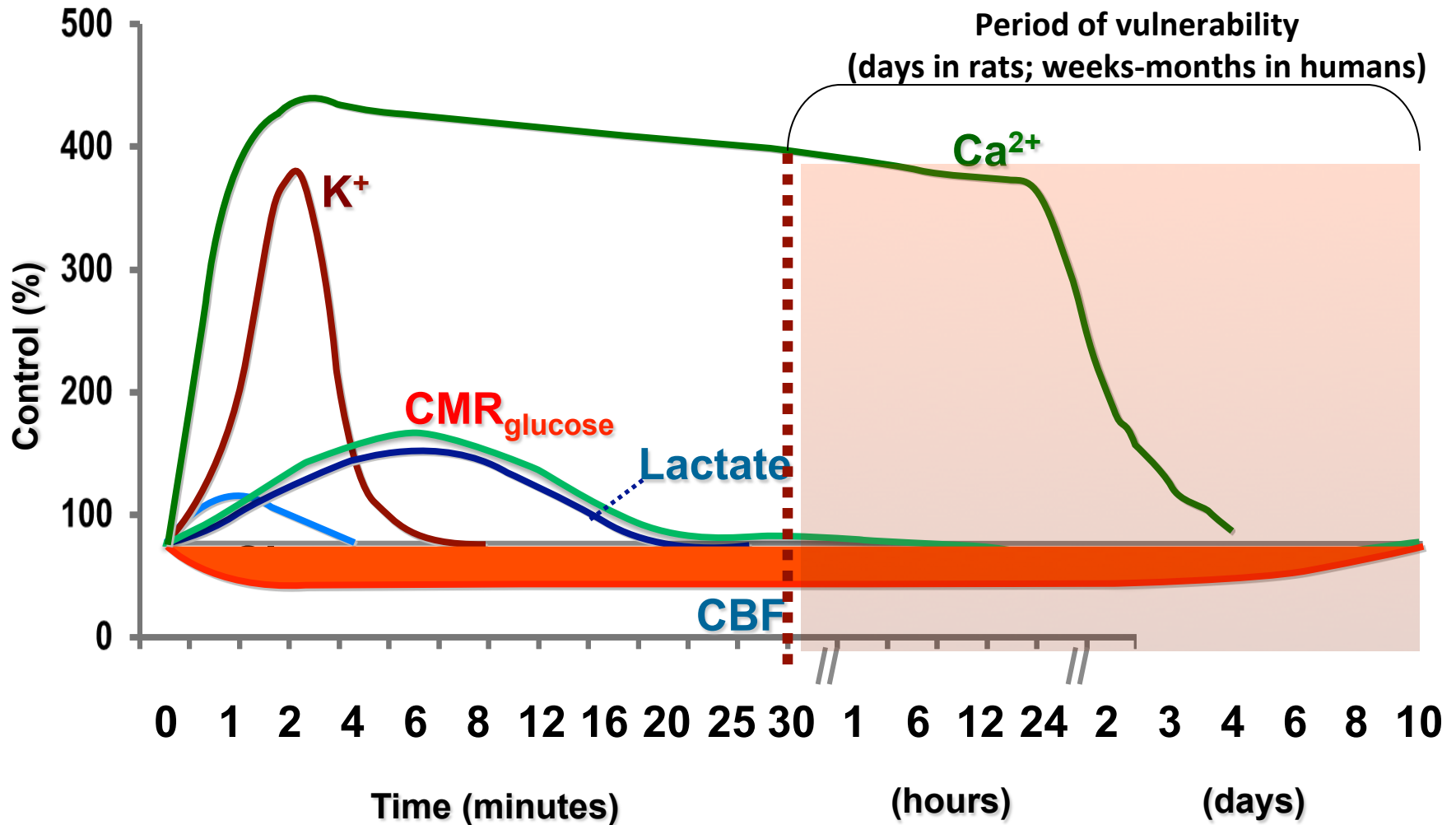


# Definition

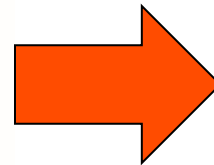
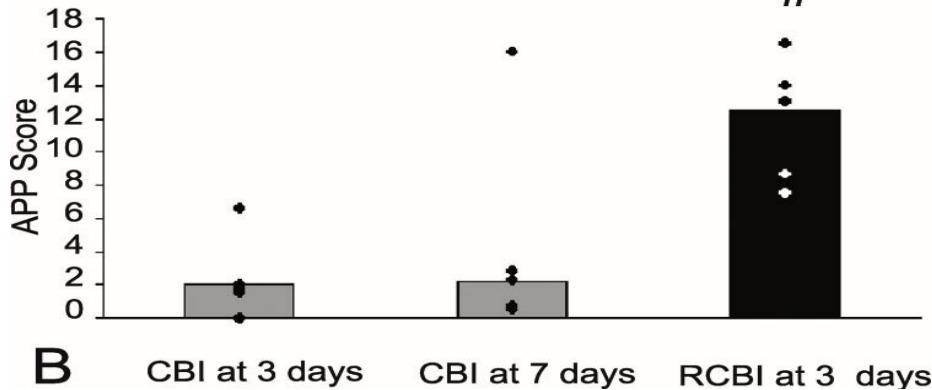
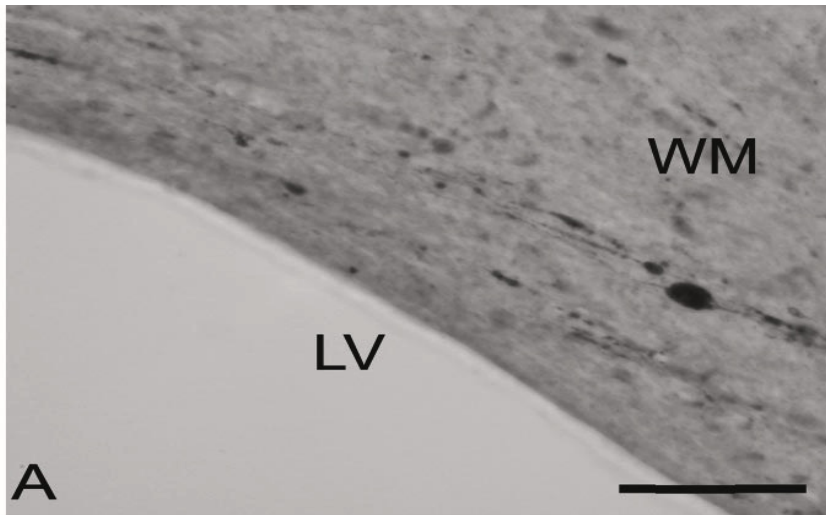
- **Brain injury** induced by **biomechanical forces** resulting is a *complex pathophysiologic process*
- ***Rotational*** acceleration > ***linear*** acceleration
- Symptoms are ***short-lived*** & promptly resolve
- +/- loss of consciousness (<**10%**)
- Predominantly ***functional*** rather than structural (***normal standard neuroimaging studies***)



