Managing Mild Traumatic Brain Injury in the School

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Objectives

At the conclusion of this presentation attendees should have an increased understanding of:

• The evolution of concussion management in the school setting over the past 10 years.
• How concussion symptoms affect learning and the need for school accommodations.
• The most recent research and guidelines on Return to Learn (RTL) after concussion.
• RTL color zones and individualizing accommodations
• The role of school nurses and athletic trainers in executing the RTL plan.
Return to Learn - Secondary School Setting

- There is a need!
- Implementation
  - Having a plan is easy, implementing it can be difficult
- Communication is key
  - Do the ground work ahead of time
  - Follow up frequency
- The first may dictate later success
- Teachers can be reluctant with accommodation/modifications
Case 2008

- 15 y/o female soccer keeper
- 3.9 GPA, 2 sport athlete
- MOI - ball kicked directly to face from short range during club soccer
- Unknown LOC, c/o mild HA, dizzy, visual problem
- Talked coach into letting her play in the second half
- Upon ride home with parents - game was in Phx - HA increased to 6/6, nausea, visual problems
- ER visit - CT scan negative. Released with statement of “CT is clear” and no other instructions
Case Study 2008 (cont.)

• Missed 6 weeks of school
  • Several pediatrician and neurologist evaluations
• Upon return no formal accommodations
• S/S short term memory loss, visual problems, HA…
• Grades plummeted

• No formal procedure in place
• Wake up call for the need for a RTL plan
• 2010 formal RTL plan developed for the district
Case 2018

- 15 y/o high school volleyball setter
- 3 honors/AP classes
- MOI- fell and hit side of head on bleachers
- Student self assessment and modified SAC administered
- c/o- HA, balance problems, visual problems, nausea, light and sound sensitivity
  - 9 s/s for 19 score
- Parents, school nurse and teachers notified
Student Self Assessment

- Quick assessment
- Track s/s over a period of time
- Helps identify what accommodations may be needed.
Case 2018 (cont.)

• Temporary modifications in class
• No activity- volleyball or PE class
• Daily follow up with athlete
• s/s decrease over 8 days to 3 s/s, 10 score
Case 2018 (cont.)

Day 10

• Ath. hit her head bending over to pet her dog
• Benchmark testing same day
• 6 s/s, 15 score after school
• States she is worried about grades dropping
• Referral to concussion specialist
Case 2018 (cont.)

• Formal accommodation from specialist
• Teachers notified of accommodations
• Removal from PE class
• No standardized testing

• RTP 3 ½ months post injury
Evolution of Concussion Care

- Education of all involved
  - Physicians, school personnel, parents, coaches, teachers, administrators, etc
- Communication
  - Key to successful treatment
- Stay current of new trends
- Have a “working document”
Brain Map

1. Frontal Lobe
   - Mood & emotions
   - Cognitive efficiency
   - Attention & concentration
   - Processing
   - Reaction time
   - Problem solving

1a. Broca’s Area
   - Speech (speak & write)

4a. Wernicke’s Area
   - Language Comprehension

4. Temporal Lobe
   - Verbal memory
   - Hearing
   - Sequential memory
   - Organization

2. Parietal Lobe
   - Proprioception
   - Distinguishing size, shape, and color
   - Visual/Spatial perception
   - Visual integration
   - Reaction time

2a. Wernicke area

3. Occipital Lobe
   - Vision processing
   - Light processing
   - Visual perception
   - Visual memory

5. Cerebellum
   - Vestibular & balance (vertigo)
   - Muscle coordination

6. Brainstem
   - Heart rate control
   - Blood pressure control
   - Respiratory control
   - Oculomotor control
   - Cervical function

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# How Concussion Symptoms Affect Learning

The effects of concussion symptoms on students in the classroom setting

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Effects on student in classroom setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>Trouble concentrating or focusing</td>
</tr>
<tr>
<td>Dizziness</td>
<td>May cause troubles with standing from a sitting position</td>
</tr>
<tr>
<td></td>
<td>May produce problems with navigating crowded hallways</td>
</tr>
<tr>
<td>Visual symptoms</td>
<td>Can produce issues with reading, electronics, small-print books, small font on screens, artificial lighting, taking notes</td>
</tr>
<tr>
<td>Difficulty concentrating or remembering</td>
<td>Issues with recalling information, learning new information, applying information previously learned, testing, ability to finish tasks in usual timeframe</td>
</tr>
<tr>
<td>Sleep difficulties</td>
<td>Daytime somnolence resulting in troubles concentrating, missing normal classes, increased feeling of “fogginess” during the day</td>
</tr>
</tbody>
</table>
Return to Learn: Research and Guidelines

• No consensus on how to reintegrate students into the school setting following a concussion.

