Management of Sports Concussions

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Learning Objectives

- Understand the signs, symptoms, and natural history associated with concussions
- Understand the basic management principles of sports-related concussions
- Be able to safely return an athlete to play following a concussion
Concussion Symptoms

Neuropsychiatric
- More emotional
- Sadness
- Nervousness
- Irritability

Migraine (Physical Sx)
- Headaches
- Visual Problems
- Dizziness
- Noise/Light Sensitivity
- Nausea

Cognitive Symptoms
- Attention Problems
- Memory dysfunction
- “Fogginess”
- Fatigue
- Cognitive slowing

Sleep Disturbance
- Difficulty falling asleep
- Sleeping less than usual
King-Devick Testing

- Total time to read all the numbers
- Time improves with clinical recovery
- Has been shown to parallel ImPACT results

10
BESS
(Balance Error Scoring System)

- Requires a firm level surface and a foam pad
- 6 maneuvers of 20 seconds each
- Total number of correction errors:
  - Opened eyes
  - Heels / toes lifted
  - Hands off hips
  - Sway > 30°
Results of an ImPACT test

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<table>
<thead>
<tr>
<th>Exam Type</th>
<th>Baseline</th>
<th>Post-concussion</th>
<th>Post-concussion</th>
<th>Post-concussion</th>
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<tbody>
<tr>
<td>Exam Language</td>
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<td>Test Version</td>
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### Composite Scores *

<table>
<thead>
<tr>
<th>Composite Score</th>
<th>Baseline</th>
<th>Post-concussion</th>
<th>Post-concussion</th>
<th>Post-concussion</th>
<th>Post-concussion</th>
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<tbody>
<tr>
<td>Memory composite (verbal)</td>
<td>93</td>
<td>75%</td>
<td>66</td>
<td>1%</td>
<td>57</td>
<td>&lt;1%</td>
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<tr>
<td>Memory composite (visual)‡</td>
<td>70</td>
<td>23%</td>
<td>41</td>
<td>&lt;1%</td>
<td>49</td>
<td>1%</td>
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<td>Visual motor speed composite</td>
<td>45.88</td>
<td>85%</td>
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<td>86%</td>
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<tr>
<td>Reaction time composite</td>
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<td>46%</td>
<td>0.60</td>
<td>6%</td>
<td>0.66</td>
<td>6%</td>
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<td>Impulse control composite</td>
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<td>Total Symptom Score</td>
<td>0</td>
<td></td>
<td>14</td>
<td></td>
<td>3</td>
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</table>

* Scores in **bold** type indicate scores that exceed the Reliable Change Index score (RCI) when compared to the baseline score. However, scores that do not exceed the RCI index may still be clinically significant. Percentile scores, if available, are listed in small type. Please consult your ImPACT User Manual for more details.

‡ Clinical composite score is available only for exams taken in ImPACT version 2.0 or later.
Computerized Neuropsychiatric Testing (ImPACT, etc.)

Current Consensus Opinion . . .

- The majority of concussions can be managed appropriately without the use of NP testing
- NP testing should be interpreted by a healthcare professional trained and familiar with the test being used
- *NP testing should be used only as a part of a comprehensive concussion management strategy and should not be used isolation.*

\(^2\)
Concussion Management

- Individual approach for each injury
- Rest until symptom free at least 48 hours
  - Physical Rest?
  - Cognitive: Reduce academic load in the classroom
- Medications
  - Pain medications (Tylenol, NSAIDs?)
  - Sleep Aids (Melatonin)
- Rehabilitation
  - Physical Therapy (Cervical Spine)
  - Vestibular Therapy (Balance)
  - Vision Therapy (Oculomotor Tracking)
Concussion Management - Rest

RCT of strict physical rest vs. limited activity x 5 days following concussion

Results: patients with strict rest exhibited more daily post-concussive symptoms and slower overall symptom resolution compared to those who were allowed some level of physical activity.

Conclusion: Strict physical rest for adolescents immediately after concussion offers no added benefit.