# Metabolic Cascade



# Metabolic & Structural Vulnerability



**90%** repeat  
concussions  
occur within  
10 days

# Pathophysiology *meets* Symptoms

Concussion Pathophysiology	Symptom/Clinical Correlate
Ionic flux	Migraine-like headache, photo/ phonophobia
Energy crisis	Vulnerability to second injury
Axonal injury	Impaired cognition, slowed processing and reaction time
Altered neurotransmission	Impaired cognition, slowed processing and reaction time
Protease, altered cytoskeletal proteins, cell death	Atrophy, development of persistent symptoms

# Increased Risk

- **History** of concussion = **3-5x** higher risk for future concussion
- **High School** > College > Professional
- **Female** > Male
- **Genetic** predisposition =  
*Individual Susceptibility*

# Concussion Diagnosis

- **Education** increases awareness
- Any **symptom, sign** or worrisome **mechanism** requires removal from play & a detailed evaluation
- Symptoms ***evolve over time***:
  - **diagnosis** may be *delayed*
  - **severity** of injury is *unpredictable*

## **Physical & Postural**

**Headache**  
**Nausea, vomiting**  
**Light & noise sensitivity**  
**Visual problems**  
**Dizziness**  
**Balance problems**  
**Altered sleep**

## **Cognitive**

**Dazed, stunned  
& slow**  
**Mentally “foggy”**  
**Difficulty  
concentrating**  
**Forgetful of recent  
events**  
**Repeats questions**

## **Emotional**

**Irritable**  
**Sad**  
**Crying**  
**Depressed**  
**Personality change**  
**Anxious**  
**Panic attacks**



# Standardized Concussion Assessment Tool (SCAT 3)

### 3 How do you feel?

"You should score yourself on the following symptoms, based on how you feel now".

	none	mild		moderate		severe	
Headache	0	1	2	3	4	5	6
"Pressure in head"	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2				
Sensitivity to noise	0	1	2				
Feeling slowed down	0	1	2				
Feeling like "in a fog"	0	1	2				
"Don't feel right"	0	1	2				
Difficulty concentrating	0	1	2				
Difficulty remembering	0	1	2				
Fatigue or low energy	0	1	2				
Confusion	0	1	2				
Drowsiness	0	1	2				
Trouble falling asleep	0	1	2				
More emotional	0	1	2				
Irritability	0	1	2				
Sadness	0	1	2				
Nervous or Anxious	0	1	2				

4

### 4 Cognitive assessment Standardized Assessment of Concussion (SAC)<sup>4</sup>

#### Orientation (1 point for each correct answer)

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
What time is it right now? (within 1 hour)	0	1

**Orientation score** of 5

#### Immediate memory

List	Trial 1		Trial 2		Trial 3		Alternative word list		
elbow	0	1	0	1	0	1	candle	baby	finger
apple	0	1	0	1	0	1	paper	monkey	penny
carpet	0	1	0	1	0	1	sugar	perfume	blanket
saddle	0	1	0	1	0	1	sandwich	sunset	lemon
bubble	0	1	0	1	0	1	wagon	iron	insect

**Total** of 15

**Immediate memory score total** of 15

#### Concentration: Digits Backward

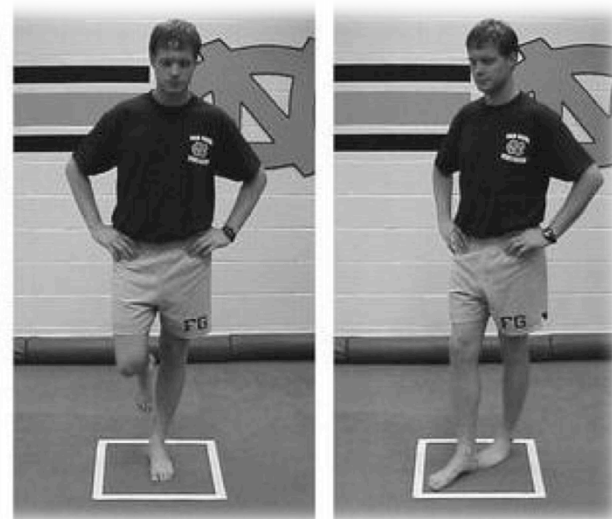
List	Trial 1		Alternative digit list		
4-9-3	0	1	6-2-9	5-2-6	4-1-5
3-8-1-4	0	1	3-2-7-9	1-7-9-5	4-9-6-8
6-2-9-7-1	0	1	1-5-2-8-6	3-8-5-2-7	6-1-8-4-3
7-1-8-4-6-2	0	1	5-3-9-1-4-8	8-3-1-9-6-4	7-2-4-8-5-6

**Total of 4** of 5

#### Concentration: Month in Reverse Order (1 pt. for entire sequence correct)

Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan	0	1
--	---	---

**Concentration score** of 5



**Total number of symptoms** (Maximum possible 22)

**Symptom severity score** (Maximum possible 132)

Do the symptoms get worse with physical activity?

Do the symptoms get worse with mental activity?

self rated                       self rated and  
 clinician interview             self rated with

**Overall rating:** If you know the athlete well prior to the athlete acting compared to his/her usual self?

Please circle one response:

no different     very different     unsure



- Athletes **ignore** or **deny** the problem
- Symptoms *may be delayed*
- Signs *are not always apparent*

