Concussion and Return to Play Guidelines: New Concussion Management Paradigms

Irfan M. Asif, MD

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Irfan M. Asif, MD

Chair/Professor, Department of Family and Community Medicine, University of Alabama-Birmingham School of Medicine

Dr. Asif is a family physician who is also board certified in sports medicine. He is on the board of directors for the American Medical Society for Sports Medicine (AMSSM) and is an associate editor for both the British Journal of Sports Medicine (BJSM) and Sports Health: A Multidisciplinary Approach. His research explores several domains within sports cardiology with an emphasis on preventing cardiometabolic disease by combating physical inactivity. He has been invited to participate and speak at a number of national and international venues, such as the American College of Cardiology (ACC) Sports and Exercise Cardiology Think Tank and the International Olympic Committee (IOC) World Conference on Prevention of Injury and Illness in Sport. For this work, he has earned a number of honors, including the AMSSM Best Overall Research Award, the Society of Teachers of Family Medicine (STFM) Research Paper of the Year Award, and the T. David Sisk Research Award for Best Review Paper in the journal Sports Health.

Dr. Asif is also an avid educator. He has extensive experience as a sports medicine fellowship director and currently serves as the chair for the AMSSM Fellowship Committee. His recent work includes developing standards of excellence for sports medicine fellowship training programs across the United States. In addition, he is a current member of the writing group that is composing the International Syllabus in Sports and Exercise Medicine Education. His contributions have earned several awards, including the STFM Resident Teacher Award and the Mayo Clinic School of Continuous Professional Development Course of the Year Award.
Learning Objectives

1. Identify the immediate and delayed symptoms of concussion or mild traumatic brain injury and recommend appropriate testing or monitoring of the patient.

2. Recognize when a concussion might have caused an intracranial blood clot and recommend additional testing, monitoring, and treatment.

3. Advise athletes, parents and coaches on when an athlete is able to return to play following a concussion or mild traumatic brain injury.

4. Develop comprehensive communication plans for school officials with recommendations for academic adjustments and monitoring.

Associated Sessions

• (PBL) Concussion and Return to Play Guidelines: New Concussion Management Paradigms
Audience Engagement System

Step 1

Step 2

Step 3

Concussion Epidemic Is Existential Threat To Football

Tackle the concussion epidemic

By Sen. Tom Udall, Special to CNN
Updated 3:39 PM ET, Wed October 5, 2011
Poll Question 1

A 13 year old female soccer player and her mother present to your clinic with questions about head injuries in contact sports. The mother is concerned that her daughter is at risk for concussion by heading the soccer ball. In discussing her concerns, you tell the mother that:

a) Athlete-to-athlete contact, not pure heading, was the most frequent mechanism of concussion in American high school soccer players.
b) Concussion from heading comprises the vast majority of adolescent soccer injuries presenting to emergency departments.
c) Padded headgear worn during soccer will reduce her daughter’s risk of concussion.
d) Evidence repeatedly demonstrates that boys sustain concussions in soccer at higher rates than girls.

Definition of Concussion

- Concussion: traumatically-induced transient disturbance of brain function
  - Subset of mild traumatic brain injury (mTBI), but at the less severe end of the brain injury spectrum
  - Signs and symptoms cannot otherwise be explained by drug, alcohol, medication use, or other injuries/comorbidities
Pathophysiology

- The pathophysiology of concussion is not completely understood
  - Force delivered to the brain causing disruptive stretching of neuronal cell membranes/axons
  - Complex cascade of ionic, metabolic and pathophysiologic events

- The increased glucose utilization combined with the injury-related decrease in resting cerebral blood flow creates an energy mismatch

- Increased brain vulnerability following an initial injury and a 2nd insult can result in worsening changes and deficits

Flowchart of process to calculate total number of sports- and recreation-related concussions in children ≤18 years.

