Sports Concussion St Mark's School of Texas

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The “Eye” in the Sky

Prevention: “Reducing the Risk”

Violent behavior that increases concussion risk should be eliminated
Promote fair play and respect
Cannot condition the brain; however you can strengthen the neck*

*University of Memphis study used isometric exercises on football players. reduced number of reported concussions by 50% over 2 years.
Fewer Concussions Why?

 Players think the newer helmets are like having an airbag in your car.
Prevention: “Reducing the Risk”

Helmets decrease risk of skull fracture and intracranial hemorrhage

**Mouth guards decrease risk of dental and oral trauma**

Role of protective equipment in prevention of concussion not established
Pressure to Play in Sports: Can We Trust What the Athlete Tells Us?

Athletic Trainers, Coaches and Physicians Cannot See the Brain Limp!

It’s a **BRAIN** injury. A concussed brain does not learn as well and can create cognitive deficiencies.

ImPACT* measures how much the brain limps

Athletics is important; academics are life long tools

They are called “**student athletes**” for a reason
Management of Sports Concussion and The ImPACT Program

ImPACT Memory Composite Scores
Brief versus Prolonged On-field Mental Status Changes

N = 64 High School Athletes

ImPACT Memory-Percent Correct
ImPACT Symptom Scale Scores
Brief versus Prolonged On-field Mental Status Changes

<table>
<thead>
<tr>
<th>Time</th>
<th>5-15 min</th>
<th>&lt; 5 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAY 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAY 7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 64 High School Athletes

Lovell, Collins, Iverson, Johnston, Bradley; Amer J Sports Med; 32;47-54, 2004

On-Field Concussion Severity Markers by Outcome Group

Percentage of Athletes Demonstrating On-Field Markers of Injury

Computer Lab Baseline Testing

What is required for baseline testing?
- Baseline testing link
- Name / Date of birth (no SS# required)
- Every 2 years age 13-19
  - Younger = yearly
  - 1 time during college, once during pros

Who can supervise / proctor the exam?
- Taken test twice themselves
- Understand the basic process
- Interpretation is done by MD or PhD.

Computer Lab Baseline Testing

Test Lab before going live
- EXTERNAL MOUSE (invalid without)

Control the testing environment
- Empty terminal between athletes
- 10-15 athletes per administrator
- Lower the lights

Use the baseline testing link.
Computer Lab Baseline Testing

- Prior to testing, educate staff / parents
  - www.impacttest.com has downloadable videos, handouts, and presentations.
    - *Have all the coaches test first.*
    - *Have coach present for testing.*
- Eliminate the mad rush when possible.
  - *End of school year testing*

Baseline Testing Recommendations

45 minute blocks (first year).

Explain the test

_Not an intelligence test._

Want to complete as fast and accurately as possible.

Difficult - not going to get everything right

Read directions twice before starting each subtest – raise hand with questions.

Take questions in a quiet place so no others are disturbed during testing.
Baseline Testing Recommendations

- Take demographic section as a group
  - Type the link together.
  - Use baseline demographics sheet to get accurate information on medical/educational histories.
  - Stop at end of demo section.

- Symptom inventory—also taken as a group.
  - Start together, completing at own pace.
  - Stop and wait before beginning test.

- Cognitive Test
  - Begin as a group
  - When finished, athletes should stay in seat and work quietly until group is finished.

Baseline Interpretation Guidelines

- Review athletes’ baselines to determine validity.
  - Check validity index
  - Compare to expectations/academic status

- Discuss invalid tests with athlete.

- Explain test/clear up confusion.
  - Repeat invalid baseline tests.
  - If invalid test is missed, simply use normative data during post-concussion evaluation.
Interpretation Guidelines:
Sources of Baseline Profile Invalidity

- “Horseplay”
- Failure to Understand Directions
- “Sandbagging” or Faking
- Not Using Mouse/Malfunctioning Mouse
- Incentive different at baseline/post-injury
In addition to the individual scores for each module described, ImPACT yields summary composite scores for Verbal Memory, Visual Memory, Reaction Time, Processing Speed and Impulse Control.