**Need for *validated, rapid screening tests***

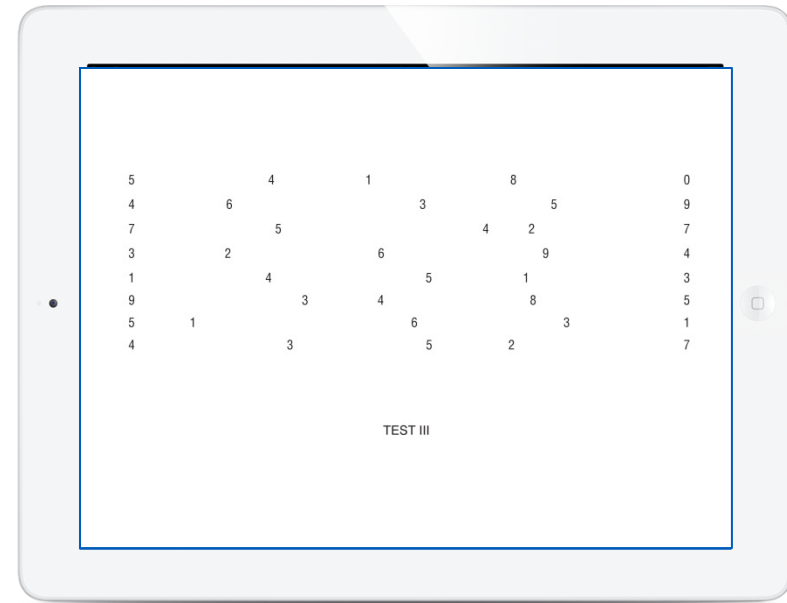
# *Objective* Concussion Diagnosis

Mayo Clinic  
Sports Medicine



# King-Devick Test

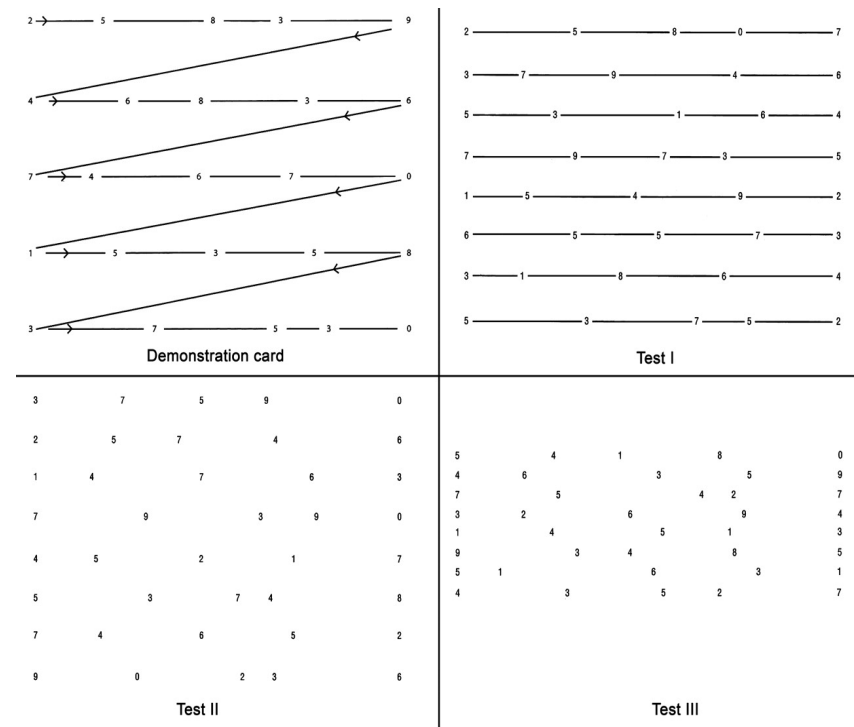
- **Rapid number naming**
  - ✓ vision
  - ✓ eye movements  
(saccadic, accommodation, vergence)
  - ✓ concentration
  - ✓ language components
  - ✓ attention
- *Validated, objective* indicator of **neurological dysfunction & brain injury**
- *Annual* **baseline** for comparison





# King-Devick Test

- Practical for **sideline, locker room & office** use
- **2 minutes** to administer
- Captures abnormalities associated with concussion:
  - Attention
  - Language
  - Processing speed
  - Eye movements
- Validated for use by ***non-medical professionals***



# Remove from Play

- **Any signs or symptoms**
- **Observed mechanism of injury**
- **Worse SCAT3 score**
- **King-Devick Test**
  1. **Slower total time**
  2. **Any uncorrected errors**



# Neurology® Clinical Practice

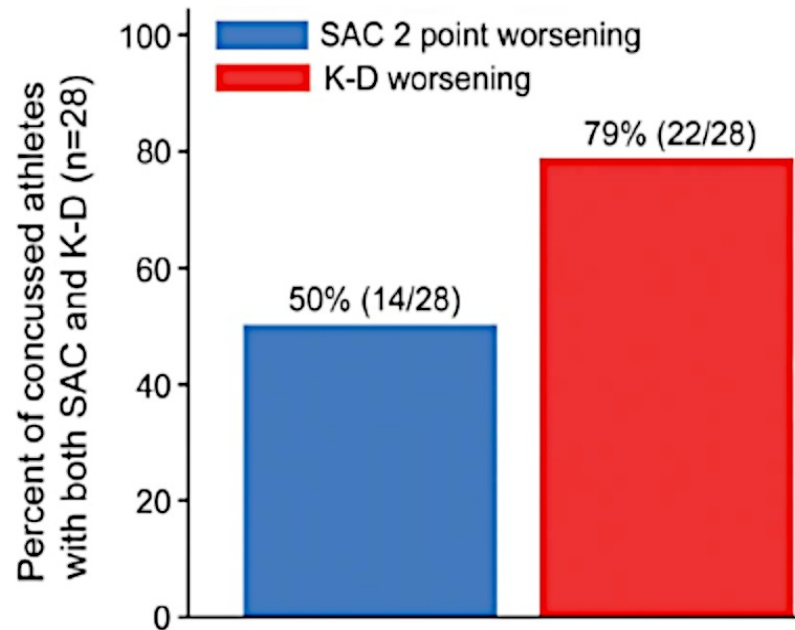
## Vision testing is additive to the sideline assessment of sports-related concussion

Zoe Marinides, Kristin M. Galetta, Connie N. Andrews, et al.  
*Neurol Clin Pract* published online July 9, 2014

## Accuracy of **combined testing** in identifying collegiate athletes with concussion

- KD = 79%
- SAC = 52%
- KD+SAC = 89%

**KD+SAC+BESS = 100%**



# King-Devick *Meta-Analysis*

1,419 athletes from 15 published studies

- De-identified participant-specific data for pooled analyses; meta-analyses using fixed-effects model techniques
- Sensitivity **86%** (96/112 concussed had worsening)
- Specificity **90%** (181/202 controls had no worsening)
- Relative risk if any worsening from baseline = **4.92 (5x risk!)**

# Remove-from-Play AND Return-to-Play

## King-Devick Test

- Quick, objective sideline testing
- Measures impairments of eye movements, speech, language, concentration and other correlates of suboptimal brain function
- Instant screening feedback in minutes

Administered by athletic trainers, coaches, parents & medical professionals in **remove-from-play** decisions

## Neurocognitive Tests

- Computerized concussion evaluation system
- Measures verbal and visual memory, processing speed and reaction
- Tracks recovery of cognitive processes following concussion

Assists clinicians & athletic trainers in making **return-to-play** decisions

# Integrating King-Devick into your Concussion Protocol

## Concussion Education

Athletes

Parents

Coaches

## Pre-Season Baseline Testing

King-Devick

Neurocognitive Testing

Other (BESS, SCAT3, Etc)

## Remove-From-Play Assessments

King-Devick

Other (BESS, SAC, Etc)