- Estimated 1.0 – 1.8 million SRCs per year in the 0-18 years age range
- 400,000 SRCs in high school athletes
• 50% of concussions were related to sport
• 19% of concussions were related to organized team sports

Epidemiologic Measures for Quantifying the Incidence of Concussion in NCAA Sports

<table>
<thead>
<tr>
<th>Sport</th>
<th># Concussions</th>
<th>Rate per 1,000 AE</th>
<th>Risks per season</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men's</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basketball</td>
<td>76</td>
<td>0.38</td>
<td>3.9%</td>
</tr>
<tr>
<td>Football</td>
<td>552</td>
<td>0.75</td>
<td>5.3%</td>
</tr>
<tr>
<td>Ice hockey</td>
<td>266</td>
<td>0.74</td>
<td>6.9%</td>
</tr>
<tr>
<td>Soccer</td>
<td>31</td>
<td>0.26</td>
<td>2.5%</td>
</tr>
<tr>
<td>Wrestling</td>
<td>68</td>
<td>0.89</td>
<td>7.9%</td>
</tr>
<tr>
<td><strong>Women's</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basketball</td>
<td>95</td>
<td>0.53</td>
<td>5.3%</td>
</tr>
<tr>
<td>Ice hockey</td>
<td>98</td>
<td>0.78</td>
<td>7.2%</td>
</tr>
<tr>
<td>Soccer</td>
<td>98</td>
<td>0.54</td>
<td>3.3%</td>
</tr>
<tr>
<td>Softball</td>
<td>40</td>
<td>0.26</td>
<td>2.4%</td>
</tr>
<tr>
<td>Volleyball</td>
<td>53</td>
<td>0.37</td>
<td>2.8%</td>
</tr>
</tbody>
</table>

Overall Seasonal Risk for All Athletes = 2.6%
Diagnosis

• The diagnosis of concussion is challenging and based on clinical assessment.
• Lack of validated, objective diagnostic tests
• Reliance on self-reported symptoms
• Non-specific symptoms (e.g. headaches, mood changes, “fogginess”, dizziness, visual changes, fatigue, and neck pain) all associated with concussion, but can originate from other etiologies
• Symptoms may be delayed in onset or initially unrecognized by the athlete

Concussion remains a clinical diagnosis made by carefully synthesizing history and physical exam findings as the injury evolves

Preseason: PPE

• The preparticipation physical evaluation (PPE) should include
  – Past concussion or other traumatic brain injury history (number, recovery course, and time between injuries)
  – Presence of other premorbid/comorbid conditions (modifiers) that may make the diagnosis/management of concussion more difficult:
    • Learning disorder
    • Attention deficit disorder
    • Motion sickness/sensitivity
    • Mood disorders
    • Migraine headaches disorder
    • Current medication use
Preseason: Baseline Testing

• Common baseline evaluations
  – Sports Concussion Assessment Tool 5th edition (SCAT 5)
  – Computerized proprietary neuropsychological tests
    • Cogsport
    • Automated Neuropsychological Assessment Metrics (ANAM)
    • Central Nervous System (CNS) Vital Signs
    • Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT)

• NCAA baseline evaluation
  – Symptom checklist
  – Cognitive evaluation
  – Balance assessment

• Baseline testing may be useful, but is not necessary, required, or an accepted standard of care (SORT B)

Poll Question 2

A 17-year-old football player is evaluated by you after sustaining a head injury during the game. He denied loss of consciousness or previous history of head injury. Initial evaluation, including mental status and balance testing, was normal, as was repeat evaluation at halftime. After the game, you note that the athlete has increased headache and blunted affect. Which of the following is correct regarding this injury?

a) The findings are typical for a concussed athlete
b) The athlete should be immediately transported for more extensive evaluation
c) The athlete should go home to rest and be re-evaluated the next day
d) The athlete can resume normal activities that evening
Sideline Assessment

- Observation of athletes during practice and competition is valuable for potential concussion recognition and management

- Reasons for immediate removal and prompt evaluation:
  - Loss of consciousness (LOC)
  - Impact seizure
  - Tonic posturing
  - Gross motor instability
  - Confusion
  - Amnesia

- Any of these reported or observed signs should result in removal from practice or competition for at least the rest of the day

Concerns for more serious head injury including prolonged LOC, severe or worsening headache, repeated emesis, declining mental status, focal neurological deficit or suspicion of significant cervical spine injury should trigger activation of the emergency action plan

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**Canadian CT Head Rule (Stiell, Lancet 2001)**

**Inclusion Criteria:** GCS 13-15, Age ≥ 16yr, No coagulopathy

**Head CT not required if NONE of the following are present**

- Age ≥ 65 years
- Vomiting > 2 time
- Suspected open or depressed skull fracture
- Signs suggesting basal skull fracture:
  - Hemo tympanum
  - Raccoon eyes
  - CSF otorrhea or rhinorrhea
  - Battle’s sign
- GCS < 15 at 2 hours post injury
- Retrograde Amnesia > 30 min
- Dangerous mechanism: Pedestrian struck by vehicle, Ejection from motor vehicle, Fall from elevation > 3 feet or 5 stairs

