Sideline Assessment of Concussion

John P. DiFiori, MD
Professor and Chief,
Division of Sports Medicine and Non-Operative Orthopaedics
University of California, Los Angeles
Head Team Physician,
UCLA Department of Intercollegiate Athletes
Sideline Assessment of Concussion

- Definition
- Concussion management plan
- Concussion assessment tools
- Preseason education and evaluation
- Diagnosis
- Initial management
- Prevention
Sports-Related Concussion

- Heightened awareness
- Increased public and scientific scrutiny
- Increasing concern for long term effects
- All 50 states have passed legislation
Sports-Related Concussion

• Understanding of concussion is relatively limited

• Management should be guided by available data and sound clinical judgement.
Care of the Concussed Athlete (or any injury)

- Priority is the health and safety of the athlete

- Disclose any potential conflicts of interest
  - Compensated by employer (e.g. professional team)
  - Financial stake in technology

- If not directly working with a school or team:
  - a document should be provided to the athlete and family that permits communication to the school/coaching staff to avoid miscommunication and/or attempts by the athlete to return prior to medical clearance.
Care of the Concussed Athlete

• Delineate components of care

• If working with a school or team establish policy in advance

• “Plan your dive, and dive your plan”
NCAA Concussion Management Plan

April 29 2010 - NCAA issued a statement to help develop a consistent approach to concussion management.

4 Key Components:

– Requires institutions to have a concussion management plan on file.

– S-A with signs, symptoms or behaviors consistent with a concussion shall be removed from practice or competition and evaluated by an athletics healthcare provider with experience in the evaluation and management of concussion.

– Once dxed with concussion – no same day RTP

– Final authority for RTP shall reside with the team physician or their designee according to the concussion management plan.
NCAA Concussion Management Plan
Key Elements

• EAP – annually updated

• S-A will sign a statement accepting responsibility for reporting their injuries and illnesses to the sports medicine staff, including signs and symptoms of concussions.

• S-A will be provided educational material on concussions.

• Equitable access to athletics health care providers for each NCAA sport.
NCAA Concussion Management Plan
Management Elements

• **Coaches** will be provided educational material on concussions and information describing the Concussion Management Plan.

• Healthcare providers have *unchallengeable authority* to determine management and RTP of any ill or injured student-athlete.

• Plan should outline the roles of all staff.

• Providers should practice within the established standards for their profession.
NCAA Concussion Management Plan
Management Elements

• Baseline assessment for:
  • BB, BKB, Diving, Equestrian, Field Hockey, FB, Gymnastics, IH, Lax, Pole Vaulting, Rugby, Skiing, Soccer, SB, Water Polo, & Wrestling

• Baseline assessment:
  • Sx checklist
  • Standardized cognitive and balance testing
  • NP testing

• Serial monitoring for signs of deterioration
• RTP – stepwise and medically supervised
Policy Planning

- Identify multidisciplinary team and define roles
  - ATC staff
  - Team physician staff
  - Emergency response
  - Academic support staff
  - Nutritionist
  - Psychology
  - Psychiatry
  - Neuropsychiatry
  - Neurology
  - Neurosurgery
Aspects of Management

• Review standards for:
  – Education
  – PPE
  – Baseline evaluation
  – Clinical diagnosis
  – Acute management
  – Monitoring
  – Return to play
Aspects of Management

• Planning
• Education
• Implementation
• Review at end of season
• Update- new evidence
• Revise plan
• Repeat yearly
Definition

• SRC is considered a subset of mTBI

• International Conference on Concussion in Sport (2013):

“A complex pathophysiologic process affecting the brain, induced by biomechanical forces.”

