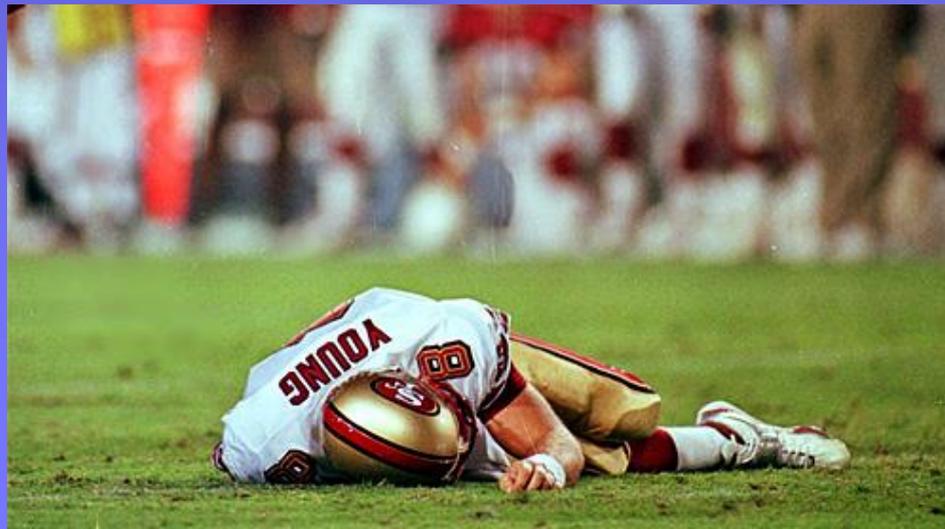


THE CONCUSSED ATHLETE

Updated Guidelines

Indiana University of Pennsylvania
Craig C. McKirgan, DO
Indiana, PA
07 DEC. 2014



Concussion: True or False

- 1. An MRI is the best way to diagnosis a concussion. T or F
- 2. Most concussions resolve within 7 to 10 days. T or F
- 3. LOC is the most common sign of a concussion. T or F
- 4. After a concussion, if the only symptom is a mild headache, it is safe to return to play. T or F

OBJECTIVES

- Epidemiology of Concussion
- Hx Concussion Guidelines
- Define Concussion
- Consequences of Concussions
- Recognize a Concussion
- Evaluation of Concussion
- Return to play guidelines



EPIDEMIOLOGY OF CONCUSSION

- Most common type of head injury in sports
- American Football
 - 1904: 19 athletes DIED or paralyzed
 - 1954: 30 athletes DIED or paralyzed
 - 1931 to 1986: 819 DEATHS (#1 head injury, #2 spinal cord injury)
 - 1973 – 1983: DEATHS in American football > all other sports combined (Ave. 8 DEATHS/yr.)
 - At Risk Players: QB, running backs, receivers, DB, specialty teams (highest risk/min.)



EPIDEMIOLOGY OF CONCUSSION

- NFL: One in every ~2 games
- High School & College: 5 – 20% of the players per year
- Brain Injury: Number 1 cause of DEATH in ALL sports
- After 1st concussion: player is at least 4x as likely to sustain a subsequent concussion



EPIDEMIOLOGY OF CONCUSSION

- 3.8 million concussions/yr. due to sport & recreational activities (<50% reported). Self-report data suggests significant higher incidence
- True incidence is unknown
- ~20% of NFL Players hide or played down the effects of a concussion. (AP Survey Nov. 2009)



EPIDEMIOLOGY OF CONCUSSION

- United States ranking of risk by sport:
 - American Football
 - Ice Hockey
 - Rugby
 - Soccer
 - Basketball



Concussion Statements

- 1997
 - Concussion Workshop, Chicago
 - 13 Organizations (USA)
- 2001
 - 1st International Symposium on Concussion in Sport (Vienna, Austria Nov. 2001).
- 2004
 - 2nd International Symposium on Concussion in Sports (Prague, Czech Republic, November 2004)
- 2005
 - Concussion Alliance
 - 6 Major Medical Professional Assoc. (USA)
- 2008
 - 3rd International Consensus Conference on Concussion in Sport
 - (Zurich, Switzerland, 30-31 Oct. 2008)



Fourth International Conference Zurich, Switzerland 01-02 November 2012

4th
International
Consensus
Conference on

Concussion in Sport

1 – 2 November 2012
hosted by FIFA at the Home of FIFA in Zurich

FIFA
For the Game. For the World.



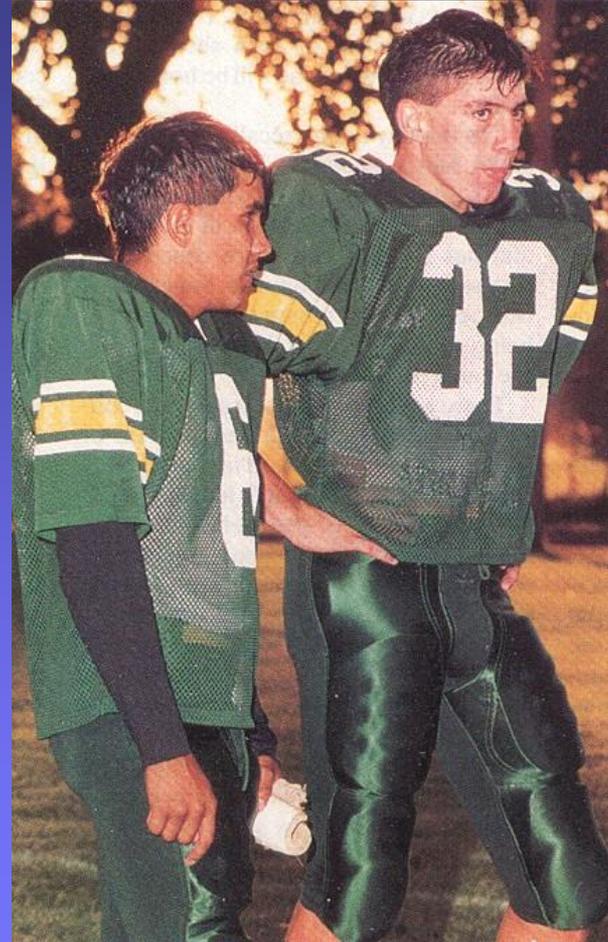
Concussion Statements

- 2012
 - 4th International Consensus Conference on Concussion in Sport
 - Zurich, Switzerland, 01-02 November
- 2013
 - Am. Med. Soc. Sports Medicine Position Statement: Concussion in Sport
- 2014
 - NATA Position Statement: Management of Sport Concussion



PURPOSE OF SYMPOSIUM

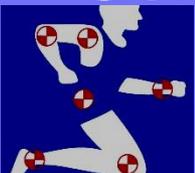
- Update Previous Recommendations
 - Improvement of safety and health of athletes who suffer concussive injuries in ice hockey, football (soccer) and other sports.



CONCUSSION

What's in a name

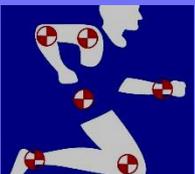
- Mild Traumatic Brain Injury (mTBI)
- Concussion
- Commotio Cerebri



CONCUSSION

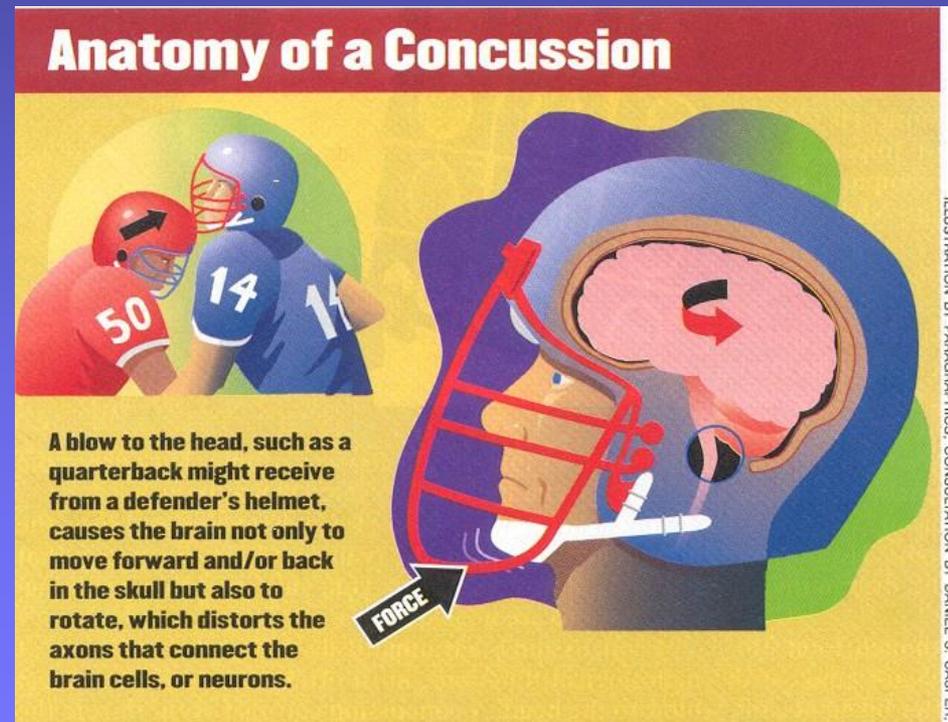
What's in a name

- Do NOT use:
 - “Ding”
 - “Bell rung”
 - “Cobwebs”