Impact: Individual decision regarding resumption of physical activities is recommended.
Concussion Management: Cognitive Symptoms

- Relieve the Cognitive demands of school
  - ½ days to full days?
  - Increase time for testing, other testing accommodations
  - Extra time for assignments, ?
  - Reduction in amount of assigned work
  - Extra breaks during the school day
Concussion Management: Rehabilitation

Physical Therapy
- Address the cervical spine

Vestibular Therapy
- Balance and dizziness issues

Convergence Therapy
- Address underlying convergence issues with the eye

Comprehensive Neuropsychiatric Evaluation

Pain Management, Rehab Medicine . . .
Return to Play Criteria

No return to play in the current practice/game
No return to play until completely symptom free
  - At rest, and with activity
  - Tolerating daily activities, school, etc.
Completion of a stepwise return to activity after symptoms resolve (Return-To-Play Protocol)
  - During recovery, symptoms may resolve at rest and return with activity

“When In Doubt, Sit Them Out”
Return To Play Protocol

Step 1: Complete rest until symptom-free
Step 2: Light aerobic exercise
Step 3: Non-contact drills/Moderate exercise
Step 4: Modified full practice (no contact)
Step 5: Full contact drills/practice
Disqualification from Sports

- No evidence based guidelines exist
- Individual decision
  - Concussion history
    - Prolonged recovery times
    - Reduced concussion threshold
  - Any structural abnormality on imaging
  - Diminished academic performance
  - Persistent Post-Concussive symptoms
Complications of Concussion
**Second Impact Syndrome**

Occurs when a relatively minor second impact occurs in the setting of an acute concussion

- Catastrophic rapid increase in ICP causing brain herniation and death
- Athletes less than 21 are at greatest risk
- Pathophysiology not well understood

Uncertain if represents pathology separate from concussion (Malignant Brain Edema)
Post Concussion Syndrome

At least 3 persistent concussion symptoms for three months following the initial injury

Risk factors:
- ADHD, Depression/Anxiety, Migraine history
- Concussion History
- Delayed Presentation

Treatment is multi-disciplinary and individualized
Chronic Traumatic Encephalopathy (CTE)

Neurodegenerative disease associated with repetitive head trauma

- Accumulation of τ protein in specific areas of the brain
- Executive dysfunction, memory impairment, depression, impulse control
- Diagnosis confirmed on post-mortem histopathology
- Develops decades after exposure to brain trauma
Can a concussion be prevented?

- Better Equipment?
- Neck Strengthening?
- Rule Enforcement?
Football Helmets and Concussion Prevention

Prospective cohort study of 2000+ HS football players during the 2012 and 2013 seasons.

- Conclusion: helmet brand, age, and recondition status was not associated with the risk of concussion in high school football players.  

Epidemiological study 2008-2013 involving 3 million+ athlete exposures (practice & game)

- Conclusion: new and reconditioned football helmets provided the same protection against concussions.  

Epidemiological study of 4580 concussions over a 9 year period looking at helmet fit and concussion severity.

- Conclusion: improper fit of helmet was a risk factor for increased concussion symptoms.
In head / head impact, the headgear provided an overall 33% reduction in impact force.

No significant reduction in force during head / ball contact.

Conclusion: The football headgear models tested did not provide benefit during ball impact. This is probably because of the large amount of ball deformation relative to headband thickness. However, the headgear provided measurable benefit during head to head impacts.
Neck Muscle Strengthening

A prospective study of 6000+ athletes in three sports (basketball, soccer, lacrosse): evaluation of neck strength and incidence of concussion.

Results: overall neck strength was a significant predictor of concussion ($p = 0.004$).

For every one pound increase in neck strength, the risk of concussion decreased by 5% ($\text{OR} = 0.95$, 95% CI 0.92–0.98).
Take Home Points

- Be able to recognize concussion symptoms and realize they can evolve after an injury; recovery from that concussion is unique to each injury.
- Each concussion is different, so the approach to recovery may also vary.
- Make sure an athlete completes a graded return-to-play protocol before they are fully cleared.
- “If in doubt, sit them out!”
Useful Resources

http://www.cdc.gov/concussion/HeadsUp
http://www.amssm.org
http://www.acsm.org