A uniform definition does not exist
Definition

• Common features of concussion:
  – May be caused by direct blow to head/neck or body with force transmitted to head.
  – Typically results in rapid onset of short-lived neurologic impairment that resolves spontaneously.
  – Acute symptoms largely reflect functional disturbance.
  – Results in a set of clinical syndromes, that may or may not involve loss of consciousness.
  – Conventional neuroimaging is usually normal (CT, MRI)

Current Cornerstones of Concussion Diagnosis & Management

Symptoms

Physical Exam

Cognitive Eval
Symptom Checklists

• **Tools:**
  – 14-22 items graded 0-6
  – Post Concussion Symptom Checklist
  – Graded Symptom Checklist

• **Sensitivity** 64%–89%

• **Specificity** 91%–100%

• No data below HS level

*Neurology* 2013 Jun 11;80(24):2250-7
Silence on Concussions Raises Risks of Injury
By ALAN SCHWARZ
September 15, 2007

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.
- Did not want to leave the game.
- Did not realize a concussion was sustained.
- Did not want to let down their teammates.

66% 41% 36% 22%
Underreporting Continues

Sports-related concussion: Anonymous survey of a collegiate cohort

- Survey of 263 D1 athletes at single university (29% response rate)
- 22% said they would be unlikely to report concussion sx
- 43% of those who had had a concussion hid sx to remain in game
- Those w/hx of concussion were sig less likely to report sx of concussion in future
Balance Assessment

• Balance Error Scoring System
• Sensitivity 34%–64%
• Specificity 91%
Neurocognitive Testing


• Typically resolve in 5-7 days (McCrea et al JAMA 2003)

• Deficits may be present after clinical symptoms have resolved (Maddocks DL 1996 Brain Inj; Broglio S 2007 J Ath Tr 42:504-508)
Computerized NC Testing in Concussion

• Available computerized test packages:
  – Automated Neuropsychological Assessments Metris (ANAM) – military
  – CNS Vital Signs
  – Axon Sports/CogSport
  – Headminder CRI
  – ImPACT (immediate post-concussion assessment and cognitive testing)

• Much less time required: <20 min
• Baseline testing recommended
• Multiple forms to minimize practice effect
Cognitive Assessment

• Sideline Assessment of Concussion (SAC)
  – Orientation, Immediate Memory, Concentration, and Delayed Recall
  – Sensitivity 80%–94%
  – Specificity 76%–91%

• Pencil and Paper & Computerized Tools
  – Sensitivity 71%–88%

Neurology 2013 Jun 11;80(24):2250-7
Potential Limitations of NC Testing

• “Gaming” the baseline

• Reaction time affected by mouse or other external factors

• Response errors

Peyton Manning Admits to Intentionally Failing Preseason Concussion Screening
by Jeff Howe on Wed, Apr 27, 2011 at 3:36PM

NONCREDIBLE EFFORT DURING PEDIATRIC NEUROPSYCHOLOGICAL EXAM: A CASE SERIES AND LITERATURE REVIEW

Michael W. Kirkwood, John W. Kirk, Robert Z. Blaha, and Pamela Wilson
Department of Physical Medicine & Rehabilitation, The Children's Hospital, Aurora, Colorado and University of Colorado Denver School of Medicine, U.S.A.

Neuropsychological test interpretation rests upon the assumption that the examinee has exerted full effort. If an individual provides inadequate effort during exam, the resulting data will be invalid and represent an underestimate of the person’s true abilities. Although
Combining Concussion Assessment Tools

• NC testing
  – Paper: 43.5% had decrement
  – ImPACT: 62.5% decrement on ≥ 1 cognitive variable
    • 16.7% had increase in ImPACT sx score but no change on cognitive
  – Headminder CRI – 78.6% had decrement on ≥ 1 variable

• Overall: 89-96% sensitivity with combination of sx, postural testing and NP testing

Pre-season Concussion Education

- Concussion Management Policy
  - Key elements
    - Reviewed yearly
    - Coaches and athletes must receive education
    - Specifies physician directed management
- NCAA Concussion Fact Sheets
- Concussion Acknowledgement forms signed by coaches and S-A
Preparticipation Evaluation