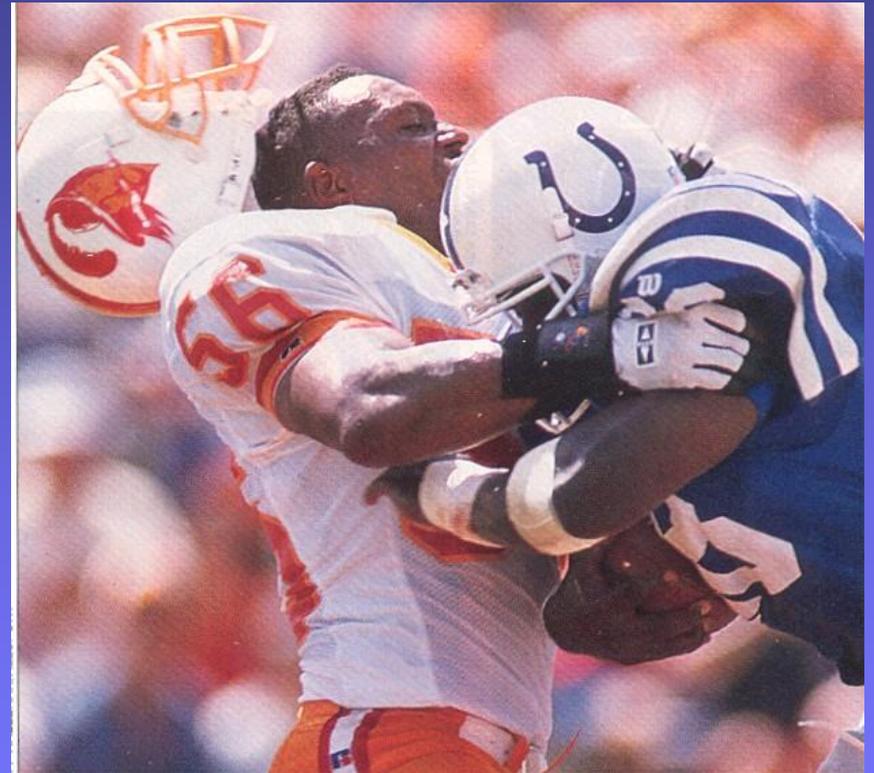
CONCUSSION DEFINITION

- A complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces.



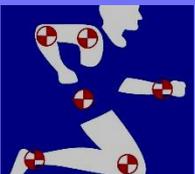
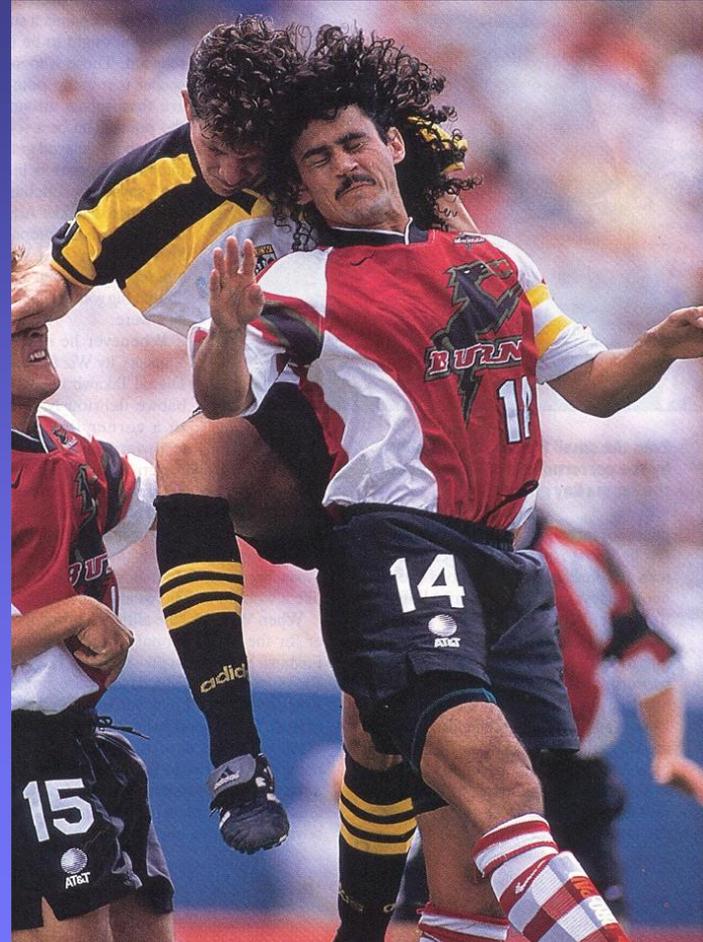
CONCUSSION COMMON FEATURES

- MOI: Caused by direct blow to the head, face, neck or elsewhere on the body with an “impulsive” force transmitted to the head.



CONCUSSION COMMON FEATURES

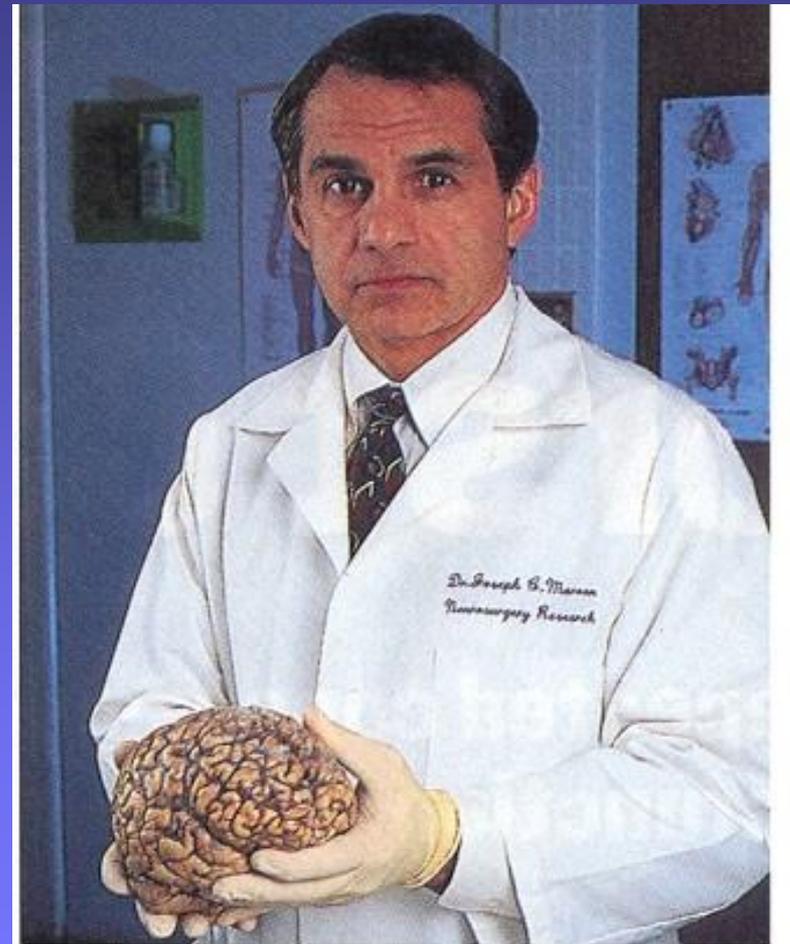
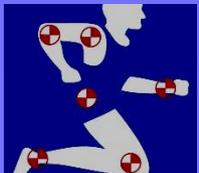
- Rapid onset of short lived impairment of neurological FUNCTION that usually resolves spontaneously.



CONCUSSION

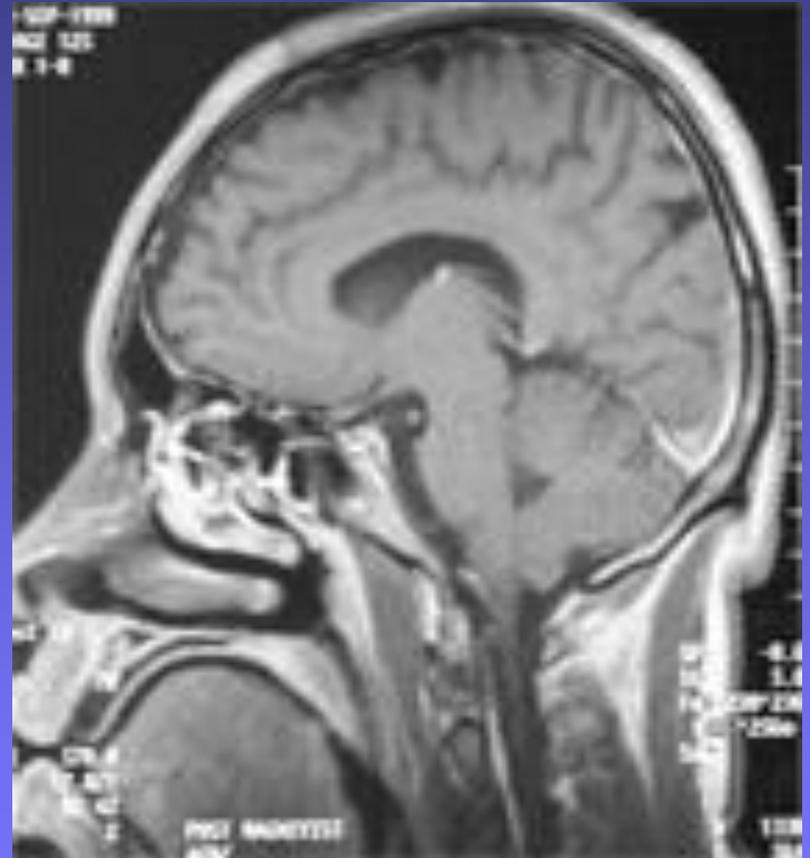
COMMON FEATURES

- May result in neuropathological changes but acute clinical symptoms largely reflect a **FUNCTIONAL** disturbance rather than structural injury.



