Current Concepts of Concussion Evaluation and Management

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DISCLOSURES

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SESSION OBJECTIVES

• Identify indications and timing for computerized neurocognitive testing as it pertains to concussion management.
• Summarize the basics of interpreting computerized neurocognitive testing, and common errors with these tests for concussion management.
Clinical:

✓ Ten physicians, a nurse practitioner, a neuropsychologist, and a registered nurse.

✓ Collaborators in neurosurgery, trauma, neuropsychology, and neurology.

✓ Over 3500 appointments per year

✓ Employ all the latest strategies and technologies in sport-related concussion assessment and management.

Research:

✓ Both clinical and basic science.
Preview

• Definition and Physiology
• Assessment and Management
• Return to Play Considerations
• Management in Prolonged Recovery
• Prevention
What is a concussion?

• Functional Injury - Not a structural injury*
• Making the diagnosis
• LOC is not essential for the diagnosis
• Return to play
Pathophysiology

• Ion flux
  – (efflux of K+, influx of Ca+)
• Depolarization – spreading depression
• Intracellular Glucose delivery interrupted
• Decreased flow with increased demand
• Creates metabolic dysfunction and cell vulnerability
  – (“Energy Crisis”)
During Injury - Ion Flux

During injury, potassium ions (K⁺) rush out of the cell...

...and toxic calcium ions (Ca²⁺) rush into the cell, leading to metabolic dysfunction.
“Energy Crisis”
Why Proper Management Is Important

• Window of vulnerability
• Physiology of developing brains
• Unique responsibilities
  – Enormous pressure and urgency with academics
(Please choose only ONE number for each symptom)

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<thead>
<tr>
<th>Symptoms</th>
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Total PCSS: _____________
Management - Overview

• Initially:
  – Remove from contact sports
  – Physical rest
  – Cognitive rest / academic accommodations
    • (be wary of “rest overdose” and deconditioning)
  – Answer questions, Manage expectations
  – If no improvement consider interventions based on most prominent symptom domain
Management

• Two central principles
  – Prevent new injury, and minimize school interruption
• School is a priority
• Prevent deconditioning
• Physical and cognitive endurance
• Prevention!
Avoid “Rest Overdose”

• Physical deconditioning
• Cognitive endurance
• Social isolation and stress
• Growing body of evidence for activity
“Aggressive Rest” Phase 1

Typically 3 to 5 days or less

- Rest
- Students often do not attend school
- Strict limits on screen time/use of electronics/reading
- No sports/rough housing
- Stretching and walking twice per day
Phase 2
Often 1 to 3 weeks

- Half days (briefly) to full days as tolerated

- School work despite low grade, stable symptoms?

- Loosen digital restrictions as school is tolerated

- Begin “nose breathing level” exercise
Phase 3

• When full days and full workload is tolerated, advance to “mouth breathing” level of exercise

• Non-contact / low risk drills, stick handling, ball handling

• School performance is the priority and driving principle
Roadblocks to Progression

• Schools and teachers may need more specific parameters, or may have a protocol in place
• Athletic trainers may not be comfortable with allowing exercise if any symptoms exist
• P.E. class or teams may have “all or nothing” rule
Date:

Patient name:

The above patient was evaluated at the Division of Sports Medicine, Children's Hospital Boston after sustaining a head injury on

The following document summarizes our academic recovery plan and recommendations.

GENERAL CONSIDERATIONS: Although there is significant variability in symptom presentation and duration, all individuals who sustain a head injury will need time for their brains to recover. It is not unusual to experience headaches and difficulties with attention, concentration, and memory. These symptoms resolve over time. However, if individuals return to pre-injury activity levels too quickly, there is the potential for long-term impact. Getting more rest than usual, modifying daily routines, and managing expectations can all help facilitate recovery and minimize symptom severity.

EDUCATIONAL ACCOMMODATIONS: The symptoms associated with head injury may affect academic performance. The cognitive exertion that school requires can provoke symptoms. Therefore, the following accommodations are recommended:

School Re-entry/Attendance:
- √ Full days as tolerated
- √ ½ days may advance as tolerated
- √ Initiate homebound education
- √ No school until __________ then attempt half/full days as tolerated.

**Full or partial days missed due to post-concussion symptoms should be medically excused.

Academic Testing:
- √ Test in a quiet environment
- √ Extra time to complete tests
- √ Three testing sessions if multiple tests
- √ Eliminate tests when possible
- √ Referral to a professional for cognitive assessment
- √ Reḳument for state license to return to school
- √ Schedule no more than one test per day