• Have you ever had a head injury or concussion?
• Have you ever been hit in the head and been confused or lost your memory?
• Have you ever had a seizure?
• Do you have frequent or severe headaches?
• Do you have headaches with exercise?
• Have you had a facial or dental injury from sports?
Preparticipation Evaluation

• If history of concussion identified, then further information is obtained including:
  – Number of previous concussions
  – Prior LOC, amnesia
  – Recovery time/time lost from participation
  – Treatment rendered
  – Attentional disorders or learning disabilities, decline in/poor academic performance
  – Hx of migraine HA
Limitations of the PPE

- Rubber stamping
  - Using embedded question approx 7% did not read questions
- Underreporting
- Intentional withholding

Have you Intentionally Withheld Information on a PPE?

N=169; 97 M 72 W
Pre-Season Baseline Evaluation

• NCAA rec sports

• Baseline symptom checklist

• Balance Testing

• Baseline neurocognitive testing
Baseline Data among NCAA D1 Athletes

<table>
<thead>
<tr>
<th>Sport</th>
<th>Men’s</th>
<th>Women’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Football</td>
<td>99</td>
<td></td>
</tr>
<tr>
<td>Water Polo</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Basketball</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Volleyball</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>Soccer</td>
<td>29</td>
<td>19</td>
</tr>
<tr>
<td>Gymnastics</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>TOTAL: 228 athletes</td>
<td>178 (78.1%)</td>
<td>50 (21.9%)</td>
</tr>
</tbody>
</table>

Graded Symptom Checklist

- 27.9% reported sx at baseline
- Ave Total Score: 2.29
Graded Symptom Checklist

Percentage of Athletes Reporting Symptom

- Head Pressure: 8.3%
- Neck Pain: 9.17%
- Headache: 10.48%
- Trouble Falling Asleep: 11.35%
- Fatigue: 11.79%
Recall

• Immediate (out of 5)
  – Trial #1: 4.50 ± 0.86
  – Trial #2: 4.84 ± 0.53
  – Trial #3: 4.91 ± 0.51

• Delayed recall: 3.89 ± 1.1

• No gender difference was observed

• No difference by concussion history was observed
Concentration

- Reverse Digits:
  - 3 Digits: 95%
  - 4 Digits: 91%
  - 5 Digits: 68%
  - 6 Digits: 63%

- Reverse Months: 83%

- No gender difference was observed

- No difference by concussion history was observed
Modified Balance Error Scoring System

- Double Leg: 10 ± 0
- Single Leg: 7.85 ± 2
- Tandem Stance: 8.79 ± 1.48
- Total: 26.63 ± 3.05

- Women demonstrated higher balance scores than men:
  - Single leg (p<0.001)
  - Tandem stance (p=0.001)
  - Total (p<0.001)

- No difference by concussion history was observed
Conclusions & Clinical Utility

- 28% of NCAA Division I Athletes report symptoms at baseline
  *Expecting a symptom score of zero prior to RTP may not be valid*

- Double leg stance appears unnecessary during baseline testing
  *Errors on DLS during an injury eval is concerning*

- Concussion history does not appear to affect baseline SCAT2 performance

- Gender differences seem to exist in baseline mBESS, but not in other SCAT2 components (Related to height?)

- Baseline concentration testing (reverse digits/months) appears warranted
On the Field Evaluation

• Impaired consciousness?
  – Protect spine, ABCs, spine board, transport
• Ask how injury occurred, where hit
• Any neck pain or paresthesias?
On the Field Evaluation

- Palpation of head and neck
- Dental exam
- Pupillary exam (fundoscopic exam in locker room)
- Cranial nerves
- Strength and sensation of extremities
- Balance/gait
Initial Findings

**Concussion Signs**
- Loss of consciousness – NOT common
- Appears dazed
- Confused about play
- Answers question slowly
  - Familiarity is helpful
- Forgets plays prior to hit (Retrograde amnesia)
- Forgets plays after hit (Anterograde amnesia)
- Irritability, emotional lability-tearfulness, giddiness, flat affect
- Seizures

**Concussion Symptoms**
- Headache
- Nausea/vomiting
- Balance problems
- Blurred vision
- Photosensitivity
- Phonophobia
- Feeling sluggish
- Feeling foggy
Standardized On the Field Assessment

- **Orientation**
  - What period/quarter/half are we in?
  - What stadium/field is this?
  - What city is this?
  - Who is the opposing team?
  - Who scored last?
  - What team did we play last?