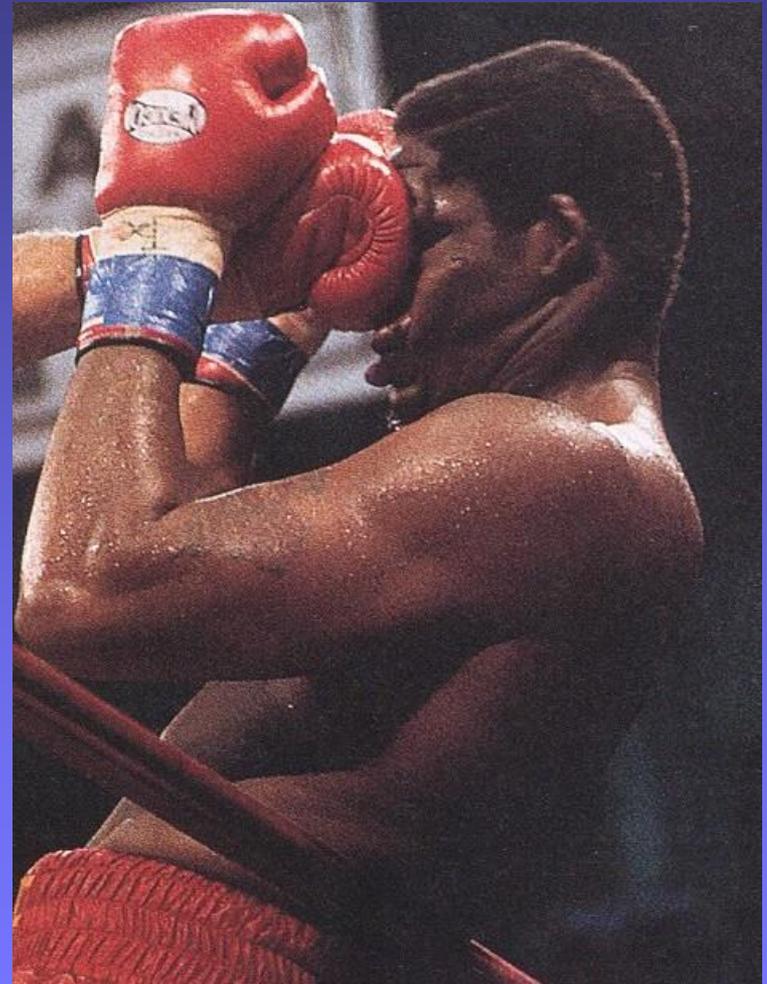
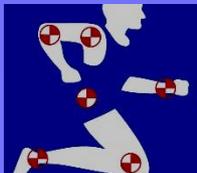
CONCUSSION COMMON FEATURES

- Typically associated with gross normal structural neuroimaging studies.



CONCUSSION COMMON FEATURES

- Results in a graded set of clinical symptoms that may involve LOC.
- Resolution of S/Sx usually follows a sequential course.
- Small % of cases have a prolonged course



CONCUSSION COMMON FEATURES

The majority (80-90%) of Concussions COMPLETELY resolve in 7-10 days.

- The recovery time frame may be longer in children & adolescents (working brains? vs. adult?)
- S/Sx may not develop for several hours post injury. (Index of suspicion).



EVALUATION of CONCUSSION

- Clinical Domains to Evaluate
 - Symptoms (e.g. Headache)
 - Physical Signs (e.g. Balance, LOC)
 - Behavioral Changes (e.g. Irritable)
 - Cognitive Impairment (e.g. Memory)
 - Sleep Disturbance (e.g. Insomnia)



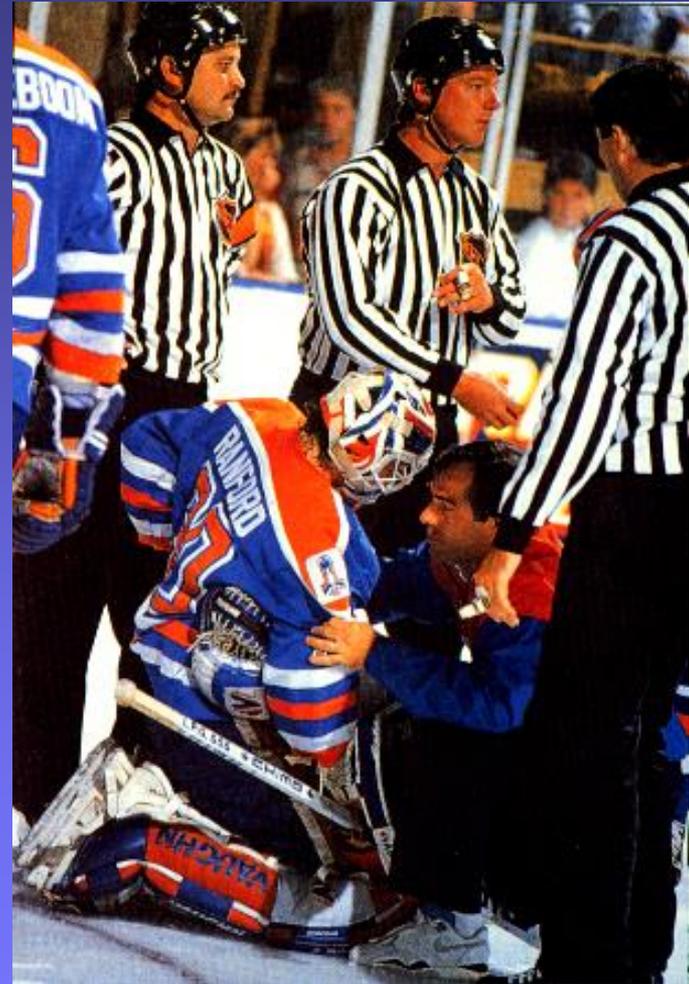
EVALUATION of CONCUSSION

- HISTORY
- PHYSICAL EXAMINATION
- CONCUSSION TOOLS



Concussion Investigation Tools

- Neuroimaging
- Objective Balance Assessment
- Neuropsychological Assessment
- Genetic Testing
- Experimental Modalities



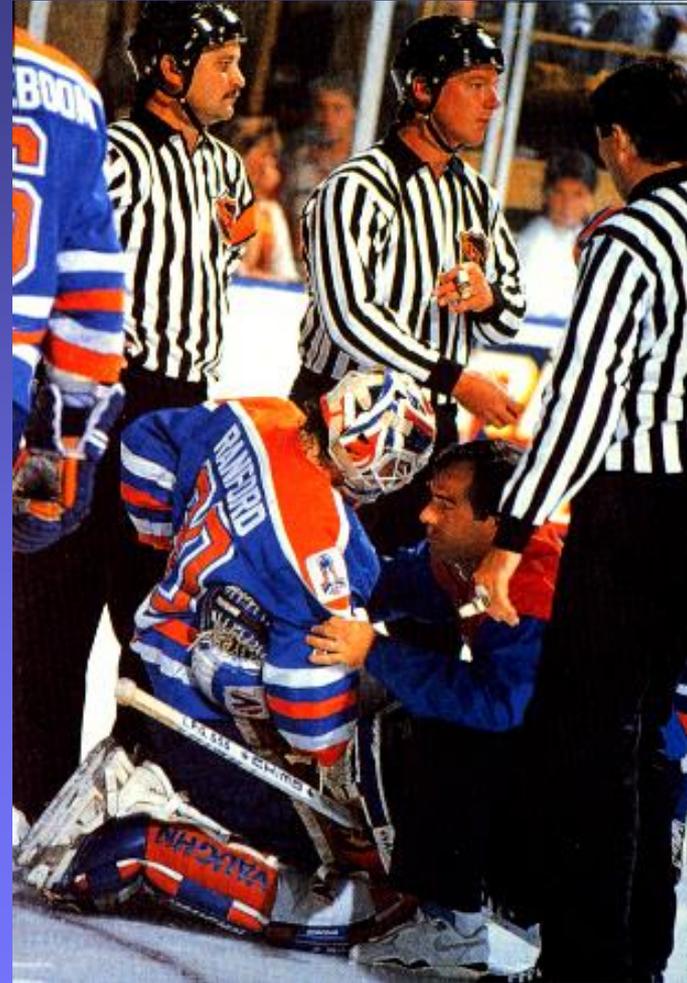
CLINICAL HISTORY

- Number of previous symptoms vs concussions
- Previous head, face, or neck injuries
- Protective equipment at time of injury
- Poor reliability from coaches and teammates
- Disproportionate impact symptom severity (i.e., worse symptoms with smaller hits)