## Return-To-Play Protocol

Back to Pre-Season Baselines

Medical Clearance

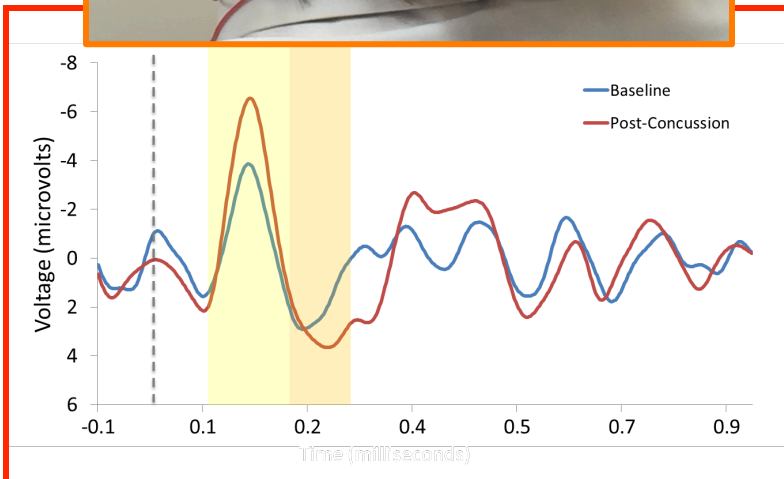
Symptom Free

# NeuroCatch QEEG



QEEG requires **6 minutes** to obtain *diagnostic concussion* information.  
(goal **<4 min**)

QEEG data shows a change in brain wave *amplitude & latency* after concussion.



# NeuroCatch QEEG

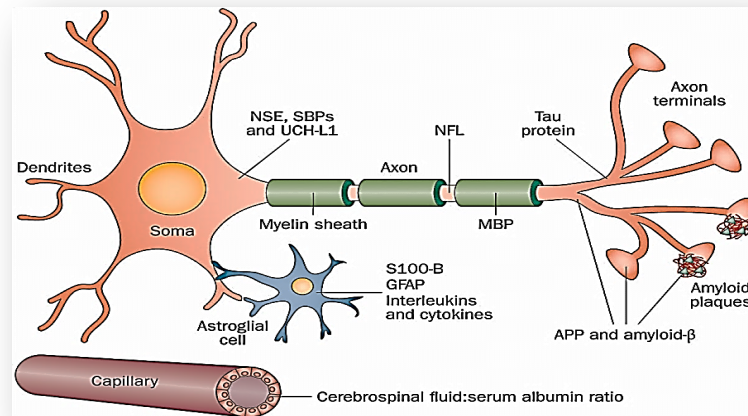
- Headset with built in recording electrodes & earphones
- Records EEG event-related potentials (ERPs)
- Provides quantitative data for processing of:
  - ✓ Sensation
  - ✓ Perception
  - ✓ Attention
  - ✓ Memory
  - ✓ Language
- Results compiled in diagnostic, reliability, validity & prognostic scores

✧ *not validated* for concussion *at this time*



# Blood Biomarkers

- Used for both acute & post-concussion evaluation
- Biomarkers are highly expressed in CNS, but very *low concentration* in peripheral **blood**
- Proteolytic degradation in blood & rapid clearance



Diagnose & quantify severity

# Imaging

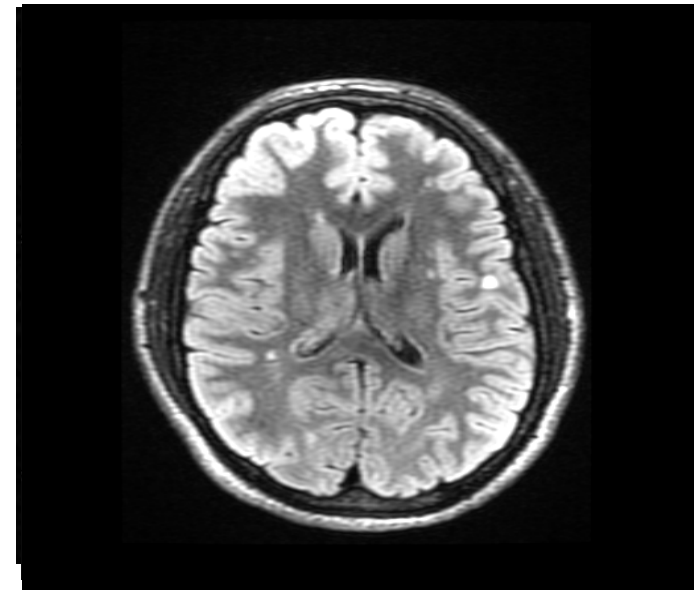
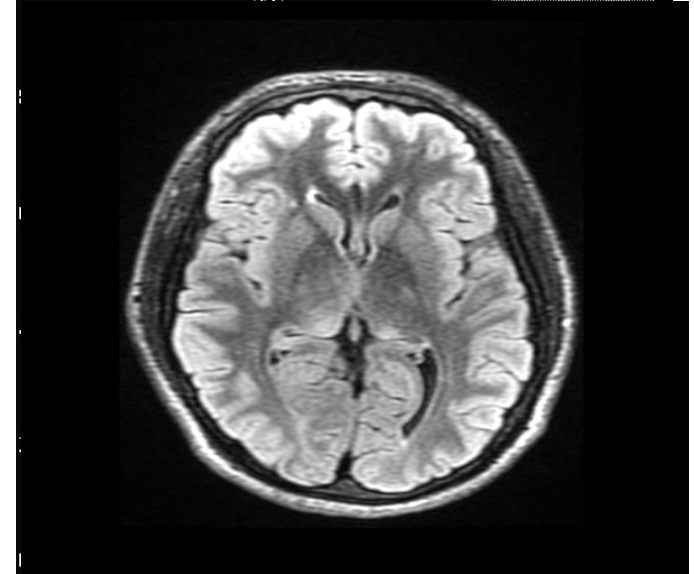
Consensus statement on concussion in sport:  
the 4th International Conference on Concussion  
in Sport held in Zurich, November 2012

“**Conventional structural neuroimaging** is typically *normal* in concussive injury. Given that caveat, the following suggestions are made: **Brain CT** (or where available an **MR brain scan**) *contributes little to concussion evaluation* but should be employed whenever suspicion of an **intracerebral** or **structural** lesion (eg, skull fracture) exists”

# Mayo Clinic

## Concussion Protocol

- **SWI** (6X greater ability to detect hemorrhagic)
- Single voxel **MRS** (frontal WM TE=144)
- **3D FLAIR**
- Sagittal **T1** & Axial **3D T1**
- Axial **T2**
- Axial **DTI**



# Concussion Management

- **No** single controlled study evaluating *any* treatment approach
- **Physical, cognitive, visual & auditory rest** (*early*) including academic accommodation
- **Symptom management** (headache, sleep, light, sound)



# Concussion Management

1. Diagnose
2. Remove from play
3. Monitor
4. Characterize
5. Treat



# 1. Diagnose

- Past history
- Mechanism of injury
  - blow to *head, neck* or *body* to a player who doesn't have the puck or just released the puck
    - ✓ head hits the glass
    - ✓ hit from a shoulder or elbow
    - ✓ open-ice, unanticipated hit
    - ✓ illegal collision