Current Research/ Guidelines:


• CDC Guideline on the Diagnosis and Management of Mild Traumatic Brain Injury Among Children (2018)
Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016


PREAMBLE
The 2017 Concussion in Sport Group (CISG) consensus statement is designed to build on the principles outlined in the previous statements1–4 and to develop further conceptual understanding of sport-related concussion (SRC) using an expert consensus-based approach. This document is developed for physicians and healthcare providers who are involved in athlete care, whether at a recreational, elite or professional level. While agreement exists on the principal messages conveyed by this document, the authors acknowledge that the science of SRC is evolving and therefore individual management and return-to-play decisions remain in the realm of clinical judgement.

Articles were screened by the expert panels for the Berlin meeting. The details of the search strategies and findings are included in each of the systematic reviews.

The details of the conference organisation, methodology of the consensus process, question development and selection on expert panellists and observers is covered in detail in an accompanying paper in this issue.5 A full list of scientific committee members, expert panellists, authors, observers and those who were invited but could not attend are detailed is at the end of the summary document. The International Committee of Medical Journal Editors conflict of interest declaration for all authors is provided in Appendix 1.

Readers are encouraged to copy and freely
5th Consensus

Research supports multi-disciplinary therapeutic approach:

• Early Intervention > Absolute Rest
• Implement Return to Learn
• Sub symptom threshold exertional rehab protocol (RTP)
• Vestibulo-ocular/cervical exercises

Results:

• Reduced recovery time
• Decreased PCS morbidity
• Better outcomes
“Schools are encouraged to have an SRC policy that includes education on SRC prevention and management for teachers, staff, students and parents, and should offer appropriate academic accommodation and support to students recovering from SRC.”

<table>
<thead>
<tr>
<th>Stage</th>
<th>Aim</th>
<th>Activity</th>
<th>Goal of each step</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Daily activities at home that do not give the child symptoms</td>
<td>Typical activities of the child during the day as long as they do not increase symptoms (e.g., reading, texting, screen time). Start with 5–15 min at a time and gradually build up</td>
<td>Gradual return to typical activities</td>
</tr>
<tr>
<td>2</td>
<td>School activities</td>
<td>Homework, reading or other cognitive activities outside of the classroom</td>
<td>Increase tolerance to cognitive work</td>
</tr>
<tr>
<td>3</td>
<td>Return to school part-time</td>
<td>Gradual introduction of schoolwork. May need to start with a partial school day or with increased breaks during the day</td>
<td>Increase academic activities</td>
</tr>
<tr>
<td>4</td>
<td>Return to school full time</td>
<td>Gradually progress school activities until a full day can be tolerated</td>
<td>Return to full academic activities and catch up on missed work</td>
</tr>
</tbody>
</table>

5th Consensus Statement on Concussion. BJSM April 2017
CDC Guidelines

- Restrict physical and cognitive activity during the first several days after mTBI.
- Gradually return to cognitive and non-sports activities, that do not exacerbate symptoms, after no more than 2-3 days of rest.
- Return-to-school protocols should be customized according to the severity of post-concussion symptoms.
CDC Guidelines

- Children with prolonged symptoms and academic difficulties should be formally evaluated by a specialist in pediatric mTBI.
- Children with persistent vestibulo-oculomotor dysfunction: referred for vestibular rehabilitation.
- Provide guidance on proper sleep hygiene methods.
- Children with persistent cognitive dysfunction: refer for formal neuropsychological evaluation.
Learn to Learn Protocol

“It is recommended that all athletes should have a clinical neurological assessment including evaluation of:

• Mental status and cognition,
• Oculomotor function,
• Gross sensorimotor coordination and gait,
• Vestibular function and balance.”

