Concussion Management and the Student-Athlete

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A CONCUSSION ENDED TAYLOR Twellman's CAREER BUT GAVE HIM A NEW MISSION: MAKING SOCCER SAFER, FROM KIDS' LEAGUES TO THE PROS.
Today’s Objectives

• Provide an overview of sports concussion signs, symptoms, and risks.
• Present a 5-step model of school concussion care.
• Discuss the rationale and process of academic accommodation for recovering students.
• Review clinical trajectories and treatments in concussion recovery.
Supporting the Student-Athlete’s Return to the Classroom After a Sport-Related Concussion

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Objective: This article provides a framework for school athletic trainers to use in advising colleagues about the health and academic needs of student-athletes presenting with concussions.

Background: Management of sport-related concussions has been an area of growing concern for school athletic programs. Recent work in this area has highlighted significant risks for student-athletes presenting with these mild traumatic brain injuries.

Description: Topics covered include general teaching points for the athletic trainer to use with school colleagues. An integrated model for school management of sport concussion injuries is presented that includes involvement of the student’s athletic trainer, school nurse, guidance counselor, teachers, social worker, psychologist, physicians, and parents.

Clinical Advantages: Academic accommodations for specific postconcussion symptoms are proposed that may help the student-athlete strike an optimum balance between rest and continued academic progress during recovery.

Key Words: athletic injuries, mild traumatic brain injuries, academic accommodations, school concussion programs
The Evolving Definition of Concussion

“A concussion (or mild traumatic brain injury) is a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head. Disturbance of brain function is related to neurometabolic dysfunction, rather than structural brain injury, and is typically associated with normal structural imaging findings (CT Scan, MRI). Concussion may or may not involve a loss of consciousness. Concussion results in a constellation of physical, cognitive, emotional, and sleep-related symptoms. Recovery is a sequential process and symptoms may last from several minutes to days, weeks, months, or even longer in some cases.”

– CDC Physicians’ Tool Kit; Collins, Gioia, et al., 2006
I. Signs, Symptoms, and Risks of Concussion

- Immediate sideline signs & symptoms
  - Any loss of consciousness
  - Headache
  - Dizziness
  - Nausea, vomiting
  - Visual disturbances: flashing lights, wavy lines, double vision, darkness, color changes
  - Vacant stare (confused facial expression)
  - Delayed responses to questions or instructions
I. Signs, Symptoms, and Risks of Concussion

• Immediate sideline signs & symptoms – 2
  – Drowsiness
  – Inability to focus
  – Confusion or disorientation: walking in wrong direction, unaware of date, time, place, game situation
  – Slurred or incoherent speech
  – Loss of coordination: stumbling, unable to walk straight line, etc.
  – Unusual emotionality: crying, laughing
  – Memory deficits: keeps asking same question, can’t follow game, etc.
Cognitive
- Fogginess
- Concentration
- Memory deficits
- Cognitive fatigue

Sleep Dysregulation
- Falling asleep
- Fragmented sleep
- Too much/too little sleep

Mood Disruption
- Irritability
- Sadness
- Anxiety

Somatic
- Headaches
- Dizziness
- Light/noise sensitivity
- Tinnitus

Adapted from Camiolo Reddy, Collins & Gioia, 2008
COGNITIVE
• Fogginess
• Concentration
• Memory deficits
• Cognitive fatigue

SLEEP DYSREGULATION
Falling asleep
Fragmented sleep
Too much/too little sleep

SOMATIC
Headaches
Dizziness
Light/noise sensitivity
Tinnitus

MOOD DISRUPTION
Irritability
Sadness
Anxiety

Adapted from Camiolo Reddy, Collins & Gioia, 2008
Post-Concussion Symptoms

- Physical
  - **Headaches**
  - Fatigue/tiredness
  - Dizziness with movement or exertion
  - Nausea
  - Light/noise sensitivity
  - Ringing in the ears
Post-Concussion Symptoms

- Physical/Sequelae
  - Interfere with focus
  - Often increase with cognitive effort
  - Limited energy
Post-Concussion Symptoms

- Cognitive
  - Poor attention & concentration
  - Inefficient short-term memory
  - Slowed thinking
  - Feeling mentally “foggy”
Post-Concussion Symptoms

• Cognitive
  – Difficulty following in class or sustaining homework effort.
  – Leads to re-reading
  – Students expect to remember information and must adapt to reduced efficiency.
Post-Concussion Symptoms

- Sleep difficulties
  - Trouble falling asleep
  - Overnight awakening
  - Oversleeping/under-sleeping
  - Feeling tired in the morning despite long hours in bed
Post-Concussion Symptoms

- Sleep difficulties
  - Adds to energy crisis
  - Further limits attention & concentration
  - Can lead to missed classes
  - Exacerbates mood changes
Post-Concussion Symptoms

- Mood disruption
  - Irritability
  - Sadness
  - Increased lability
  - …Anxiety
  - …Depression
Post-Concussion Symptoms

• Mood disruption
  – Further reduces ability to concentrate (binds mental energy)
  – May lead to changes in peer or teacher interactions
Neurometabolic Cascade Following Cerebral Concussion/MTBI

- Glutamate
- Calcium
- K+
- Glucose

(Giza & Hovda, 2001)

Cerebral Blood Flow

UCLA Brain Injury Research Center
Individual Recovery From Sports MTBI: How Long Does It Take?