# 1. Diagnose

- Past history
- Mechanism of injury
- Visible clues
  - decreased responsiveness
  - lying motionless or slow to get up
  - unsteady skating or falling down
  - grabbing or clutching the head
  - a dazed or blank look
  - confusion or unawareness of events
  - nervous, emotional or irritable feelings



# 1. Diagnose

- Past history
- Mechanism of injury
- Visible clues
- Symptom checklist
- Examination
  - Cervical spine
  - Vestibular
  - Neuro
  - Cognitive
  - Balance
  - King-Devick





## 2. Remove from play

## 3. Monitor

- Refer to emergency department
  - suspected neck injury or neck pain
  - weakness, numbness, tingling (arms or legs)
  - prolonged loss of consciousness (more than a few minutes)
  - severe or increasing headache
  - unusual behavior change
- Refer to health care professional



## 4. Characterize

### Primary Clinical Trajectories

1. Cognitive/Fatigue
2. Vestibular
3. Oculomotor
4. Affective
5. Migrainous
6. Cervical spine

✧ *specific*  
**treatment**  
*for each type*

## 5. Treat

- Educate
- Manage expectations
- Sleep hygiene
- Exercise (subsystem threshold)
- Hydration
- Nutrition
- Pharmacotherapy (headache, sleep, mood)

# *Acute* Treatment

## Omega-3 Fatty Acids (fish oil):

eicosapentaenoic acid (EPA) & docosahexaenoic acid (DHA)

- ***Decreased*** inflammation, permeation of blood-brain barrier & apoptosis
- ***Decreased*** affective disorders associated with concussion (e.g., depression, anxiety)

Lewis et al. *Military Medicine* 2011

**40 mg/kg**  
(~**3000** mg/day in 70 kg person)

# *Acute* Treatment

N-acetylcysteine (NACA): amide form

- Studies supplement within 15-30 minutes
- Single randomized, double blind, placebo controlled study in MTBI from blast injury
  - Complete symptom resolution @ 7 days in **86%** of NAC vs. **42%** placebo treated within 24 hours (p = 0.006)

Hoffer et al. *PLOS One* 2013

**4gm** loading dose *within 72 hours*  
**4 gm/day** x 6 more days

# Return to Play

- **Resolution** of *all* post-concussion **symptoms**
- **Return to baseline** cognitive, physical & neurological **status**
- Consideration given to **prognostic factors**
- **Return-to-play protocol**



# Confounding Factors which Influence Return-to-Play Decisions

- Concussion **history** (#, severity, timing, threshold)
- **Symptoms** (#, duration >10d, severity)
- **Signs** (amnesia, LOC > 1min)
- **Age** (child or adolescent)
- **Comorbid** disorders (migraine, depression, ADHD, learning disorder)
- **Sport** & position



# Neuropsychological Testing

Baseline testing is valuable...

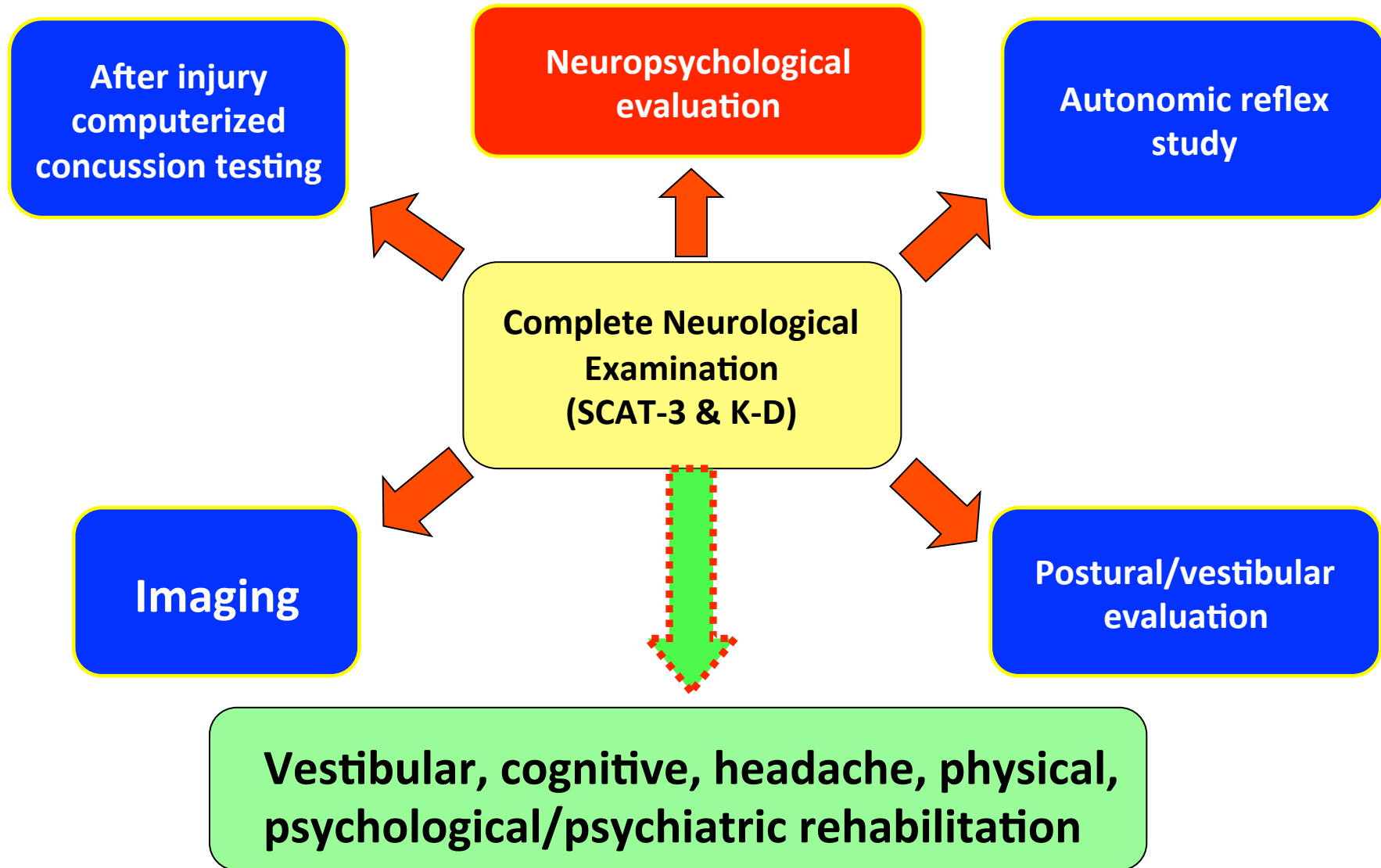
*but only one piece of the puzzle*

- ✓ Test reliability questioned
- ✓ May not be valid for young athletes
- ✓ Should be applied only after ***symptom-free***

Use **clinical judgment** *with or without neuropsychological test scores* to make return-to-play decisions