**Numeric Display of all Composites over Time**

<table>
<thead>
<tr>
<th>Exam Type</th>
<th>Post- concussion</th>
<th>Post- concussion</th>
<th>Post- concussion</th>
<th>Post- concussion</th>
<th>Post- concussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Tested</td>
<td>01/26/2006</td>
<td>02/01/2006</td>
<td>02/10/2006</td>
<td>02/24/2006</td>
<td>03/10/2006</td>
</tr>
<tr>
<td>Last Conclusions</td>
<td>03/24/2006</td>
<td>03/24/2006</td>
<td>03/24/2006</td>
<td>03/24/2006</td>
<td>03/24/2006</td>
</tr>
<tr>
<td>Exam Language</td>
<td>English</td>
<td>English</td>
<td>English</td>
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<td>English</td>
</tr>
</tbody>
</table>

**Composite Scores**

<table>
<thead>
<tr>
<th>Composite Score</th>
<th>Post- concussion</th>
<th>Post- concussion</th>
<th>Post- concussion</th>
<th>Post- concussion</th>
<th>Post- concussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory composite (verbal)</td>
<td>54 (&lt;1st)</td>
<td>67 (2% 72)</td>
<td>7% 79</td>
<td>5% 78</td>
<td>10%</td>
</tr>
<tr>
<td>Memory composite (visual)</td>
<td>58 (&lt;1st)</td>
<td>47 (1% 72)</td>
<td>7% 70</td>
<td>3% 72</td>
<td>5% 73</td>
</tr>
<tr>
<td>Visual motor speed composite</td>
<td>98.00 (3%)</td>
<td>24.88 (4% 30.60)</td>
<td>6% 31.63</td>
<td>4% 31.08</td>
<td>3% 32%</td>
</tr>
<tr>
<td>Reaction time composite</td>
<td>1.19 (&lt;1st)</td>
<td>0.80 (1% 0.64)</td>
<td>1% 0.58</td>
<td>0% 0.55</td>
<td>0% 0.62</td>
</tr>
<tr>
<td>Impulse control composite</td>
<td>13 (&lt;1st)</td>
<td>5 (2% 4)</td>
<td>5% 5</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Total Symptoms Score</td>
<td>33 (1%)</td>
<td>24 (15% 15)</td>
<td>15% 13</td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

* Scores in bold type indicate scores that exceed the Reliability 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 ranges, if available, are listed in a table. Please consult your ImPACT User Manual for more details.

1 Clinical composite score is available only for exams taken in ImPACT version 2.0 or later.

**Percentile Ranges**

- **Superior/Very Superior**: 90 – 99th % ile
- **High Average**: 75 – 89th % ile
- **Average**: 26 – 74th % ile
- **Low Average**: 16 – 25th % ile
- **Poor (Borderline Impaired)**: 6 – 15th % ile
- **Impaired**: < 5th % ile

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Understanding the Use of Normative Data

With no baseline, athlete must be compared to pre-injury estimates of functioning

- **Important to obtain educational and academic history**
  - SAT/ACT score (percentile rank)
  - GPA/Grades
  - Learning Disability/Special Education?

- **Estimated** athlete’s percentile scores on ImPACT
  - A/B student, High SAT = 65-75th percentile or higher
  - B/C student, Average SAT = 35-40th percentile or higher
  - D/F student, Low SAT, Learning Disability = 20th percentile or higher

- **Need to understand symptoms and cognitive data in combination**
Goal: Student safely returns to school and activity!

Main objectives related to role of the coach:

1. Gain awareness of the severity of the injury
2. Identify cognitive, emotional, and behavioral problems that may result from the injury
3. Identify accommodations that may be needed
4. Understand importance of communication among those involved

Impact of School and Learning on mTBI symptoms

We are most aware of negative effect of premature PHYSICAL exertion, but fewer are aware of problems cognitive exertion can cause.