5th Consensus
RTL Protocol: Testing

Neurocognitive Testing (ImPACT, CBS)
• Degree/type of cognitive impairment
• Baseline vs normative data

Oculomotor function:
• King Devick Cards
• NPC, tracking, phoria, OMT

Vestibular function and balance
• Bertec force plate
• Balance Error Scoring System (BESS)
• Vestibular/Ocular-Motor Screening (VOMS)
Symptoms of concussion can affect students in different ways in an academic setting. When considering returning to learn for a concussed student, plans must be individualized.

**Individual Concussion Action Plan (ICAP)**

- Testing to determine functional capabilities (neuro-cognition, ocular, vestibular, exertional)
- Targeted accommodations to keep cognitive load 10-20% below current capability
- Progress to full cognitive load as functional capability/symptoms improve.
RTL: Accommodations

• Allows the brain to continue healing without prolonging symptoms
• Keeps the student stimulated (optimal healing)
• Purpose: to appropriately challenge and enable to do more academically than they could without accommodations.

Do not go over the symptom threshold
RTL: Color Zones

Depending on severity of symptoms may need up to 1-2 days off (RED ZONE)

Part time with maximal individualized accommodations (ORANGE ZONE)

Half to Full time with fewer accommodations (YELLOW ZONE)

Gradual return to normal schoolwork as tolerated by symptom threshold (GREEN)

Back to full academics and sports (BLUE)
**RTL: Accommodations**

- Complete academic rest (no school work)
- Light basic cognitive tasks at home as tolerated

<table>
<thead>
<tr>
<th>Red</th>
<th>Half time attendance or less</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Allow visits to nurse for worsening symptoms at any time</td>
</tr>
<tr>
<td></td>
<td>Limited class participation (limited speaking, reading, presenting)</td>
</tr>
<tr>
<td></td>
<td>No tests or quizzes</td>
</tr>
<tr>
<td></td>
<td>Minimal to no homework. Prioritize learning goals and focus on major concepts</td>
</tr>
<tr>
<td></td>
<td>No computer or projector screens, use audio books and printed notes/slides (no smartphones)</td>
</tr>
<tr>
<td></td>
<td>Allow use of items to accommodate to light and noise</td>
</tr>
<tr>
<td></td>
<td>No band, music, chorus, or PE class</td>
</tr>
<tr>
<td></td>
<td>Allowance to leave class few minutes early to avoid busy loud hallways</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Orange</th>
<th>Half to full time attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Partial or limited workload and homework</td>
</tr>
<tr>
<td></td>
<td>Flexible due dates for assignments/projects. Allow partners, tutors to help</td>
</tr>
<tr>
<td></td>
<td>Excuse or waive non-critical work as determined by school concussion recovery team</td>
</tr>
<tr>
<td></td>
<td>Set reasonable schedule for makeup of essential work</td>
</tr>
<tr>
<td></td>
<td>One test per day with extra time allowed may be considered at this stage</td>
</tr>
<tr>
<td></td>
<td>Screen time should still be limited at this stage (including smart phones)</td>
</tr>
</tbody>
</table>
**RTL: Accommodations**

- Full time attendance, including non contact PE/gym activities
- Transition back to full workload with normal expectations for all new material
- Create and follow plan to make up work identified as necessary for progression

**Green**

- Back to full academic time and workload
- Can consider return to sport if cleared by physician

**Blue**
NPC and Academic Tolerance

Near Point Convergence Predicting Return to Learn

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1. Department of Dance, University of Arizona, Tucson, Arizona
2. SPARCC Sports Medicine, Tucson, Arizona
3. CACTIS Foundation, Scottsdale, Arizona

<table>
<thead>
<tr>
<th>ZONE</th>
<th>Ave. NPC (cm)</th>
<th>Percent of patients with NPC ≤ 9cm</th>
<th>Percent of patients with NPC &gt; 18cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange</td>
<td>15.97</td>
<td>21.05%</td>
<td>35.14%</td>
</tr>
<tr>
<td>Yellow</td>
<td>12.00</td>
<td>31.09%</td>
<td>13.45%</td>
</tr>
<tr>
<td>Green</td>
<td>7.98</td>
<td>81.18%</td>
<td>4.55%</td>
</tr>
<tr>
<td>Blue</td>
<td>7.31</td>
<td>86.67%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

NPC average per RTL zone

![Bar chart showing NPC average per RTL zone with data points for blue, green, yellow, and orange zones.](attachment:image.png)