# *Persistent Signs & Symptoms Guide Treatment*



# CTE (Chronic Traumatic Encephalopathy)

- one type of *progressive neurologic disease* diagnosed at autopsy by Tau protein deposition in the brain
- a concern for athletes with a history of *repetitive* traumatic brain injuries
- we don't know *who* is at risk, *how common* it is, the *threshold* of concussions or the *clinical significance* of the post-mortem findings

The greatest risk factor for **dementia** in American society is **high blood pressure, obesity & diabetes**, which are *far more prevalent* in children who *do not exercise*

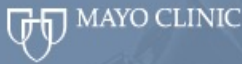
# *Concussion* Prevention

1. Coach, player & parent **education**
2. Teaching technique & body control **skills**
3. Sportsmanship & **mutual respect**
4. Rule **enforcement**
5. Rule **changes**
6. Limiting **contact** *in practice*
7. Improved protective **equipment**
8. Neck **strengthening**

# Concussion Prevention in Ice Hockey







Mayo Clinic Sports Medicine Center

# ICE HOCKEY SUMMIT: ACTION ON CONCUSSION

October 19-20, 2010



Siebens Medical Education Building, Leighton Auditorium  
Mayo Clinic  
Rochester, Minnesota

Course Directors:  
Michael J. Stuart, MD  
Aynsley M. Smith, RN, PhD

This Program Jointly Sponsored with:



CONFERENCE BOOKLET

- Reduction of concussion risk, severity & consequences requires a *collaborative effort* from **medicine, psychology, sport science, coaching, engineering, athletic training, officiating, manufacturing, & community partners**

# 6 PRIORITY ACTION AREAS

## FORMULATED AT MAYO CONCUSSION SUMMIT 2010

### DATA BASES AND METRICS

- Develop consistent definition
- Base recommendations on data
- Partner with pending legislation

### EQUIPMENT AND ARENAS

- Communicate protective role equipment plays
- Share pros and cons of all helmets
- Support research for all equipment

### EDUCATION AND PREVENTION

- Mandate concussion education for coaches, officials, players and parents
- Charge hockey organizations with delivering existing educational content
- Educate for behavioral and cultural change



### DIAGNOSE, MANAGE

- Mandate education
- Remove players suspected of concussion
- No return to play until cleared by health care provider

### RULE RECOMMENDATIONS

- Enforce head and body contact rules
- Create curriculum to teach body control for legal checking (No checking until age 13)
- Ban fighting at all levels

### COMMUNICATION

- Mandate pre-season meetings
- Deliver unified, consistent message
- Develop a multi-media package

*Clin J Sport Med* 2011 & 2015

The ESPN logo is displayed in white, stylized, italicized letters against a red background.

**Study: Many hockey helmets *unsafe***

The word "TIME" is written in white, serif, all-caps letters against a red background.

**Your Kid's Hockey Helmet *May Not Be as Safe as You Think***

The KARE 11 logo features the word "KARE" in white, serif, all-caps letters, followed by a stylized "11" in white, set against a blue background.

[kare11.com](http://kare11.com)

**New study suggests many hockey helmets *unsafe***



## Hockey STAR: A Methodology for Assessing the Biomechanical Performance of Hockey Helmets

BETHANY ROWSON, STEVEN ROWSON, and STEFAN M. DUMA

Department of Biomedical Engineering and Mechanics, Virginia Tech, 313 Kelly Hall, 325 Stanger Street, Blacksburg, VA 24061, USA

$$\text{Hockey STAR} = \sum_{L=1}^4 \sum_{\theta=1}^3 E(L, \theta) * R(a, \alpha).$$

**5 Stars:** *Best Available*

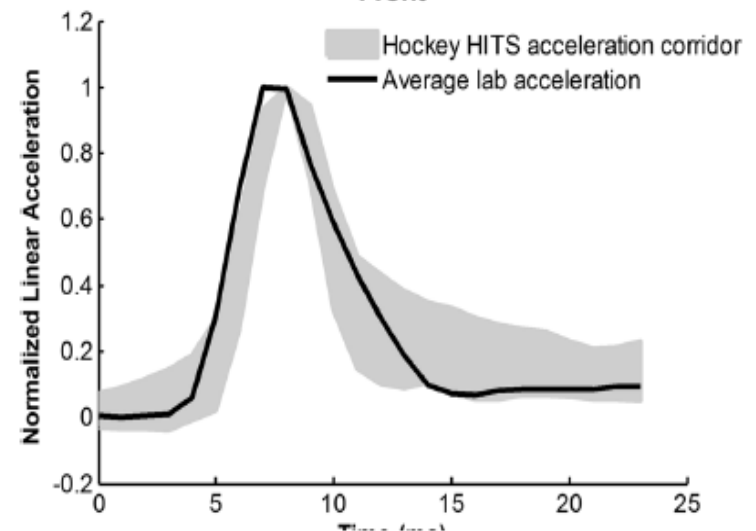
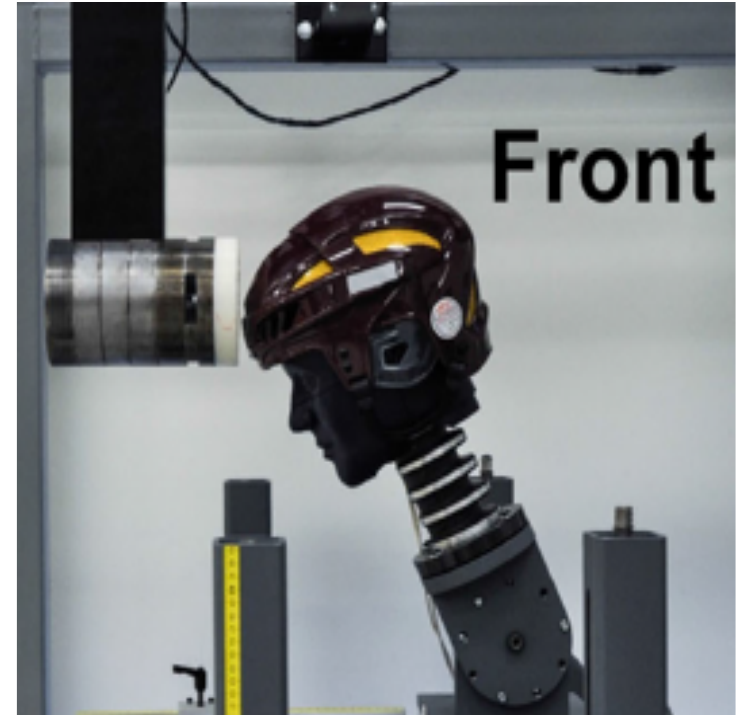
**NONE**

**4 Stars:** *Very Good*

**NONE**

**3 Stars:** *Good*

**Warrior Krown 360 (2.98)**



# Hockey Helmets

- ✓ Difficult to measure *effect*
- ✓ Helmets do what they were designed for: **reduce skull fracture & hematoma**
- ✓ Facial protection: no reduced concussion risk, **but may reduce severity**