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**New Orleans Rule (Haydel NEJM, 2000)**

**Inclusion Criteria:** Age >18, GCS 15, Blunt head trauma occurring within previous 24 hr causing LOC, amnesia, or disorientation

**Head CT not required if NONE of the following are present**

- Headache
- Vomiting
- Age >60y
- Drug or Alcohol intoxication
- Persistent anterograde amnesia
- Visible trauma above the clavicles
- Seizure

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**Nexus II Rule (Mower, Ann of Emer Med, 2002)**

**Inclusion Criteria:** Non-penetrating trauma to the head, Presentation within 24 hours, GCS 14 or 15, Age ≥ 16

**Head CT not required if NONE of the following are present**

- Age ≥ 65yr
- Evidence of significant skull fracture
- Scalp hematoma
- Neurologic deficit
- Altered level of alertness
- Abnormal behavior
- Coagulopathy
- Recurrent or forceful vomiting

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**ACEP Clinical Policy (Mower, Ann of Emer Med, 2008)**

**Inclusion Criteria:** Non-penetrating trauma to the head, Presentation within 24 hours, GCS 14 or 15, Age ≥ 16

A noncontrast head CT indicate in head trauma patients with LOC or post-traumatic amnesia only if ≥ 1 of following is present:

- Headache
- Vomiting
- Age> 60
- Drug or alcohol intoxication
- Deficits in short-term memory
- Physical evidence of trauma above the clavicle
- Post-traumatic seizure
- GCS < 15
- Focal neurological deficit
- Coagulopathy
Poll Question 3

Which of the following statements is correct concerning sideline/real-time evaluation of an athlete with a suspected sports related concussion (SRC)?

a) Standard orientation questions (eg, time, place, person) are reliable in the sporting situation when compared with memory assessment
b) Abbreviated testing paradigms for rapid SRC screening on the sidelines can replace a comprehensive neurological evaluation
c) Current evidence does not support the use of impact sensor systems for real-time SRC screening
d) Maddocks questions are not useful for sideline SRC evaluation

Sideline Diagnosis

Most common sideline tests are generally below accepted threshold for clinical utility (0.75 – 0.90)

Multi-modal assessment increases sensitivity and specificity

<table>
<thead>
<tr>
<th>Sideline Test</th>
<th>Test-Retest Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>0.40</td>
</tr>
<tr>
<td>SAC</td>
<td>0.39 – 0.55</td>
</tr>
<tr>
<td>BESS</td>
<td>0.41 – 0.60</td>
</tr>
<tr>
<td>King-Devick</td>
<td>0.74 – 0.90</td>
</tr>
</tbody>
</table>

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BESS Balance Testing

King Devick Test

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Symptom Clusters

- Impaired balance/gait
- Visual motion sensitivity
- Confusion
- Disorientation
- Tired
- Somnolence
- Anxiety
- Depression
- Sadness
- Migraines
- Neck Pain
- Headache
- Blurry Vision

Sideline Testing

- The SCAT 5/Child SCAT 5 provide a standardized framework to evaluate athletes for concussion
- Symptoms are most sensitive indicator of concussion
- The primary endpoint of sideline evaluation is determine if the athlete had a concussion
- Serial evaluation is key: Concussion is an evolving injury
Office Evaluation

- Injury Mechanism
- Symptom Trajectory
- Neurocognitive Functioning
- Sleep/Wake Disturbance
- Vestibular and Ocular Function
- Gait/Balance
- Cervical Spine Exam
### The Vestibular/Ocular Motor Screening (VOMS)

- Vestibular symptoms: ~2/3 of concussions
- Ocular symptoms: ~1/2 of concussions

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**Vestibular Symptoms**

- Smooth Pursuit (Horizontal & Vertical)
  - Tests ability to follow a slowly moving target.
  - Both patient and clinician sit on stable, unmovable surface.
- Saccades (Horizontal & Vertical)
  - Tests ability to make quick, jerky movements.
  - Both patient and clinician sit on stable, unmovable surface.
- Convergence
  - Tests ability to focus on a close target.
  - Patient and clinician sit on stable, unmovable surface.

**Ocular Symptoms**

- Visual Motion Sensitivity
  - Tests ability to fixate on a moving target.
  - Patient and clinician sit on stable, unmovable surface.
- Vestibulo-Ocular Reflex (Horizontal & Vertical)
  - Tests ability to fixate on a moving target.
  - Patient and clinician sit on stable, unmovable surface.