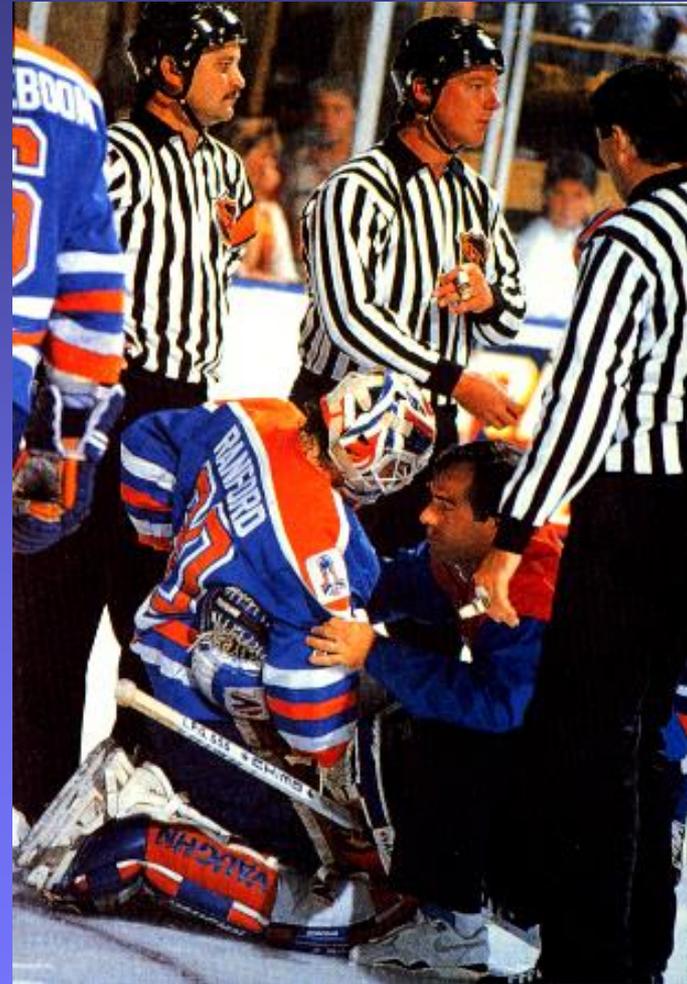
ON-FIELD or SIDELINE INITIAL EVALUATION

- Evaluate all athletes that show ANY features of a concussion



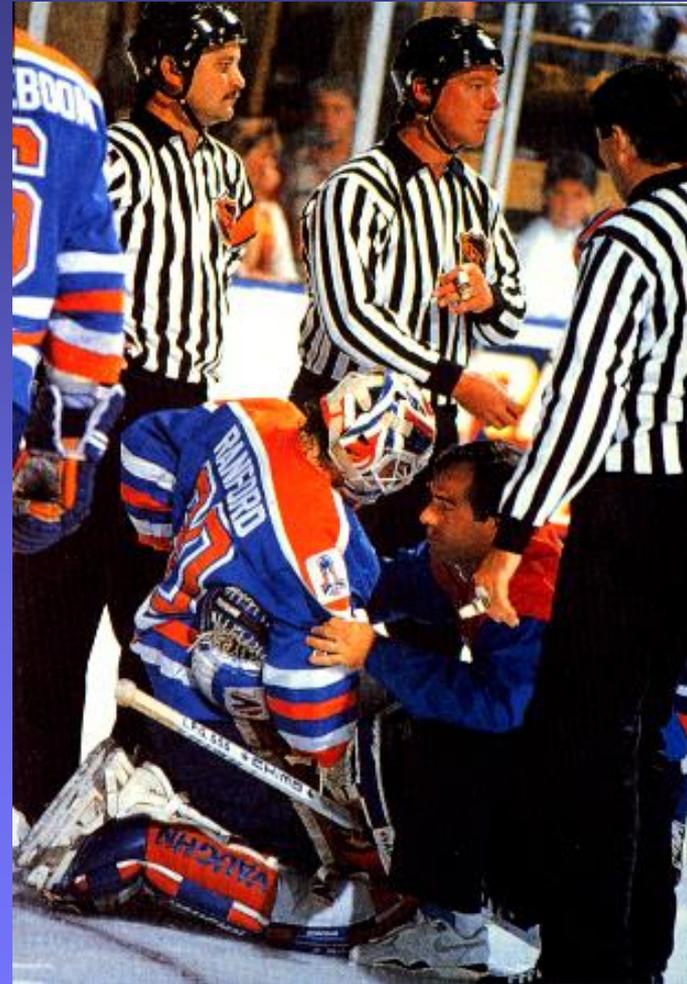
ON-FIELD or SIDELINE INITIAL EVALUATION

- Medically evaluated for ABCs & to r/o C-Spine Injury
- Deposition determined by healthcare provider
- No healthcare provider: remove from contest & refer to a physician.



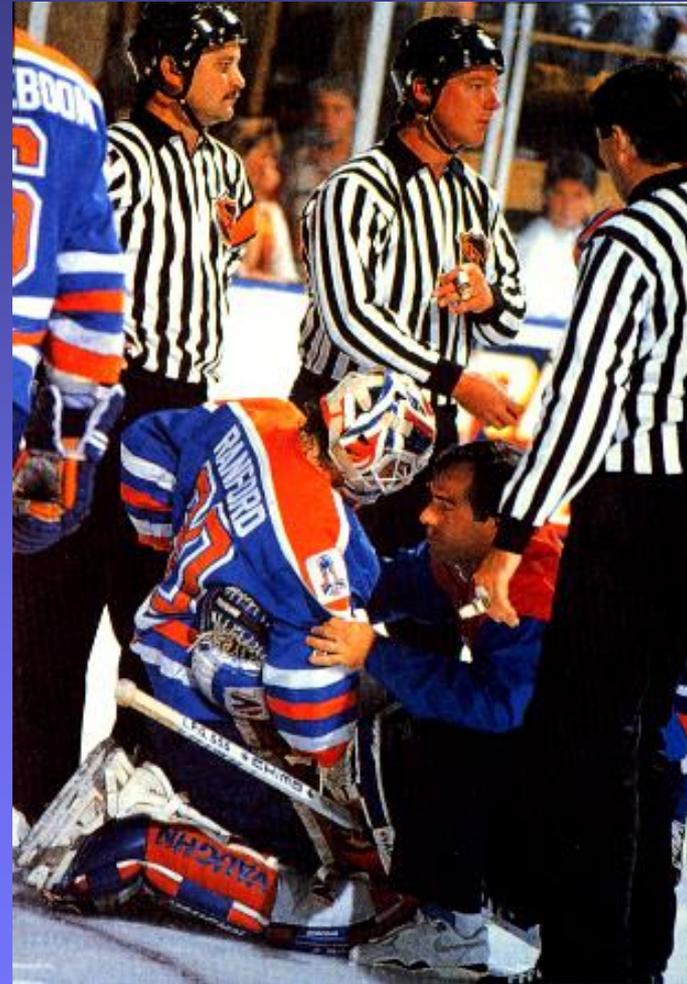
ON-FIELD or SIDELINE INITIAL EVALUATION

- Once first aid issues are addressed, then evaluate for concussion (e.g. SCAT 3)
- Do not leave athlete alone
- Do serial monitoring over the next few initial hours



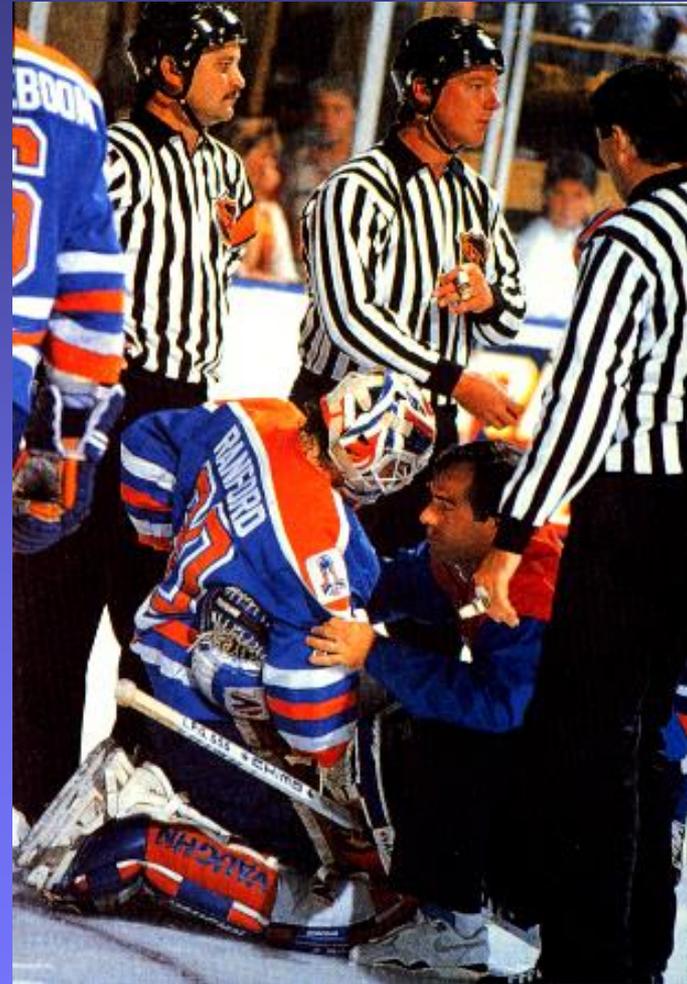
ON-FIELD or SIDELINE INITIAL EVALUATION

- Once diagnosed with a concussion:
- Player NOT allowed to return to play the same day.
- (Previous Exceptions in Adults (NFL)) (NFL Changed policy 02 Dec. 2009)