 MAYO CLINIC

Mayo Clinic Sports Medicine Center

ICE HOCKEY SUMMIT:  
ACTION ON CONCUSSION

# Hockey STAR: *A Methodology for Assessing the Biomechanical Performance of Hockey Helmets*

**Michael J. Stuart MD**

- well-done *laboratory experiment*
- raises awareness of the *limitations* of current helmet choices
- does not prove if a specific helmet *will or will not prevent or even reduce the risk of a concussion* if worn by a hockey player



# Can we make a difference?



PROVIDING THE **SAFEST** ENVIRONMENT  
FOR **YOUR CHILD**  
IS WHAT **WE DO.**

USA Hockey puts a major emphasis on providing a safe sport environment for kids. And only USA Hockey brings you a level of safety and protection that includes the following:

- background checks for those dealing with kids, including coaches and officials
- extensive coaching education programs and officials' training
- a locker room supervision policy
- a comprehensive insurance program specific to hockey
- a safety committee featuring some of the nation's top doctors
- leadership in concussion prevention

AFTER ALL, KEEPING KIDS SAFE  
IS **ALWAYS** OUR NUMBER ONE GOAL.



"USA Hockey is a sports leader in supporting research and safety initiatives that enhance the protection and safety of everyone playing hockey. As a parent myself, it gives me great comfort knowing that USA Hockey has a focus on the well-being of players and all those involved in the game like no other organization."

- DR. MICHAEL STUART  
CHIEF MEDICAL OFFICER, USA HOCKEY  
CO-DIRECTOR, SPORTS MEDICINE CENTER, MAYO CLINIC

TO LEARN MORE ABOUT WHAT SETS USA HOCKEY APART,  
HEAD TO [USAHOCKEY.COM](http://USAHOCKEY.COM)



WE DON'T JUST LIVE AND BREATHE HOCKEY.  
**WE ARE HOCKEY.**



# Can **we** make a difference?

## Education

- *mandatory* concussion education for **coaches**
- *mandatory* concussion education for **parents & athletes**

USA Hockey now has a  
**Manager of Player Safety:**  
Kevin Margarucci



# Can **we** make a difference?

## Rule Changes & Enforcement

- eliminate **head contact**  
*(intentional & incidental)*

### Proposal #68B

**Minor:** contact to the head, face or neck

**Major/Game:** intentionally or recklessly

**Match:** attempt to injure or deliberate injury



# National Hockey League

## Rule Changes & Enforcement

- ✓ eliminate **head contact**
- The NHL revised their **Illegal Check to the Head** rule in March 2011 (Rule 48.1)
  - A hit resulting in *contact with an opponent's head* where the head is **targeted** & the **principal point of contact** is not permitted



# Can **we** make a difference?

## Body Checking Subcommittee

### Player Development

Younger athletes do not have the **cognitive ability** to learn multiple skills simultaneously- skating, puck handling, ice awareness & anticipation

**Checking** hinders **physical skill acquisition**- let the opponent get the puck first in order to initiate contact or disregard the puck to avoid getting hit





# Can **we** make a difference?

## Body Checking Subcommittee

### Player Safety

- significant increase risk of overall **injury & concussion (3x)** Emery et. al. *JAMA* 2010
- **dangerous and/or illegal** activities *more prevalent*
- lack of physical skills & mental awareness results in a **loss of body control, unanticipated hits & high-risk collisions** that are *misconstrued* as “checking”



# Can **we** make a difference?

## Body Checking Subcommittee

### Player Safety

- Body **CONTACT** is **encouraged** at the mite & squirt levels
- Since ***injury risk*** is *dramatically lower in practice*- body checking is incorporated into **drills & scrimmage** at the Pee Wee level



# Can **we** make a difference?

- establish a progressive, structured curriculum to teach body control, angling, anticipation, body contact & body checking skills

Checking is not being *removed*...

IT IS BEING **IMPROVED** !



# Can **we** make a difference?

## Rule Changes & Enforcement

- delay legal body checking (boys) in games until age 13 (Bantam level)

### Proposal #94B

Body Checking is prohibited in the **12 & under youth** age classifications, **all Girls' / Women's** age classifications and in non-check Adult classifications



- Fights can result in significant **rotational concussion-causing force** to the brain
- Dazed fighters are sent to the **penalty box** instead of the "quiet room"
- Lack of fighting in college, U20 & Olympic play *does not* diminish quality; it **enhances** hockey



Linesman Derek Nansen checks out the Sabres' Corey Tropp on Sept. 22 after Tropp fought the Maple Leafs' Jamie Devane. Tropp suffered a concussion and a broken jaw.

## Fists cause concussions

Michael J. Stuart, David W. Dodick and Aynsley M. Smith  
Special for USA TODAY Sports

**CASE AGAINST FIGHTING**

"Science has responded to the game on the ice. Now it's time for the game to respond to the science." — Ken Dryden, Hall of Fame goalie, at the Mayo Clinic Ice Hockey Summit II, Oct. 8-9.

Fighting is not tolerated in the sport of ice hockey, except at the junior and professional levels in the USA and Canada. In our opinion, hockey without fighting is a better and safer game. A no-fighting policy with automatic game ejection is congruent with other professional sports and is consistent with the NHL's aggressive strategy to eliminate hits to the head. Rule changes that deter fighting will reduce the risk of concussion. The fundamental purpose of a hockey fight is to punch the opponent in the

face or head, which can result in a significant rotational, concussion-causing force to the brain when compared to an illegal shoulder or elbow hit. Fighting is a head hit. Players frequently fall during a fight and strike their head on the ice, sometimes without a helmet. An unprotected fall, especially if the player is unconscious or his opponent lands on top of him, can result in severe traumatic brain injury. Dementia, psychiatric disease and premature death in "enforcers" with a history of on-ice fighting highlight the potential for devastating neurological consequences, which might be related to repeated concussions. Despite the recent effort to improve recognition of a concussed player and remove him from the game, the diagnosis might be missed after a fight. Dazed players are sent to the penalty box instead of the "quiet room," bypassing the NHL mandate requiring formal evaluation for suspected concussions. Proponents say fighting is important to self-police the sport, but there

is no evidence that fights prevent other dangerous or injurious behaviors. The recent emphasis on rule enforcement and player suspensions will prove to be effective deterrents. Fighting is negative role modeling for younger hockey players and directly contradicts efforts that promote safety and mutual respect. Hockey can mend public perception by eliminating all fights. Lack of fighting in world junior and Olympic competition does not diminish quality; it enhances hockey. The skilled, fast and physical international game has proved to be an unsurpassed spectator experience. Contact sports are being scrutinized because of concussion concerns. The future of ice hockey hinges on our collective efforts to improve the safety of this great game — and the time is now. Stuart, Dodick and Smith are with the Mayo Clinic. Stuart, chief medical officer for USA Hockey, has two sons, Mike and Colin, who played in the NHL and one, Winnipeg Jets defenseman Mark Stuart, playing now. Daughter Cristin played for Boston College.