– Analogy:
  An athlete returning to drills too early after an ACL injury
  An athlete returning to drills too early after a concussion
– What about cognition (Thinking)?
  Cognition equates to mental “drills”
Impact of School and Learning on mTBI Symptoms

~ Cognitive Exertion (Thinking) can significantly increase symptoms, even when the student has begun to recover.

~ Research suggests an energy crisis with concussion that causes symptoms to increase when returning to school.

Impact of School and Learning on mTBI Symptoms

~ Added stimulation of the school environment

~ Apparent causes

~ Subtle/Hidden Causes
Assisting School Personnel Understand the Symptoms

~ Presentation/Intensity varies and can be:

1. Cognitive
2. Somatic
3. Emotional

~ Can wax and wane throughout the day; usually gets worse as the day progresses

~ Student may not look or even act injured

Like a Hurricane: Cognitive, Physical, and Emotional Problems
Cognitive Symptoms in the Classroom: Communicate with classroom teachers

– Attention/Concentration Problems are Common:
  Student “Drifts off” during class
  Hard to focus on difficult material
  Hard to focus for a sustained amount of time
  Restlessness

– May experience difficulty with memory:
  Learning new information
  Recalling previously learned information
  Forgetful and/or Repetitive
  Remembering details of the injury

Cognitive Symptoms in the Classroom

Student may report feeling less cognitively able
– Multitasking Difficult (auditory, visual, etc.)
– Confused about instructions, time or places
– Feels mentally “foggy”
– Thinking/processing speed may be slowed
– After school activities likely affected (e.g., memorizing lines for a play, assisting team while on “injured reserve”)
– Difficulty handling new situations
– Gets lost
Cognitive Symptoms: Accommodations for the classroom teacher to consider

~ No tests (especially mid-terms, APs, SATs)
  - Can the test be postponed?
  - SAT/ACT too high stakes to take

~ Untimed/extra time on tests/assignments
  - Is it critical that the test be timed?
  - Can extra time be allotted?

~ Elimination of certain assignments
  Is this assignment critical?

~ Removal of distracting or extraneous information from materials
  What are the most important features of the concept?

~ Math and math-like subjects are most difficult

Cognitive Symptoms: Accommodations

~ Consider using precise and direct language

~ Can schedules/checklists for assignments be provided to the student?

~ Can the teacher meet with the student at end of day to review?

~ Opportunities for working in a quiet environment?

~ Can preferential seating in classroom be arranged?

~ Is Tutoring/Mentoring/Extra Supervision possible?
Cognitive Symptoms: Accommodations

~ Reduced workload / Abbreviated assignments
  - Instead 20 problems, can it be 10?

~ Printed classroom notes / Taped lectures / Test reader or scribe / Books on tape
  - Are there resources that may assist the student?

~ Use of summary materials (graphs, templates, tables)
  - Are there summary opportunities with the material?

~ Breakdown assignments into organized, ordered steps
  - Is it a process that can be analyzed into parts

~ Taking notes during longer reading assignments
  - Opportunity for notes/note taker?

~ Repetition of important information
  (Multiple modalities)
  - Opportunity to use several means/methods for review/summary

~ Delayed assignments (especially early in recovery)
  - Opportunity to make up the assignments at a later date?

~ Use cues prior to asking the student questions
  - Opportunity for reminders, prompters, clues?
Emotional Symptoms in the Classroom

~ Concussion can change the athlete’s social roles, sense of self/identity, self esteem.

~ Affects relationships with friends, parents, coaches, teachers, community.