- **Anterograde Amnesia**
  - Ask the athlete to repeat the following words: *Girl, Dog, Green*

- **Retrograde Amnesia**
  - *Ask the athlete the following:*
  - Do you remember the hit?
  - What happened in the play prior to the hit?
  - What happened in the quarter/period prior to the hit?
  - What was the score of the game prior to the hit?

- **Concentration**
  - *Ask the athlete to do the following:*
  - Repeat the days of the week backwards (starting with today)
  - Repeat the months of the year backward (starting with December)
  - Repeat these numbers backward 63 (36), 419 (914), 6294 (4926)

- **Word List Memory**
  - Ask the athlete to repeat the three words from earlier: *Girl, Dog, Green*

Sideline Assessment

- Onset may be delayed
- Not all symptoms or findings may occur
- Denial of symptoms common
- Have a high index of suspicion
On the Field Evaluation

• Immediate assessment of symptoms/findings
• Once concussion suspected, remove from contest/practice
  – Take helmet or other equipment
  – Notify ATC staff and coaches that player is out
  – Do not return to play same day, unless alternative diagnosis made by MD
• Ongoing monitoring for deterioration
• Serial exams
### Concussion Evaluation Form

**Evaluation Date/Time:**

**Concussion Day #:**

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>0 = none</th>
<th>0 – 6</th>
<th>0 – 6</th>
<th>0 – 6</th>
<th>0 – 6</th>
<th>0 – 6</th>
<th>0 – 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Headache</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Pressure in head</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Neck Pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Nausea or vomiting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Dizziness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Blurred vision</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Balance problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Sensitivity to light</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Sensitivity to noise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Feeling slowed down</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Feeling like “in a fog”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. “Don’t feel right”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Difficulty concentrating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Difficulty remembering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Fatigue or low energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Confusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Drowsiness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Trouble falling asleep</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. More emotional</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Irritability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Sadness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Nervous or anxious</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Are you currently feeling normal?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Any other abnormal symptoms since your last evaluation?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total sx score**

- **Document findings using a standardized form**
- **Allows for monitoring of findings at follow up exams**
# SCAT 3

**SCAT3**

Sport Concussion Assessment Tool – 3rd Edition

[Image of the SCAT3 assessment form]

## What is the SCAT3?

The SCAT is a standardized tool for evaluating injured athletes for concussion and can be used in conjunction with other tools or on its own. The SCAT was developed by the SCAT Assessment Team led by the Concussion in Sport Group. The SCAT is intended for use by medical professionals. If you are not qualified, please use the Sport Concussion Assessment Tool (SCAT), which is available for free online.

## Background

**Name:**
**Gender:**
**Age:**
**Time of injury:**
**Date of assessment:**

## Cognitive & Physical Evaluation

### Cognitive Assessment

<table>
<thead>
<tr>
<th>Orientation</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>What month is it?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is the date today?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is the day of the week?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What time is it right now?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SYMPTOM EVALUATION

**How do you feel?**

### Medically Scored

#### Headache

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Neck Examination

<table>
<thead>
<tr>
<th>Range of motion</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Balance Examination

#### Medial-Lateral (left-right)

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Coordination Examination

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## SAC Delayed Recall

**Delayed recall score:**

---

*SCAT3 SPORT CONCUSSION ASSESSMENT TOOL – 3RD EDITION © 2010 Concussion in Sport Group*
SCAT3

Standardized Assessment of Concussion (SAC)

Sensitivity 0.80-0.94
Specificity 0.76-0.91

1. Orientation: month, date, day, year, time
2. Immediate memory: 5 words x 3 tries
3. Concentration:
   a. Digits backwards (3, 4, 5, 6)
   b. Months in reverse order
4. Test Balance
5. Upper extremity coordination
6. Delayed recall: same 5 words, one try.