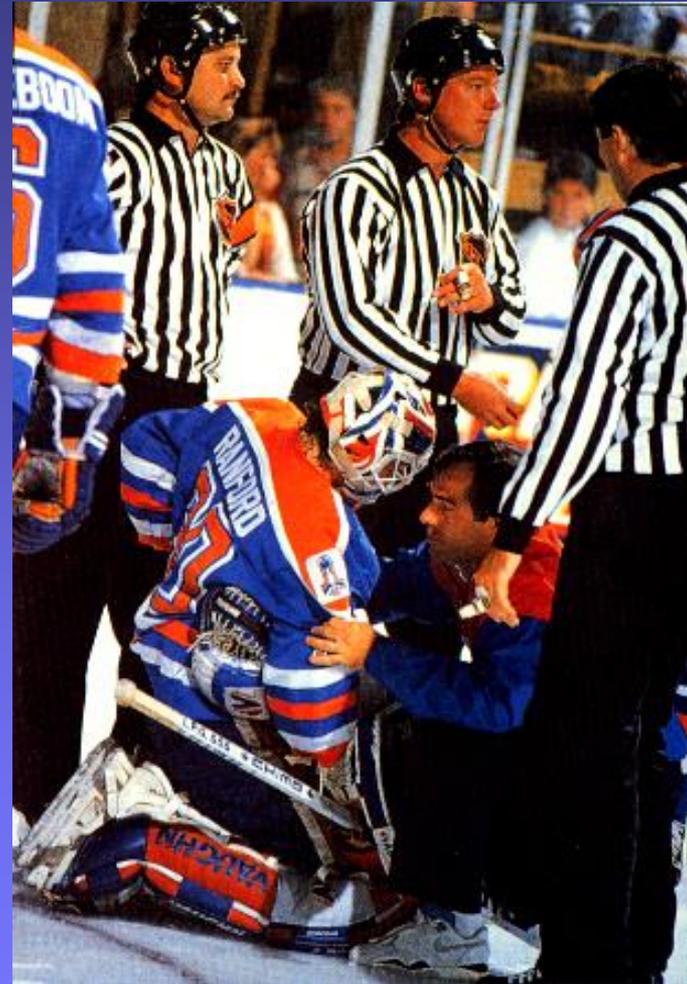
Emergency Dept. & Medical Office Evaluation

- Additional points of evaluation:
- Comprehensive History
- Detailed Neurological Exam:
 - Mental Status
 - Cognitive function
 - Gait
 - Balance



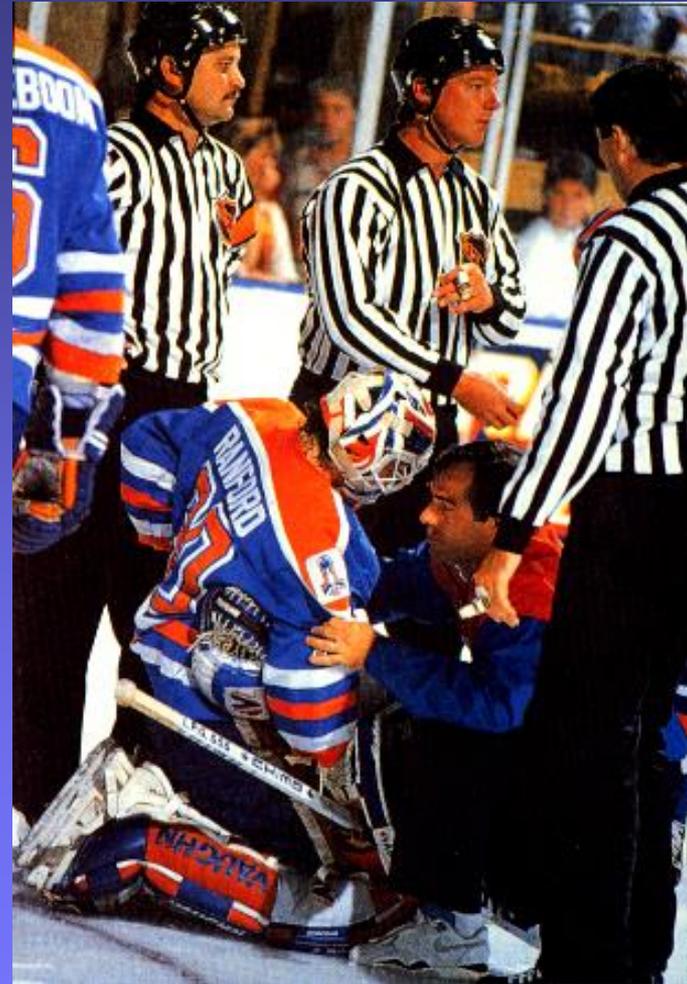
Emergency Dept. & Medical Office Evaluation

- Determine Clinical Status Change
 - Improving
 - Unchanged
 - Deterioration



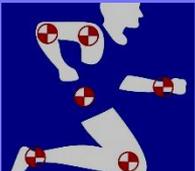
Emergency Dept. & Medical Office Evaluation

- Determine need for Emergent Neuroimaging (R/O Structural Abnormalities: Subdural, Epidural bleeds/hematoma)
 - MRI
 - CT



NEUROIMAGING

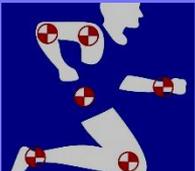
- Conventional CT or MRI is usually normal
 - Not essential for otherwise uncomplicated concussive injury
 - Indications for Imaging: Suspicion of structural lesion
 - Prolonged disturbance of conscious state
 - Focal neurological deficit
 - Seizure activity
 - Persistent clinical or cognitive symptoms
 - Worsening Symptoms
 - Vomiting (Multiple times)
 - Agitation
 - Somnolence



NEUROIMAGING

– MOST IMPORTANT
Indications for
Conventional CT or
MRI:

- GETTING WORSE
- NOT IMPROVING



NEUROIMAGING

- Functional imaging (Not indicated at this time)
 - PET: Positron Emission Tomography
 - SPECT: Single Photon Emission Computed Tomography
 - fMRI: Functional Magnetic Resonance Imaging
 - Diffusion Tensor Imaging
 - Etc.



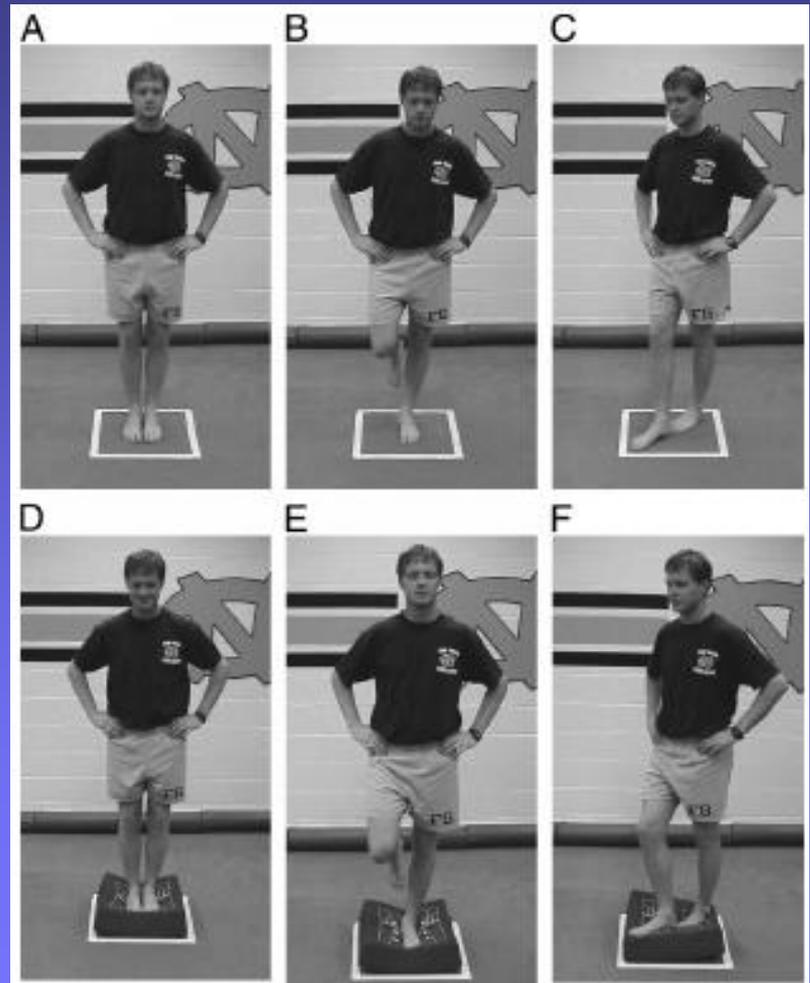
Objective Balance Assessment

- Postural Stability Deficits last 72 hr. post Concussion
 - Balance Error Scoring System (BESS)
 - Useful tool to evaluate the motor component of neurological testing (valid & reliable).