~ May create difficulty in responding to new situations

Emotional Symptoms in the Classroom
Include:

- Irritable
- Short-tempered
- Impulsive
- Sad/Depressed
- Flat/quiet
- Anxious/Nervous

- Withdrawn
- Labile/unstable
- Restless
- Angry

- Hurt
- Scared
- Betrayed
- Confused
Emotional Symptoms in the Classroom

- Emotional reactions may occur to:
  - the trauma of amnesia or loss of consciousness
  - being significantly impaired or unable to perform
- Emotional or behavioral symptoms may be the direct result of the concussion OR a result of adjustment to injured status.
- Preexisting condition (e.g. depression, ADD, ADHD, LD) may be exacerbated or slow down recovery

Somatic (Physical Symptoms) in the Classroom

- Headache pain, nausea, dizziness, clumsiness, drowsiness, visual or hearing problems, fatigability, sensitivity to light and noise, sleep disturbance etc.
  - may influence performance and abilities
- With significant symptoms, student may miss whole or half days of school early in recovery
- Injury-related sleep difficulties may lead to daytime drowsiness or fatigue
- With prolonged recovery, medication may be used to manage symptoms, which also may produce side effects
### Controlling Symptoms: What to do

<table>
<thead>
<tr>
<th>Symptom/Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overwhelmed; needs meds</td>
<td>Go to nurse for rest/meds</td>
</tr>
<tr>
<td>Sensitivity to light</td>
<td>Sunglasses; hat; dim the room</td>
</tr>
<tr>
<td>Sensitivity to noise</td>
<td>Avoid cafeteria, assemblies, shop or other “noisy” classes</td>
</tr>
<tr>
<td>Crowded environment</td>
<td>Early dismissal from class before hallways fill up</td>
</tr>
<tr>
<td>Needs break</td>
<td>Nurses office or ATR</td>
</tr>
</tbody>
</table>

### Are Accommodations Helpful? One Student’s Perspective

[Image of a student]
Communicate

Suggested Practices

~ Communication with Teachers/Nurse/Counselor
~ Serve as liaison as needed; make principal aware also

Provide documentation (multiple copies of doctors orders)
  • Don’t keep fellow professionals out of the loop
It’s not “just a concussion”
  • Seriousness/ returning too soon
  • Accommodations
  • Signs/ symptoms to look for
Concussion Action Plan (CDC)
Collaborative Approach by All

School Nurse  
Teachers  
Student Athlete  
Parents/Peers/Teammates  
Coach  
Administrator  
Counselor

Why Accommodations May Fail...

Communication problems: Staff are not aware of the injury or the severity of the problems (parents, guidance counselor, school nurse are key)

Education problems: Shrug off injury because the student “looks fine,” “just had his/her bell rung,” or “this is only their first concussion, I had 10 when I played football and it didn’t bother me” (individual differences)

Resistance: From student (doesn’t want to look different, be treated differently, worried about impact on overall academics); From staff (unsure of how to implement)
Return to School and Play Considerations

No
Shut Down
Homebound Education

Yes
Partial Day
Full Day

Return to School: Step 1

<table>
<thead>
<tr>
<th>Step 1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No School attendance: emphasize Cognitive &amp; Physical rest</td>
<td>-Sensitivity to light</td>
</tr>
<tr>
<td>No tests, quizzes or homework</td>
<td>-Sensitivity to noise</td>
</tr>
<tr>
<td>If student remains at step 1 longer than 2 weeks, consult the student support team* to discuss lack of progress</td>
<td>-Cannot read more that 10 minutes without symptoms returning</td>
</tr>
<tr>
<td>Go to Step 2 when:</td>
<td></td>
</tr>
<tr>
<td>Decreased sensitivity to light</td>
<td></td>
</tr>
<tr>
<td>Decreased intensity and frequency of headaches</td>
<td></td>
</tr>
<tr>
<td>Ability to read more than 10 minutes without symptoms increasing</td>
<td></td>
</tr>
</tbody>
</table>

*Student support team = teachers/counselors/principal/nurse
**Return to School: Step 2**