WEEK 1: 40% RECOVERED
WEEK 2: 60% RECOVERED
WEEK 3: 80% RECOVERED
WEEK 4: 100% RECOVERED
WEEK 5: N=134 High School Male Football Athletes

- All Athletes
- No Previous Concussions
- 1 or More Previous Concussions

Collins et al., 2006, Neurosurgery
Risk Factors for Prolonged Recovery

• Higher number of concussions
• Concussions occurring too close in time
• Re-injury prior to full recovery

>>Premature physical exertion OR cognitive stress can cause symptom flare-ups & prolong recovery.
Smarter, Safer Concussion Management for the Student Athlete

1. Concussion Education
2. Baseline Testing
3. Post-Concussion Evaluation
4. Academic Support During Recovery
5. Return-to-Play Decision
When in doubt, sit them out!
Smarter, Safer Concussion Management for the Student Athlete

1. Concussion Education
2. Baseline Testing
3. Post-Concussion Evaluation
4. Academic Support During Recovery
5. Concussion Management Policy
Composite Scores

Verbal Memory
Visual Memory
Visual Motor Speed
Reaction Time
Impulse Control
Symptom Score

Memory Composite (Verbal)
Smarter, Safer Concussion Management for the Student Athlete

2. Baseline Testing
• Controls for individual factors such as LD, ADHD, medications, etc.
• Can be done in large groups with educational seminars
• Orients athletes to concussion issues at start of season
• Annually for injured athletes; every 2 years for those with no concussion history
“Sandbagging” Baseline Test Performance on ImPACT, Without Detection, Is More Difficult than It Appears”  
Schatz., P. & Glatts, C.  

- 60 college undergrads – non-athletes
  • 1st ImPACT
  • No hx of concussion

- 3 Groups
  • Control – regular baseline test
  • Naïve malingerers – “Try to perform poorly.”
  • Coached malingerers – “Try to perform poorly but not make it obvious.”
“Sandbagging” Baseline Test Performance on ImPACT, Without Detection, Is More Difficult than It Appears”
Schatz., P. & Glatts, C.

- Standard Flagging (5 criteria)
  - Controls – “Do your best” — 0% flagged
  - Naïve sandbaggers — 70% flagged
  - Coached sandbaggers — 65% flagged
- Standard flags + Word Memory Distractors <22
  - Naïve sandbaggers — 95% flagged
  - Coached sandbaggers — 100% flagged
Smarter, Safer Concussion Management for the Student Athlete

1. Concussion Education
2. Baseline Testing
3. Post-Concussion Evaluation
4. Academic Support During Recovery
5. Return-to-Play Decision
CASE 1: KICK-OFF RETURNER

<table>
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<th>Exam Type</th>
<th>DAY 3</th>
<th>6</th>
<th>10</th>
<th>13</th>
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<table>
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<th>Composite Scores *</th>
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<th>6</th>
<th>10</th>
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<tr>
<td>Memory composite (verbal)</td>
<td>92 68%</td>
<td><strong>81</strong> 28%</td>
<td><strong>83</strong> 35%</td>
<td><strong>79</strong> 23%</td>
<td><strong>89</strong> 60%</td>
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<tr>
<td>Memory composite (visual)†</td>
<td>78 52%</td>
<td><strong>83</strong> 69%</td>
<td>78 52%</td>
<td><strong>84</strong> 71%</td>
<td><strong>81</strong> 63%</td>
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<td>Visual motor speed composite</td>
<td>28.33 19%</td>
<td><strong>34.55</strong> 55%</td>
<td><strong>32.13</strong> 36%</td>
<td><strong>36.25</strong> 66%</td>
<td><strong>40.33</strong> 82%</td>
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<tr>
<td>Reaction time composite</td>
<td>0.62 18%</td>
<td><strong>0.49</strong> 90%</td>
<td>0.51 81%</td>
<td>0.49 90%</td>
<td>0.47 94%</td>
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<td>Impulse control composite</td>
<td>41</td>
<td>5</td>
<td><strong>15</strong> 15%</td>
<td>9</td>
<td>10</td>
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<tr>
<td>Total Symptom Score</td>
<td>0</td>
<td><strong>1</strong></td>
<td><strong>4</strong></td>
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</table>
Smarter, Safer Concussion Management for the Student Athlete