Balance Error Scoring System (BESS)

Sensitivity 0.34-0.64
Specificity 0.91

a. Double leg stance (20s)
b. Single (non-dominant) leg stance (20s)
c. Tandem stance (20s)
Signs of Deteriorating Neurologic Function

- Seizures
- Impaired consciousness
- Focal neuro signs
- Repeated vomiting
- Increasing slurring of speech, confusion
- Severe worsening headache
- Severe irritability
Possible risks of premature return to play

- Second impact syndrome
- Repeat concussion – vulnerable period
- Chronic headaches
- Depression
- Long-term cognitive deficits
- Post-traumatic encephalopathy
Advanced Neuroimaging
The Future of Concussion Management?

- DTI
- MRS
- fMRI
- PET

Pharmacologics

Omega-3 fatty acid supplementation and reduction of traumatic axonal injury in a rodent head injury model

Laboratory investigation

James D. Mills, M.D., Julian E. Bailes, M.D., Cara L. Sedney, M.D., Heather Hutchins, M.S., R.D., and Barry Sears, Ph.D.

1Department of Neurosurgery, West Virginia University School of Medicine, Morgantown, West Virginia; and 2Inflammation Research Foundation, Marblehead, Massachusetts
“As amazing as the marketing claims here are, the science doesn’t support the use of any dietary supplements for the prevention of concussions or the reduction of post-concussion symptoms that would enable one to return to playing a sport faster.”
NAD Recommends Trinity Sports Group Discontinue Certain Claims, Testimonials for ‘NeuroImpact’ Supplement

New York, NY – Feb. 11, 2014, 2014 – The National Advertising Division has recommended that Trinity Sports Group, LLC, discontinue certain claims for the company’s “NeuroImpact” dietary supplement, including claims that the product has been clinically tested.
NCAA Rule Change for FB 2013

Rules committee recommends ejection for targeting defenseless players

Ty Halpin, NCAA.com
Last Updated - February 13, 2013 3:00 GMT
Contact | Archive | RSS

The NCAA Football Rules Committee took steps to further protect student-athletes by proposing a rule to eject players who target and contact defenseless players above the shoulders.

The committee, which met Monday through Wednesday, unanimously voted to increase the on-field penalty for targeting. The penalty, if approved by the Playing Rules Oversight Panel, will be a 15-yard penalty and automatic ejection of the player. The Panel meets on March 6 to review the proposals and membership comment.
The Pac-12 will limit the amount of contact that will be allowed during football practices. Pac-12 Commissioner Larry Scott said specific details would be forthcoming at the league's media day in July and said the league-wide guidelines would be "less than what the NCAA permits."
NCAA Targets Injury Cut With Less Full-Contact Football Practice
By Eben Novy-Williams Jul 7, 2014 9:01 PM PT

The National Collegiate Athletic Association suggested curbing full-contact football practices, echoing a policy instituted by the Ivy League in 2011.
The recommendation is among a set of guidelines created to “generate a cultural shift within college athletics,” the NCAA said on its website yesterday. Other changes suggested are requirements for medical care and instructions for the diagnosis and management of sport-related concussions.
Pop Warner Football Rule Changes 2012

• No full speed head-on blocking or tackling drills in which the players line up more than 3 yards apart are permitted. There should be no intentional head-to-head contact!