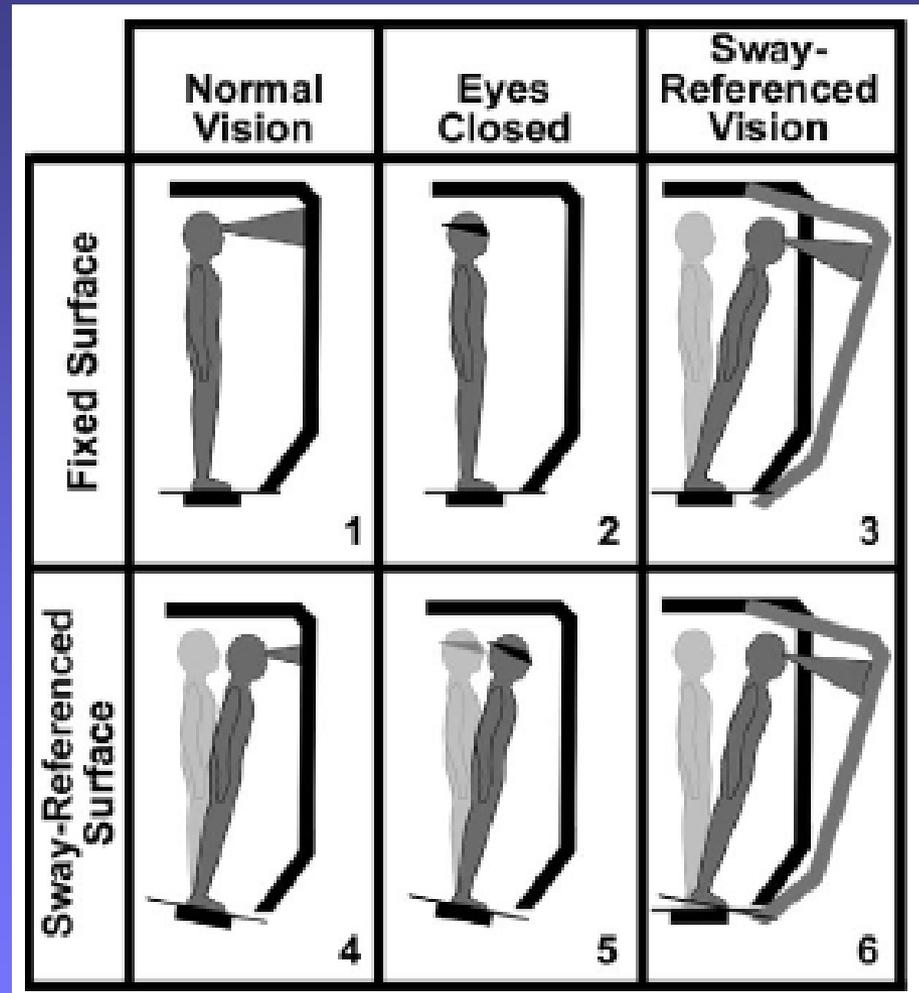


Balance Testing

- BESS (Balance Error Scoring System)



Balance Testing



RESEARCH METHODS

- Electrophysiological recording
 - ERP: Evoked response potential
 - EEG: Electroencephalogram
- Biochemical Serum Markers (Detecting Cellular damage. Seen in more severe trauma)
 - Glial protein S-100b
 - NSE: Neuron-specific enolase
 - MBP: Myelin basic protein
 - GFAP: Glial Fibrillary Acid Protein
 - Tau Polymerase
- Genetic Phenotyping
 - ApoE4 Risk Factor for Adverse Outcome
 - Calcium subunit gene: brain swelling



NEUROPSYCHOLOGICAL EVALUATION

- Neuropsychologic Evaluation
 - Orientation
 - Memory
 - Concentration
- Acutely for Diagnostic purposes
- Non-acutely for Return-To-Play issues



NEUROPSYCHOLOGICAL EVALUATION

- Evaluation
 - Sideline neurological and mental status testing of acute injury
 - i.e., SCAT3 (Sport Concussion Assessment Tool3)
 - Practical and effective
 - **HOWEVER**, these tests are designed for rapid concussion evaluation & are **NOT** meant to replace comprehensive neuropsychological testing which is sensitive to subtle deficits beyond the acute injury.



SPORT CONCUSSION ASSESSMENT TOOL (SCAT3)

- Developed to establish a valid, standardized, systematic sideline evaluation for immediate assessment of concussion in athletes.
- It is objective and quantifiable
- Provides immediate feedback to medical personnel



SPORT CONCUSSION ASSESSMENT TOOL (SCAT3)

- 1. Symptoms
- 2. Memory Function
- 3. Balance Testing



BASELINE NEUROPSYCHOLOGIC ASSESSMENT

- Pittsburgh Steelers since 1993
- IUP since 2000 (SAC then ImPACT)
- IHS since 2002 (ImPACT)
- Great variability between athletes, not within an athlete



Neuropsychological Assessment Post Concussion

- Cognitive FUNCTION important for return to play decision. Assess information processing, planning, memory and switching mental set.
 - Paper & pencil test (McGill ACE, SAC)
 - Comprehensive Protocols administered by Neuropsychologists
 - Computerized test platforms (e.g. ImPACT, CogSport, ANAM, Headminders)



Baseline Neuropsychological Testing

- RTP is a Medical decision
- Considered a useful tool for RTP.
- Typically done when asymptomatic (exception in peds for academic reasons)
- Should ideally be performed by a neuropsychologist



NEUROPSYCHOLOGIC ASSESSMENT

If PRE-injury evaluation has been performed, neuropsychologic testing may be the MOST sensitive method of detecting post concussive dysfunction.



BASELINE COGNITIVE ASSESSMENT TESTING

- “At present, there is insufficient evidence to recommended widespread routine use of baseline NP testing.”



MANAGEMENT AND REHABILITATION



28 DEC. 2008 Pittsburgh Steelers QB Ben Roethlisberger. concussion

MANAGEMENT AND REHABILITATION

- REST
 - Physical
 - Cognitive (School)
- Asymptomatic
- Graded program of exertion
- Medical Clearance
- Return to Play



MANAGEMENT AND REHABILITATION

- REST

- Physical

- “Low-level exercise for those who are slow to recover MAY be of benefit, although the optimal timing following injury for the initiation of this treatment is currently unknown.”



ORTHOPAEDIC SURGERY

- David T. Biscup, MD
Board Certified
- Douglas S. Pappas, MD
Board Certified
- Craig C. McKelgan, DO
Board Certified
- Chong Hui Park, MD
Board Certified
- David B. Wilson, MD
Board Certified

PHYSICIAN

- Jagadeesh H. Shetty, MD
Board Certified
Physiatry and Pain Medicine

PODIATRY

- Howard P. Miller, DPM, FACFAS
Diplomate American College of Podiatric Surgery
Certified in Foot Surgery

PHYSICIAN EXTENDER

- Yasmina L. Conrad, PA-C
- Alan P. Keady, MPAC
- Gregory C. Pharrup, MPAC
- Christa L. Roetzel, CRNP

REHABILITATION

- Devin A. Schindler, PT
Director of Rehab Services

CONCUSSION SCHOOL/SPORTS EXCUSE

Patient Name: _____ Date _____

FIRST MIDDLE LAST

Patient DOB: _____

The above named student has suffered a concussion and is currently under care of this office. He/she is not permitted to participate in any contact sport activity until formally cleared by this office.

In addition to no contact sports, the additional recommendations apply:

___ No school

___ No gym class

___ Restricted gym class activity as specified below:

___ Full academic accommodations as specified below:

- ___ untimed tests
- ___ preprinted class notes
- ___ tutoring
- ___ reduced workload when possible
- ___ frequent breaks from class when experiencing symptoms
- ___ modified homework assignments
- ___ extended time on homework, projects
- ___ other:

___ Additional recommendations:

Physician Signature _____ MD/DO/PA-C/CRNP

COSM



MANAGEMENT AND REHABILITATION

- Acute Response: Player has ANY S/Sx of concussion
 - NOT allowed to return to play in current event
 - Should NOT be left alone. Regular monitoring for changes (Delayed Onset of S/Sx)
 - Should be medically evaluated after injury
 - Return to play under medical supervision

A player should NEVER return to play while symptomatic. “When in doubt, sit them out.”