1. Concussion Education
2. Baseline Testing
3. Post-Concussion Evaluation
4. Academic Support During Recovery
5. Return-to-Play Decision
Post-Concussion Symptoms

• Become better with rest…
  – From physical-sports exertion
  – From mental exertion
    • Sustained attention in class and during school day
    • Reading
    • Homework
    • Tests/quizzes
Post-Concussion Symptom Cycle

• What happens for some students?
  – Wake up fatigued
  – Develop headaches sitting in class
  – Can’t fully grasp class material
  – Feel worse as the day wears on
  – Bothered by light/sound at school
  – More symptomatic trying to do homework
  – Upset and worried they are falling behind
  – Go to bed feeling worse
Post-Concussion Symptoms

• What happens for some students?
  — MATH
    Conceptualizing and thinking problems through to completion
  — FOREIGN LANGUAGE – even if highly proficient
    Word retrieval
    Grammar command
  — READING
    Visual scanning + attention + memory
    Poor comprehension >> re-reading
    Poor retention
Post-Concussion Symptoms

• What happens for some students?
  - Writing may not seem as challenging
    • Allowed to follow own train of thought
    • Easier when not required to retrieve specific information
Post-Concussion Symptoms

• Learning and attentional disability
  – Temporary?
  – Short-lasting?
  – Improved more quickly with proper management
  – Complete recovery typically expected
Reasonable Accommodations for Students in Recovery

- Excused absence from classes
  - *Time out of school/compleate rest to start?*
  - Partial attendance if needed
    - Morning fatigue/poor sleep >> arrive late
    - Afternoon fatigue in school >> leave early
  - Selective attendance?
    - Core classes vs. electives?
    - Avoid classes that are too challenging?
Reasonable Accommodations for Students in Recovery

- Rest periods during the school day
  - School nurse’s office
  - Go to rest before symptoms become too intense
  - Take Tylenol/Advil, etc. as recommended by doctor
  - Return to classes if feeling better
  - Early dismissal if rest does not help
Reasonable Accommodations for Students in Recovery

• Extension of assignment deadlines!
  – Homework, papers, projects
  – According to student’s capacity
  – Removed major source of pressure
  – Allows student to prioritize sleep & rest
Reasonable Accommodations for Students in Recovery

• Excuse from some assignments?
  – More common in lower grades
  – Less catch-up to do during/after recovery
  – Consolidate work into more manageable units
Reasonable Accommodations for Students in Recovery

• Postponement of quizzes & tests
  – Until student is able to prepare and symptoms are under better control
  – Avoid high stakes testing (e.g., AP exams, SAT, GRE) while symptomatic
  – Extended time (x1.5 or x2) until recovered
  – Spring concussions – wait until summer to complete course work and exams?
Reasonable Accommodations for Students in Recovery

• Accommodation for light/noise sensitivity
  – Excuse from assemblies
  – Able to eat lunch away from dining hall
  – Cap or sunglasses for light sensitivity
  – Avoid fluorescent lights, windows
Reasonable Accommodations for Students in Recovery

• Excuse from team sports practice and gym
  – Use time for rest & homework
  – Short practice visits to stay connected to team
  – Do NOT ride bus to away games with team
Reasonable Accommodations for Students in Recovery

• Limit other forms of physical exertion
  – Heavy backpacks
  – Climbing stairs
  – Wind instruments
The Accommodation Process

• Check in daily with School Nurse and/or Guidance Counselor
  – Provides updated to staff on symptom status
  – Facilitates tracking of academic progress

• Email communication
  – Initial notice of injury
  – Symptom updated (progress/setbacks)
  – Parents may be included
Smarter, Safer Concussion Management for the Student Athlete

1. Concussion Education
2. Baseline Testing
3. Post-Concussion Evaluation
4. Academic Support During Recovery
5. Concussion Policy and Return-to-Play Consultation
Massachusetts Concussion Law

- Nov 2009—Testimony before Joint Committee on Public Health
- July 2010—S. 2469 signed by Gov. Patrick
  - “An Act Relative to Safety Regulation for School Athletic Programs” (7th in US)
- Oct 2010—DPH convenes Medical Advisory Committee
- Spring 2011—Final regulations released:
  - 105 CMR 201.000 – “Head Injuries and Concussions in Extracurricular Athletic Activities”
Lystedt Laws

- Mandatory concussion education
- Immediate removal; no return to play same day
- Written authorization for return to play from licensed/certified clinician
Clinical Trajectories

- Vestibular
- Ocular
- Cognitive
- Migraine
- Anxiety/Mood
New Conceptual Model of Sport-related Concussion Clinical Trajectories and Targeted Treatment Pathways

Risk Factors: Previous Concussions, Migraine, LD/ADHD, Sex, Age, Motion sensitivity, Ocular Hx?