• The amount of contact at each practice will be reduced to a maximum of 1/3 of practice time. “Contact” means any drill or scrimmage in which players go full-speed with contact.
Prevention

- Mouthguards
  - No evidence that they prevent SRC
  - Evidence supports use for prevention of dental trauma

- Hemet add ons
  - No evidence to support reduction in SRC
  - Risk compensation is a concern

- FTC cracks down on anti-concussion claims
- Increased concern about sports-related head injuries leads to rise in products that promise protection

- September 06, 2012|By Julie Deardorff, Chicago Tribune reporter
Not Little Adults: Special Concerns in Youth Concussion

• Immature brain may be more vulnerable to the effects of concussion

• White matter fiber tracts not fully myelinated

• Unmyelinated fibers more susceptible to concussive injury (Reeves 2005 Exp Neurol)
Not Little Adults: Special Concerns in Youth Concussion

• Immature rats raised in enriched environments develop more elaborate neuronal connections, increased cerebral cortex thickness, and superior cognition.

• However, after concussive brain injury, immature rats do not respond to rearing in an EE (Fineman 2000 J Neurotrauma)
Not Little Adults: Special Concerns in Youth Concussion

- Clinical symptoms following concussion are more generally more prolonged in children and adolescents

- Memory and neurocognitive deficits persist longer after symptom resolution (Field 2003 J Pediatr)
Avoiding the Pitfalls

• Intentional under-reporting

• Lack of initial recognition – must observe over time

• Failure to diagnose concomitant injury

• Don’t rely on one tool – none are completely reliable
Key Points

• Establish overall management approach with all staff

• Have high index of suspicion

• Low threshold to remove from play
  – “When in doubt, sit them out”

• Individualize management including academic support

• Understand limitations of baseline assessments and components of management, including NP testing
UCLA Concussion Prevention Program
Resources

• NCAA Sports Medicine Handbook
• NCAA Concussion Fact Sheets
• CDC Concussion Toolkit
  http://www.cdc.gov/concussion/headsup/physicians_tool_kit.html
Thank you
Caution

• If bilateral symptoms or neck pain is present, manage for possible cervical spine injury.

• Other red flags:
  — Lower extremity symptoms
  — Severe cervical spasm
  — Limited neck range of motion or apprehension
Physical Findings

• Rule out C-spine injury first
  – Palpate
  – Range of motion, if clear

• Rule out fracture (clavicle, scapula, prox humerus)
Physical Findings

• Neck: NTTP, full active range of motion, Spurling - may be + in cases with ext-compression mx
• May have TTP over supraclavicular region (Erb’s point)
• Sensory loss that is not dermatomal
• Weakness of abduction, external rotation, elbow flexion (C5-C6)
# Physical Examination

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Innervation</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deltoid</td>
<td>Axillary (C5,C6)</td>
<td>Shoulder abduction</td>
</tr>
<tr>
<td>Supraspinatus</td>
<td>Suprascapular (C5,C6)</td>
<td>Empty can test</td>
</tr>
<tr>
<td>Infraspinatus</td>
<td>Suprascapular (C5,C6)</td>
<td>External rotation</td>
</tr>
<tr>
<td>Biceps brachii</td>
<td>Musculocutaneous (C5,C6)</td>
<td>Elbow flexion</td>
</tr>
<tr>
<td>Pronator teres</td>
<td>Median (C6,C7)</td>
<td>Forearm pronation</td>
</tr>
<tr>
<td>Triceps brachii</td>
<td>Radial (C7,C8)</td>
<td>Elbow extension</td>
</tr>
<tr>
<td>Abductor digiti minimi</td>
<td>Ulnar (C8,T1)</td>
<td>Fifth digit abduction</td>
</tr>
</tbody>
</table>
Differential Diagnosis

• C-spine injury
  – Fracture
  – Disc herniation
  – Instability
  – Cord contusion
• Rotator cuff injury
• Shoulder instability- “dead arm syndrome”
• Clavicle fx
• AC joint injury
• Scapular fx/ coracoid fx
• Proximal humerus fx
• TOS
The National Collegiate Athletic Association suggested curbing full-contact football practices, echoing a policy instituted by the Ivy League in 2011.
The recommendation is among a set of guidelines created to “generate a cultural shift within college athletics,” the NCAA said on its website yesterday. Other changes suggested are requirements for medical care and instructions for the diagnosis and management of sport-related concussions.