### Step 2 Modified Daily class Schedule

<table>
<thead>
<tr>
<th>1st day PM classes</th>
<th>2nd day AM classes</th>
<th>3rd day 10am-2pm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce weight of back pack</td>
<td>provide 2nd set of books in each class</td>
<td>Obtain “5 minute” pass to avoid noisy hallways between classes</td>
</tr>
<tr>
<td>No tests/ quizzes/ homework; provide copies of class notes</td>
<td>Report to AT or Nurse daily</td>
<td>Allow sunglasses to view</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smart boards/ wear a cap/ dim lighting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No PE or RTP exercise</td>
</tr>
</tbody>
</table>

**Return to School: Progress to Step 3 When...**

- Each of class has been attended at least once
- School activity does not increase symptoms
- Overall symptoms continue to decrease/ headache free
Return to School: Step 3

Step 3 Full Day of School
No tests, quizzes or homework; provide copies of class notes
Reduce weight of backpack; provide 2nd set of books in each class. Obtain “5 minute” pass to avoid noisy hallways between classes.
Teacher has discretion to use “mastery learning” criteria to reduce subject workload

- Report to AT or Nurse daily
- Start RTP exercise progressions

5 Stage Post-Concussion Exertion Program

Target Exertion calculated by Karvonen’s equation:

\[
\text{Target Exertion} = \left[ \frac{\text{Max. H.R.} \times (220 - \text{Age}) - \text{Resting H.R.}}{2} \right] \times \text{Target \%} + \text{Resting H.R.}
\]

<table>
<thead>
<tr>
<th>Stage</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage 1</strong>&lt;br&gt;Target Heart Rate: <strong>25% of maximum exertion</strong>&lt;br&gt;Recommendations: 10-15 minutes of cardio exercise; low stimulus environment; no impact activities; balance and vestibular treatment (pm); limit head movement/position change; limit concentration activities</td>
<td>- Very light aerobic conditioning&lt;br&gt;- Sub-max strengthening&lt;br&gt;- ROM/Stretching&lt;br&gt;- Very low level balance activities</td>
</tr>
<tr>
<td><strong>Stage 2</strong>&lt;br&gt;Target Heart Rate: <strong>50% of maximum exertion</strong>&lt;br&gt;Recommendations: 20-30 minutes of cardio exercise; exercise in gym areas; use various exercise equipment; allow some positional changes and head movement; low level concentration activities</td>
<td>- Moderate aerobic conditioning&lt;br&gt;- Light weight strength exercise&lt;br&gt;- Stretching (active stretching initiated)&lt;br&gt;- Low level balance activities</td>
</tr>
<tr>
<td><strong>Stage 3</strong>&lt;br&gt;Target Heart Rate: <strong>75% of maximum exertion</strong>&lt;br&gt;Recommendations: any environment ok for exercise (indoor, outdoor); integrate strength, conditioning, and balance / proprioceptive exercise; incorporate concentration challenges</td>
<td>- Moderately aggressive aerobic exercise&lt;br&gt;- All forms of strength exercise (80% max)&lt;br&gt;- Active stretching exercise&lt;br&gt;- Impact activities running, plyometrics (no contact)&lt;br&gt;- Challenging proprio-balance activities</td>
</tr>
</tbody>
</table>
Return to School: Go to Step 4 When...

- ImPACT/Neurocognitive test scores normalize
- Symptoms almost resolved
- School activity does not exacerbate symptoms

If student cannot go past Step 3 after an "extended period of time, make up home work should not be required and student should be reevaluated by the student support team for lack of progress including referral back to treating physician.