Concussion → Concussion Clinical Trajectories: Vestibular, Ocular, Cognitive, Migraine, Anxiety/Mood, Cervical

Treatment and Rehab Pathways
Clinical Trajectories

• Cognitive/Fatigue
  – Fatigue, decreased energy
  – Poor concentration
  – Increased headache with cognitive activity
  – Sleep disruption?
  – Symptoms worsen as day goes on
  – Memory and/or speech deficits on ImPACT
  – May do OK on brief testing but trouble at school
Clinical Trajectories

• Cognitive/Fatigue Treatment
  – Rest from physical and cognitive exertion
  – Regulate sleep cycle, diet, hydration
  – Daily walks
  – Neurostimulant meds: Amantadine, Ritalin, Adderall
  – Sleep meds: Melatonin, Amitriptyline
  – Cognitive/speech therapy for slower recoveries
Clinical Trajectories

• Vestibular
  – Dizziness, nausea, fogginess, detachment
  – Anxiety
  – Overstimulation in complex environments
  – Rapid head/body movements can trigger symptoms
  – Symptoms provoked with horizontal/vertical gaze stability
  – May not have balance problems
  – Cognitive: lower speed/reaction time on ImPACT
Clinical Trajectories
Collins, Kontos et al. “A Comprehensive, Targeted Approach to the Clinical Care of Athletes Following Sport-Related Concussion.”

- Vestibular Treatment
  - Vestibular evaluation & therapy
  - Patients can react emotionally to VT
  - Persistent vestibular problems
    - Migraine episodes
    - Sleep dysfunction
  - Meds for migraine or sleep
Clinical Trajectories

- Ocular Motor
  - Frontal headaches
  - Fatigue
  - Distractibility
  - Trouble in visually-based activities (classroom, screens)
  - Trouble reading
  - Worse with effort at school, better over weekends
  - Blurred or double vision?
  - Marked by problems with near-point convergence or accommodation (near > far > near)
Clinical Trajectories

• Ocular Motor Treatment
  – Evaluation with neuro-optometrist
  – Vision therapy?
  – Vestibular therapy can substitute for convergence insufficiency
  – Reduce eye strain: audiobooks, less reading, limit screen time, take reading/screen breaks
  – Can continue with aerobic exercise if other symptoms low enough
Clinical Trajectories

• Anxiety/Mood
  – Feeling overwhelmed
  – Ruminative thoughts
  – Hypervigilance
  – Sad, hopeless
  – Sleep trouble due to inability to settle down
  – Often personal/family history of anxiety
  – Symptoms may be reported as headache, foggy, dizzy, fatigued
  – Symptoms more noted when quiet, inactive
Clinical Trajectories

• Anxiety/Mood Treatment
  – Supervised exercise as soon as possible (no vestibular symptoms)
    • Emotional release, increase relaxation
    • Daily plans to track exercise programs
  – Regulate sleep schedule, hydration
  – Overall better with structure
  – Psychotherapy, meds if needed
Clinical Trajectories

- Migraine
  - Unilateral, moderate to severe headache following head trauma with a pulsating quality, associated with nausea, light and/or noise sensitivity, aggravated by physical exercise
  - Usually intermittent
  - Exacerbated by sleep dysregulation, stress, anxiety, dietary triggers (e.g. Caffeine)
  - Check for personal/family history of migraine
  - ImPACT: memory deficits more common
Clinical Trajectories

• Migraine Treatment
  – Medications
    • Tricyclic antidepressants (Amitriptyline)
    • Anticonvulsants
    • Beta Blockers
    • Calcium channel blockers
    • Triptans (abortive)
  – Increased cardio activity/supervised exercise protocol
  – Structured, regulated sleep, diet, etc.
Clinical Trajectories

- Cervical (whiplash)
  - Headache
  - Neck pain
  - Numbness/tingling of extremities
  - Evaluation by PT or physical medicine
Clinical Trajectories

• Cervical Treatment
  – Range of motion exercises
  – Physical Therapy
  – Biofeedback
  – Meds: analgesics, anti-inflammatories, muscle relaxants
New Conceptual Model of Sport-related Concussion Clinical Trajectories and Targeted Treatment Pathways

Risk Factors: Previous Concussions, Migraine, LD/ADHD, Sex, Age, Motion sensitivity, Ocular Hx?

Concussion → Concussion Clinical Trajectories: Vestibular, Ocular, Cognitive, Migraine, Anxiety/Mood, Cervical

Treatment and Rehab Pathways: Image of patients undergoing treatment and rehabilitation.