Trendline for series 1: $r^2 = 0.931$
RTL: Accommodations

Trigger Avoidance: reduces excessive brain stimulation:

Eliminate or limit…

- Texting
- Video games
- Internet
- T.V.
- Loud music
- Known triggers
- Cognitive overload
RTL: Accommodations: Sports/PE/Recess

Requirements:

• Symptom free (without medications)
• Normal physical exam (VOMS, BESS, NPC, etc…)
• Back to full workload at school
• Cognitive testing back to BL/norms
• Normal exercise tolerance
• Completed RTP protocol for HS student athletes
RTL: Incentives

• RTL Plan has built in leverage points
• Prevents “milking the system”
• Depending on zone:
  • No sports, PE, regular recess
  • No recreational screens or smart phones
  • No video games
  • No driving or long travel
  • No high stimuli activities (noise, lights)
  • Limited social life
RTL: Accommodations Follow up

- Follow up with PCP/Concussion Specialist every few weeks for updated RTL plan as needed
- Cognitive testing to assess progression
- Formal neuropsychology testing/504 planning typically needed after 6-8 weeks
- Coordinated Concussion Management Team: PCP, Concussion Specialist, School Nurse, ATs, School Counselor, Neuropsychologist, Neuro-optometrist, PT, Psychologist, etc.
“Concussions can have a more serious effect on a young, developing brain and need to be addressed correctly. Proper recognition and response to concussion symptoms in the school environment can prevent further injury and can help with recovery.”
RTL: Role of School Nurse (continued)

• School nurse can assist recovery by:
  • Implementing accommodations to minimize worsening of student’s symptoms (ICAP, 504)
  • Communicating with teachers regarding student accommodations
  • Providing an area for a student to rest
  • Acting as an advocate for the student

• A survey of school nurses reported only 30–50% of schools had a policy to assist in a student’s recovery after a concussion

• School nurses felt the greatest barrier to assisting a student was a lack of communication with the healthcare provider who diagnosed the concussion
### Academic adjustments to assist students with concussion symptoms

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Academic adjustments to assist student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>Provide breaks in nurse’s office or scheduled breaks throughout the day; allow student to eat in less crowded alternative to cafeteria</td>
</tr>
<tr>
<td>Dizziness</td>
<td>Encourage hydration; offer students assistance while walking the halls; allow students to leave class early to avoid busy hallways</td>
</tr>
<tr>
<td>Visual symptoms</td>
<td>Encourage large-print books; increase font size on computer/electronics (18-point size or greater); adjust brightness on electronics as needed; avoid contrast of bright screens in darkened rooms; use audiobooks; adjust students’ seating in classroom; consider reading with a ruler to track from line to line; consider oral testing; provide preprinted notes</td>
</tr>
<tr>
<td>Noise sensitivity</td>
<td>Avoidance of music or shop classes; provide earplugs or noise-dampening headsets; allow for lunch in quiet area away from cafeteria</td>
</tr>
<tr>
<td>Difficulty concentrating</td>
<td>Reduce workload; provide additional time for completing assignments; extend time for testing; consider temporary grading as pass/fail; avoid standardized testing; consider use of tutor</td>
</tr>
</tbody>
</table>
RTL: Role of Athletic Trainer

• Education!

• Empower the athlete to advocate for themselves
  • If needed the AT may have to advocate for the athlete

• Coordinate communication for school personnel and parents/guardians

• Monitoring of s/s

• Coordinate RTP protocol
RTL: Helping the Student-Athlete

- Many times we are removing their “identity”
  - We do not want to lose these kids
- Sub-symptom integration is key
- Honesty across the board
- Open lines of communication
- Buy in from all parties involved
Resources

• 5th Consensus Statement on Concussion in Sport.
• SCAT 5/ Child SCAT5 assessment tools
• CDC Guideline on the Diagnosis and Management of Mild Traumatic Brain Injury Among Children.
• CDC/Heads up https://www.cdc.gov/headsup
• SPARCC website: https://sparcctucson.com/
  • Patients > Handouts > Concussion
References


• Mucha, AM etal. (2014). A Brief Vestibular/Ocular Motor Screening (VOMS) Assessment to Evaluate Concussions: Preliminary Findings. Investigation performed at the University of Pittsburgh, Pittsburgh, Pennsylvania, USA.