MANAGEMENT AND REHABILITATION

•Return to Play Protocol

- No activity, complete rest; once asymptomatic, go to next level
- Light aerobic exercise (walking, stationary bike, NO P.R.E.)
- Sport specific training (skating, running, etc.)
- Non-contact training drills
- Full-contact training after medical clearance
- Return to full sport

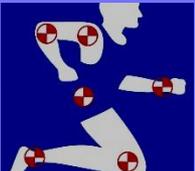
If recurrent S/Sx, drop back to previous asymptomatic level and try to progress again after 24 hours.



Canadian Academy of Sports Medicine Concussion Comm., Clin. J. Sports Medicine 2000; 10:209-211

MANAGEMENT AND REHABILITATION

- Pharmacological Therapy
 - Management of Specific S/Sx: (Sleep, Anxiety)
 - Modify Underlying pathophysiology of the condition
 - CONSIDERED ONLY IN COMPLEX CONCUSSIONS
 - Masking or Modifying S/Sx of Concussion?
- Sports Psychology
 - Depression:
 - Reported as possible Long-term consequence of TBI & Sports concussion.
 - fMRI: Limbic-Frontal Model of Depression



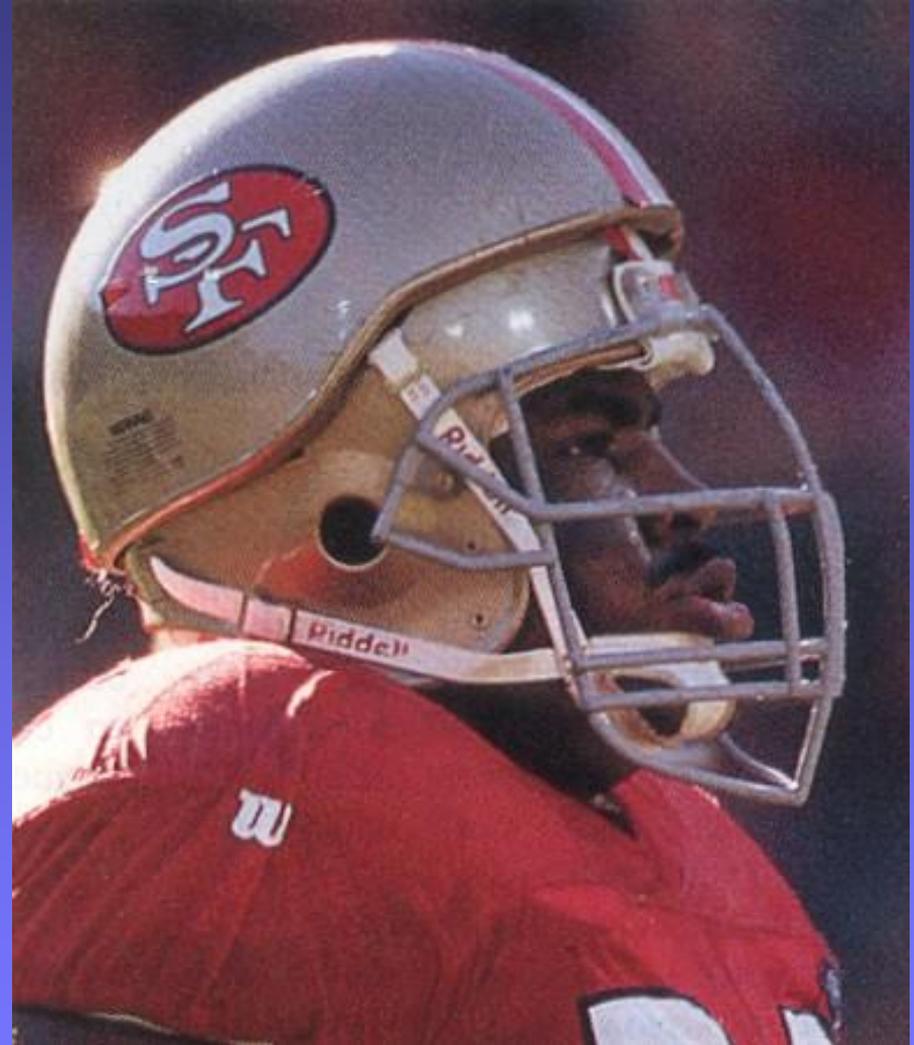
SPECIAL POPULATIONS

- Children & Adolescents: Recc for ≥ 13 y/o. Child SCAT3, Should not return to sport if not able to return to school.
- Elite vs. Non-Elite Athletes: No difference, but consider baseline NP testing (more resources).
- Chronic Traumatic Encephalopathy (CTE): Cause & effect relationship not demonstrated.



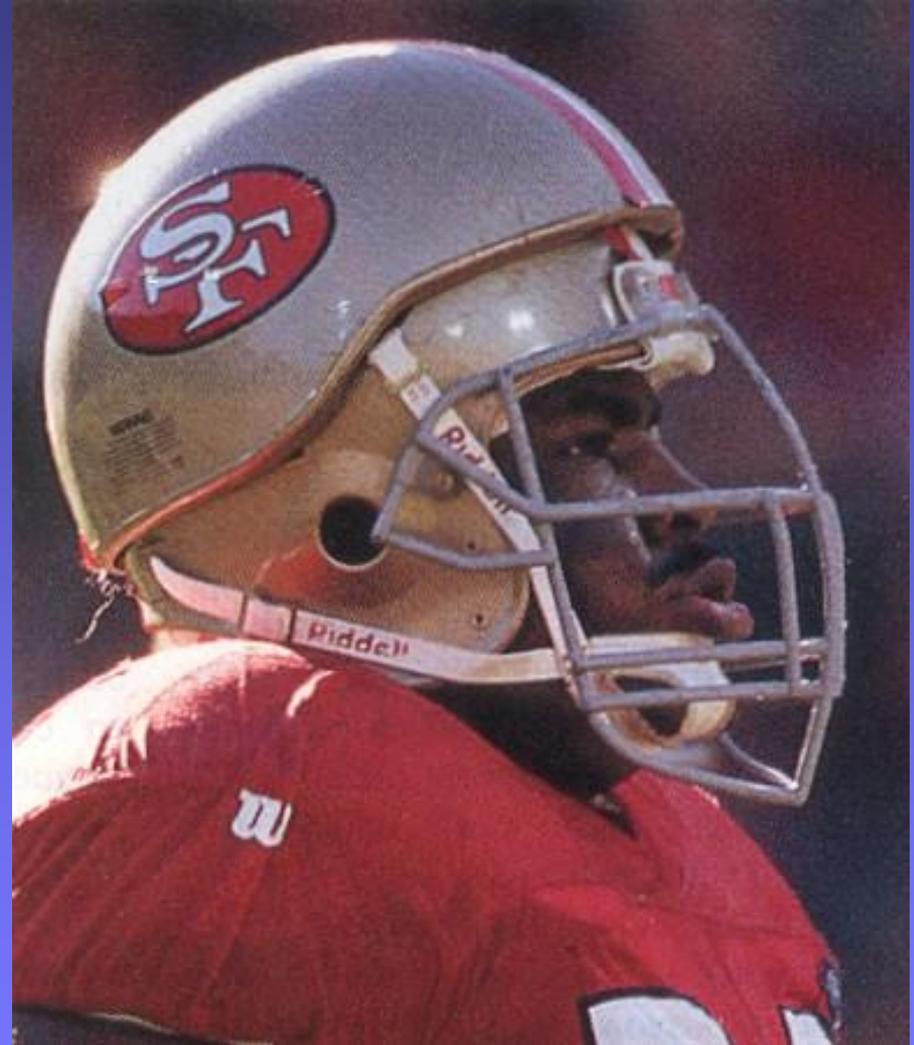
PREVENTION

- There is NO good clinical evidence that any currently available protective equipment will PREVENT a concussion.