Curriculum Accommodations:
- √ Extended time: Allow student extended time to turn in assignments. While experiencing symptoms of headache and concentration difficulties, increased, students are advised to rest, and therefore may need a modified schedule for completing assignments.
- √ Workload reduction: Reduce overall amount of make-up work, class work, and homework. Examples of how to shorten work include reducing the length of essays, have the student do every other problem in a homework assignment, or highlight key concept areas for testing while eliminating testing on less critical topics.
- √ Make up/Keep up: Develop a systematic plan for balancing the “make up/keep up” challenge of recovery. The process of making up missed work can be anxiety provoking and needs to be undertaken over time, with support and supervision.
- √ Note taking: Allow student to obtain class notes or outline beyond the usual limits for organization and reduce multi-tasking demands. If this is not possible, allow the student photocopies notes from another student.
- √ Breaks: Take breaks as needed. For example, if headache worsens during class, the student may need to put his/her head on the desk to rest. For more severe symptoms, he/she may need to go to the nurse’s office. In some situations, scheduled breaks interspersed throughout the day may be required.
<table>
<thead>
<tr>
<th>STAGE</th>
<th>KEY IDEAS</th>
<th>EXPECTED DURATION</th>
<th>TEACHER'S ACTIONS</th>
<th>STUDENT'S ACTIONS</th>
</tr>
</thead>
</table>
| **RED** | Complete Rest | 2-4 days | • Contacted by nurse.  
• Create a team captain  
• No work to be done by student. | • REST  
• Out of school.  
• Strict limits on computers, television, texting and cell phones. |
| **ORANGE** | Significant deficits in processing and in processing and concentration. SLOW integration back into activity. | 2-14 days | • Goal: Transition student back to school at a SLOW pace  
• Develop three categories for assignments:  
1. Excused. Not to be made up.  
2. Accountable. Responsible for content, not process. May work with another student or tutor.  
3. Responsible. Must be completed by student.  
• Advocate for a tutor if patient is struggling with workload.  
• Continue communication between home and school.  
• Support student through their slow recovery. | • Half days.  
• When you first return to class, don’t take notes, just listen.  
• Communicate with teachers about symptoms and create work calendar.  
• Keep copies of current work and assignment.  
• Be patient with slow recovery and be involved in class as much as possible. |
| **YELLOW** | Gradual increase in student responsibilities as they progress to a normal workload. | Longest stage, one week up to several months. | • Support and create a work calendar to stagger make-up work.  
• Continue to communicate with the student and parents regularly.  
• Advocate for a tutor if patient is struggling with workload.  
• Decrease workload if symptoms worsen.  
• Limit student to one major test per day. | • Continue to communicate with teachers on your progress on make-up work.  
• Follow work calendar.  
• Communicate with your parents and teachers on your recovery. |
| **GREEN** | Complete return to normal activities. | | • Monitor completion of make-up work.  
• Continue school-to-home communication to ensure the student is at the same pace with all other students.  
• Inform guidance if term grades have been updated. | • Attend school full-time.  
• Continue to meet with teachers regularly to make-up schoolwork with work calendar.  
• Return to sports ONLY if cleared by a physician AND you are managing your school work well, using a gradual return to play protocol. |
Consideration for RTP

• Resolution of symptoms at rest
  (measured with Post Concussion Symptom Scale)

• Academic tolerance

• Exercise Tolerance

• Neurocognitive Test results (where applicable)
Consideration for RTP

• Resolution of symptoms at rest

• **Academic tolerance**
  (Tolerating full days of school, normal workload and performance)

• **Exercise Tolerance**

• **Neurocognitive Test results** (where applicable)
Consideration for RTP

- Resolution of symptoms at rest
- Academic tolerance

- **Exercise Tolerance**
  (No symptoms during or after graded, noncontact exercise challenges)

- Neurocognitive Test results  (where applicable)
Exercise Tolerance

• Grades of exercise

• “Successful days” between stages (i.e. no symptoms during or after exercise, and academic tolerance)
  – Variable by age (1 to 2 days for college/pro)
  – 3-4 for high school
  – Slower pace for younger athletes)
<table>
<thead>
<tr>
<th>Step</th>
<th>Level of activity</th>
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<tbody>
<tr>
<td>1</td>
<td>No activity, complete rest. Once asymptomatic, proceed to level 2.</td>
</tr>
<tr>
<td>2</td>
<td>Light aerobic exercise such as walking or stationary cycling, no resistance training.</td>
</tr>
<tr>
<td>3</td>
<td>Sport specific exercise - for example, skating in hockey, running in soccer; progressive addition of resistance training at steps 3 or 4.</td>
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<td>4</td>
<td>Non-contact training drills.</td>
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<tr>
<td>5</td>
<td>Full contact training after medical clearance.</td>
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<tr>
<td>6</td>
<td>Game play.</td>
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Consideration for RTP

- Resolution of symptoms at rest
- Academic tolerance
- Exercise Tolerance
- **Neurocognitive Test results** (where applicable)
  
  (Often using computerized neuropsych testing or SAC)
Prolonged Recovery
(Beyond 4 to 6 weeks)

- Consider other causes of headache
- PT, Acupuncture, Trigger point injections
- Possible need for extended neuropsych testing (?pre-existing disability?)

- Medications are considered depending on most prominent symptom
  - headache
  - cognitive symptoms
  - psych symptoms
  - Melatonin for insomnia

- Note: Meds are Not FDA approved for Tx of concussion. Off-Label use
With prolonged recovery, interventions are considered based on predominant symptoms

(Please choose only ONE number for each symptom)

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Treatment and Prevention

• Periscapular and Postural Stabilization

• Bike / elliptical / swim
  – (low intensity, non-impact exercise to mitigate physical deconditioning)

• Fair Play and Age/Skill/Size matching

• Open Communication!!
Take Home

• Low threshold to sit athlete out
• Physical Rest / Cognitive rest
  – But avoid deconditioning
• Plan for Follow up
• Have organized RTP plan
• If prolonged, consider imaging and interventions based on symptoms
Michael J. O’Brien, M.D.
Division of
Sports Medicine

319 Longwood Ave, Boston
9 Hope Ave, Waltham

Concussion Clinic 781-216-1328

General Appointment Line 617 355 3501

Email: Sports.medicine@childrens.harvard.edu
www.Kidssportsmed.org
Suggested Reading


- CDC.gov/Concussion