Michael J. Stuart, David W. Dodick, Aynsley M. Smith

# What should **USA Hockey** do?

## Rule Changes & Enforcement

- **eliminate fighting**

**Rule 614** *Starting in 2014-15:*

Any fighting major in **Tier I** or **Tier II** junior hockey will be accompanied by a **10-minute misconduct**

Any fighting major in **Tier III** junior hockey will be accompanied by a **game misconduct**



# What should **USA Hockey** do?

## Rule Changes & Enforcement

- eliminate fighting

### Proposal #64C

**2<sup>nd</sup>** fighting major = **3** game  
suspension

**3<sup>rd</sup>** fighting major = **suspension**  
(until a hearing is conducted)





# What should **USA Hockey** do?

## Rule Changes & Enforcement

- **eliminate fighting**

### Proposal #65A

A **game misconduct** penalty shall be assessed to any player whose helmet/facemask comes off their head before or during an altercation & a **match penalty** for deliberate removal



# Points of Emphasis

## Elimination of:

- Head contact
- Charging
- Boarding
- Checking from behind



**Major + 10 minute  
Misconduct**

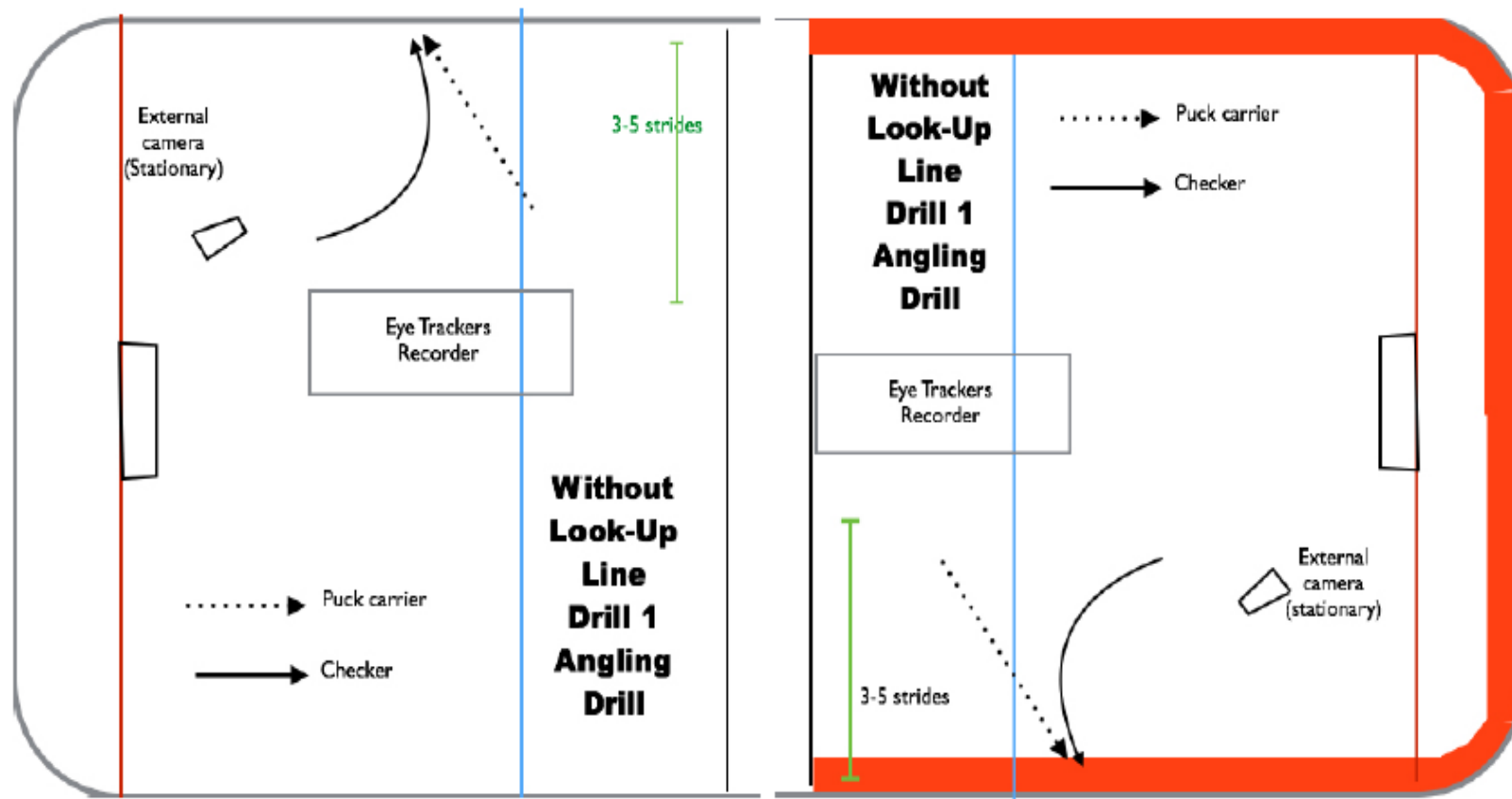
# “Look Up Line”

## *Does it Work?*



# “Effect of the Look-Up Line on the Gaze, Head Orientation & Performance of Elite Ice Hockey Players”

Joan Vickers, Joe Causer, Michael Stuart, Elaine Little, Sean Dukelow, Marc LaVangie, Sandro Nigg, Gina Arsenault, Barry Morton, Matt Scott, Carolyn Emery



## Two results *support* the look-up-line:

- 1) Players *looked up more during preparation* (P1), indicating greater focus & anticipation at the outset of each trial.
- 2) Players *skated further from the boards* prior to contact (P3) or during contact (P4), preferring to control the black puck on white ice, thus reducing the risk of collision with the boards.

## Two results *reject* the look-up-line:

- 1) More *fixations* occurred on the LUL rink.
- 2) The look-up-line caused the players to *look down more during the contact* (P4).

# Recommendations

1. This research ***does not provide evidence*** to recommend or mandate the LUL in all arenas and *does not* condemn the voluntary use of the LUL.
2. The presence of a LUL on the ice surface creates an **opportunity for player education** on the risk of contact near the boards, as well as injury prevention strategies.
3. More research is needed to determine if the LUL improves safety in ice hockey:
  - game time video analysis comparisons with and without LUL
  - strong epidemiological data with injury surveillance



# Cost-Benefit Analysis of Team Sports

- **youth** is associated with **injury risk** because they are *active & fearless*
- contact sports are actually *less risky* than skateboarding, bicycling, skiing & horseback riding
- team sports produce **fun**, physical **fitness**, **friendships**, academic **success** & many valuable **life lessons**
- sports participation *reduces* **depression**, **obesity**, **drug & alcohol** abuse

The **answer** is not to *get rid of youth sports*, but to *work even harder* to **make them safe**



# Thank You