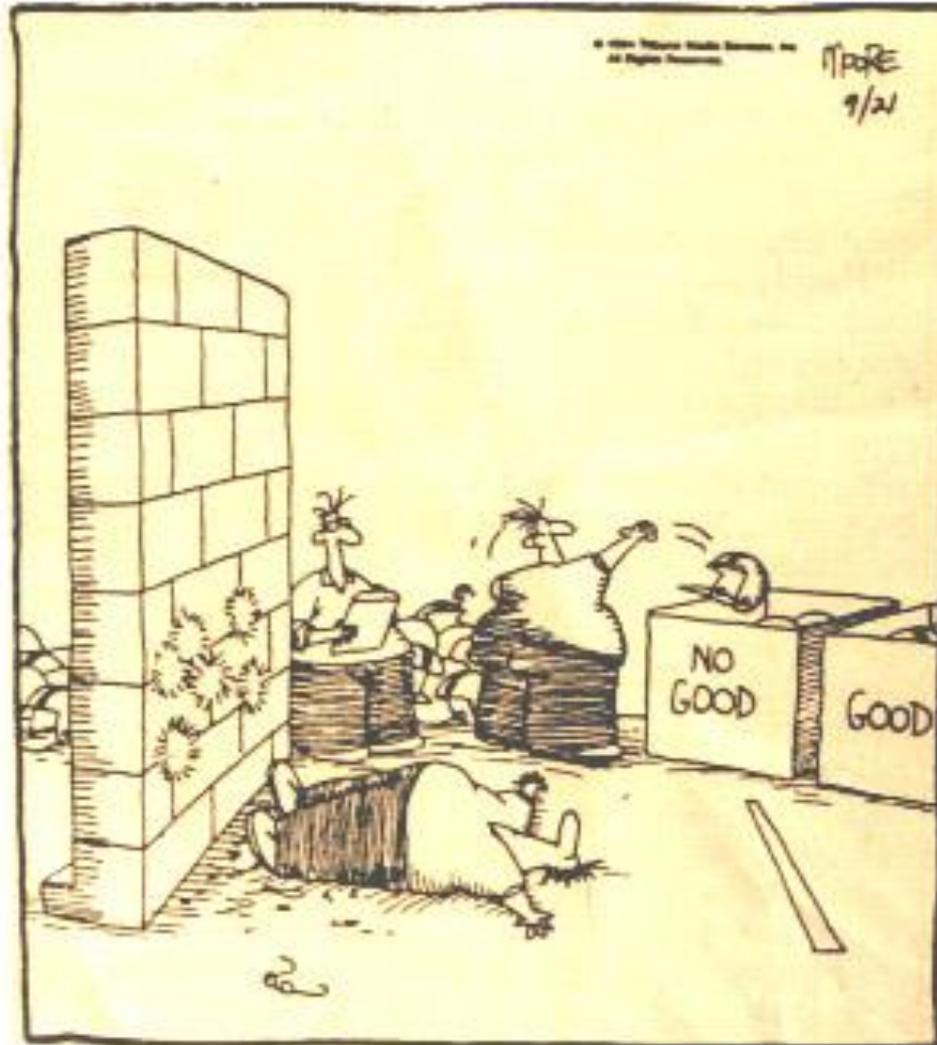
PREVENTION

- Obtain good history (equipment, MOI, etc.)
- Helmets (Head & Face)
- Risk Compensation
- Mouth Guards: (Theoretical, not proven)
- Rule Changes
- Rule Enforcement
- Aggression vs. Violence in sport



HELMET TESTERS

IN THE BLEACHERS



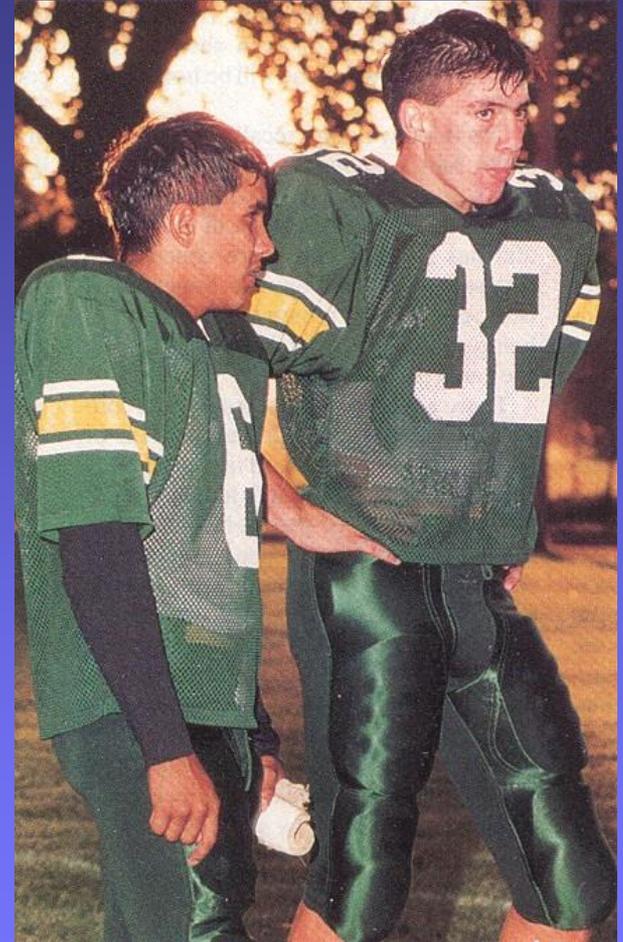
Helmet testers

HELMETS

- 1893 First Football Helmet Army v. Navy game
- Do NOT prevent Concussions
- May actually INCREASE the incidence of Concussions
- Do Decrease incidence of:
 - Skull Fracture
 - Major Head Trauma
- Riddell's Revolution T Helmet 2002
- 2011 May 10: Virginia Tech Rating System (Annals for Biomedical Eng.)

EDUCATION

- Health Care Providers
 - Athletes
 - Sports Officials
 - Administrators
 - Parents
 - Coaches
 - Media
- (www.cdc.gov/concussion/sports)
- (www.thinkfirst.ca)



EDUCATION

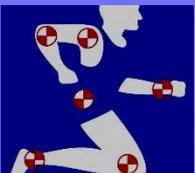
Co-Publications

- Clinical J. Sports Medicine
- Physician and Sports Medicine
- Neurosurgery
- Physical Medicine & Rehabilitation
- J. of Athletic Training
- Scandinavian J. of Medicine & Science in Sports
- J. of Clinical Neuroscience
- J. of Science & Medicine in Sport



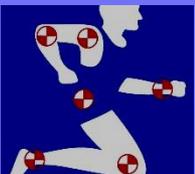
FUTURE

- Validation of SCAT3
- Gender effect
- Pediatric Care
- On field Predictors
- Long term outcomes
- Repeated concussions
- Molecular markers
- Imaging
- Functional deficits



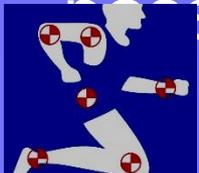
FUTURE

- The 5th International meeting will review & update present recommendations formally prior to 01 Dec. 2016



MEDICAL-LEGAL CONSIDERATIONS

- Not intended as a Standard of Care
- Management and return to play remains largely a CLINICAL judgment and individualized.
- Legislation (State & Federal) as of May 2011, 22 states have passed legislation.

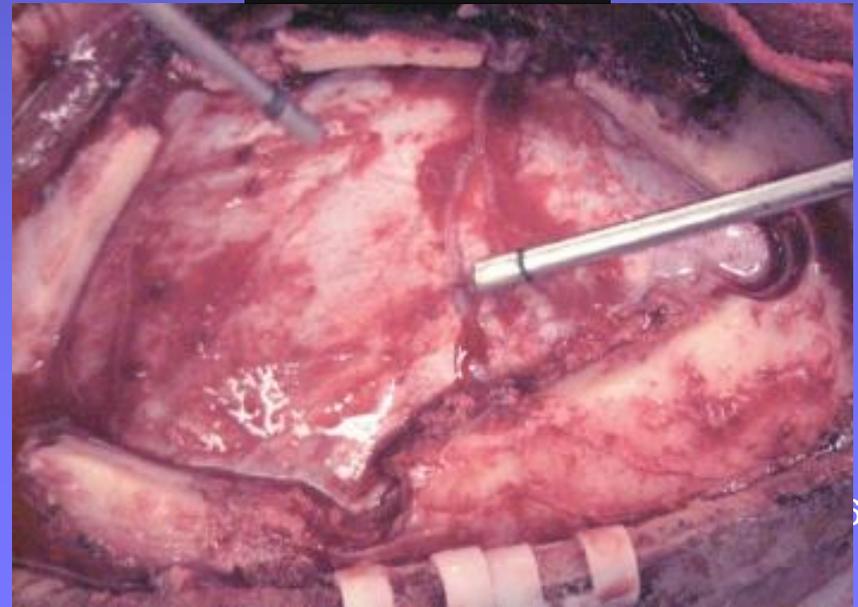


SUMMARY

- Epidemiology of Concussions
- Hx of Concussion Guidelines
- Define Concussion
- Recognize the S/Sx
- Proper Evaluation
- Return to Sport Guidelines
- Education
- Prevention



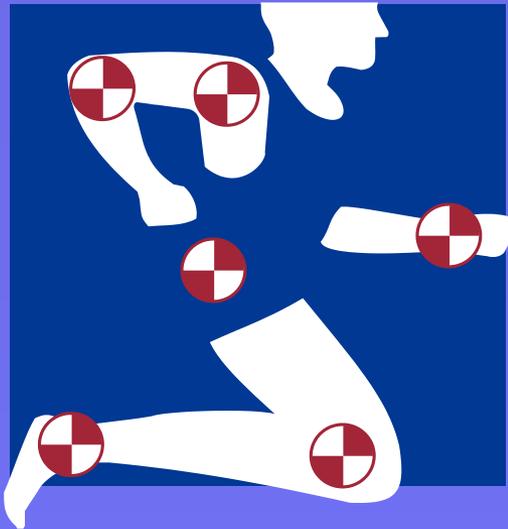
**CAVEAT: Not all concussions are
JUST concussions**
Natasha Richardson 17 Mar. 2009





Concussion: True or False

- 1. An MRI is the best way to diagnosis a concussion. FALSE
- 2. Most concussions resolve within 7 to 10 days. TRUE
- 3. LOC is the most common sign of a concussion. FALSE
- 4. If the only symptom is a mild headache, it is safe to return to play. FALSE



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