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5 Stage Post-Concussion Exertion Program

Target Exertion calculated by Karvonen’s equation:

\[
\text{Target Exertion} = \left( \frac{\text{Max. H.R.} - \text{Resting H.R.}}{220 - \text{Age}} \right) \times \text{Target %} + \text{Resting H.R.}
\]

<table>
<thead>
<tr>
<th>Stage</th>
<th>Activity</th>
</tr>
</thead>
</table>
| **Stage 4** (Non Contact Drills) | - Non-contact physical training  
- Aggressive strength exercise  
- Impact activities/ plyometrics  
- Sports specific training activities |
| **Stage 5** (Return to Full Practice) | - Resume full physical training activities with contact  
- Continue aggressive strength/ conditioning exercise  
- Sport specific activities |
Return to School: Step 4

Step 4 Full Academic Load
Resume all academic responsibilities: tests/homework
PE and RTP exercises should be progression at this point
IF any symptoms return, return to Step 3

Report to AT or Nurse Daily
Follow up w AT/nurse/counselor after one week for update; introduce counseling if needed
Students are encouraged to continue meeting with counselors to help determine if “neurocognitive stall” is occurring

SUMMARY
~ Awareness, Cooperation, & Communication are key at all levels
~ Recovery is quicker and safer when students receive a consistent message- all on the same page
~ Teachers and injured students should discuss options/observations
~ Proper accommodations should allow student to continue learning while controlling symptoms and maintaining grades
~ “Healthy” appearance of student is usually a difficulty, not advantage, in terms of self- and other-expectations
~ Athletes don’t stop learning just because they stop playing
“What's the big deal; I never had problems playing with a concussion?” Really? Really?

REMEMBER THE GOOD OLD DAYS WHEN WE PLAYED SPORTS AND NEVER WORRIED IF WE GOT CONCUSSIONS?

NO.

in the Bleachers © 2012 Steve Moore. Distr. by Universal Uclick

Treatment/Rehabilitation
Athletic Training: Shotgun Approach

7th Grade English:

Either/Or

Both/And

Treatment Following Concussion

“Yo, Dewey! Got another one over here when you’re done.”
Best Practice

1. Identify Signs/Symptoms
2. Remove from game/practice
3. Rest 48 hours no activity
4. See a Physician at day 3 or 4 to get school accommodation
5. Once headache free/ full day of school start RTP progressions
6. RTP when cleared with clinical, symptoms, neurocog, & RTP all clear
Sideline Evaluation

If Signs and Symptoms

Removes from practice or game and DO NOT return the same day

Rest for 48 hours no school

- REST No Texting
- REST No Videos/computer
- REST No TV/Concerts
- REST No Physical Activity
- REST No Chores (yeah!)
- REST LOTS of Sleep
After 48 hours see a Physician on day 3 or 4 They will develop a plan of care and give school accomodation and/or excuse for missing school.

School will still be there Tommorrow but will you know it?
We use a systematic approach; Treat every concussion with the same matrix

1. Presumed event (AT, coach, parent, doctor, etc.)
2. Office visit (Detailed History, Exam, Neurocognitive Test, Computerized Balance Test, Extraneous Tests)
3. Analysis of all data for clinical decision
4. Treatment (Rest, Academics, medications, Education, communication)
5. Follow-up
6. Return to classroom/play progression and clearance

You will be on top of the world; and know it
Before returning to contact:

- Fit in a different helmet using “finger” test
- Review number of helmet hits in your practices
- Review your coaching techniques
- Establish weekly helmet safety check procedures

Take Home Message
“Cornerstones of Management”*

The 3 “R” s

**Remove**, **Restrict**, **Return**

*Remove* symptomatic player from competition

*Restrict* from competition until symptoms resolve

*Return* to Play (RTP) gradually after exertion and **without** symptoms

Neuropsych testing recommended

*Source 2001 & 2004 Vienna and Prague*
Concussion Resources:

www.texashealth.org/benhogan
ACTive™
www.impacttest.com
www.cdc.gov/Concussion
www.TSATA.com

UPMC Sports Medicine
–Lovell, Collins, Pardini

If it looks like a concussion and acts like a concussion it probably is a CONCUSSION