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Mucha, AJSM, 2014
Emerging Assessment Tools

- King-Devick Test (KD) is a proprietary, timed saccadic eye movement test
- Simple reaction time as a sideline screen has also been studied using a dropped weighted stick
- Other technologies such as app-based measures of reaction time, eye trackers, postural stability, speech pattern, quantitative electroencephalography
- Helmet monitors
  - Indirectly monitor linear and angular acceleration forces to the brain
  - Neither a device nor a specific threshold measure of force or angular acceleration can be used to diagnose concussion

Imaging

- Head CT should be used when clinical suspicion for intracranial bleeding or macro-structural injury exists
  - Intracranial bleeds are rare
  - CT is the standard evaluation tool for these and other suspected neurosurgical emergencies in acute and critical care
- Brain magnetic resonance imaging (MRI) may have value in cases with atypical or prolonged recovery
- Advanced multi-modal MRI technologies (e.g., diffusion tensor imaging, resting state functional MRI, quantitative susceptibility imaging, magnetic resonance spectography, arterial spin labeling) are used in research protocols to understand the neurobiological effects and recovery after SRC
Biomarkers

- Show promise for ruling out intracranial bleeds and structural damage to reduce utilization of head CTs in the ED setting
  - Glial fibrillary acidic protein (GFAP)
  - Ubiquitin carboxy-terminal hydrolase L1 (UCHL1)
  - S100 calcium-binding protein β (s100β) (Europe)

Poll Question 4

What percentage of those who sustain a mild traumatic brain injury have symptoms lasting for more than 10 days?

a) Less than 5%
b) 10-15%
c) 30-50%
d) Greater than 70%
Treatment

- Vast majority of concussion symptoms resolve spontaneously
  - 80% - 90% of older adolescents and adults return to baseline within 2 weeks
  - In younger athletes up to 4 weeks is considered normal

- It is important to communicate the normal time course of recovery

Targeted Treatment

- Vestibular Rehabilitation
- Academic Modifications
- Cognitive Behavioral Therapy
- Manual Therapy
- Headache Treatment

- Counseling
- Cognitive Behavioral Therapy

Incidence, Clinical Course, and Predictors of Prolonged Recovery Time Following Sport-Related Concussion in High School and College Athletes

Harmon, BJSM/CJSM, 2019
Predicting Recovery

• The most consistent predictor of recovery from concussion is the number and severity of acute and subacute symptoms.

• Subacute headache or depression after injury are risk factors for symptoms persisting for > 1 month.

• Do not appear to be at risk for prolonged recovery:
  – Learning disabilities
  – Attention deficit/hyperactivity disorder.
Treatment – Rest

Rest has been the mainstay of treatment for decades

Total rest, i.e., “the dark room” or “cocoon therapy,” may have detrimental effects similar to social isolation effects seen in animal studies and is no longer recommended

Consensus guidelines endorse 24-48 hours of symptom-limited cognitive and physical rest followed by a gradual increase in activity, staying below symptom-exacerbation thresholds

Treatment – Exercise

• Exercise intolerance is an objective sign of physiologic concussion
• Concussion may reflect autonomic function and control of cerebral blood flow
• Exercise improves autonomic nervous system balance

• Emerging evidence suggest that symptom-limited activities may begin as tolerated after an initial brief period of rest
Persistent Post-Concussive Symptoms

- Symptoms lasting longer than 2 weeks in adults/4 weeks in children
- Do not represent ongoing concussive injury to the brain
- A formal symptom-limited aerobic exercise program has been shown to be safe and improve resolution compared to controls
- The Buffalo Concussion Exercise Treatment Protocol is the most studied

**Buffalo Concussion Treadmill Test**

3.2-3.6 mph @ 0% grade

Record HR, RPE and symptoms pre-test and q minute during test

Increase grade by 1% q minute (then 0.4 mph after max incline)

No or < 3 point increase in symptoms from pre-test value? Yes

Exhaustion (RPE 17-20)

≥ 3 point increase in symptoms from pre-test value?

Stop test
Note HR
“Physiologic Concussion”
Design sub-threshold exercise program

No concussion
Consider other causes of symptoms or begin graded RTP

Leddy, Curr Sport Med Rep, 2014
PPCS: Collaborative Care

- Ocular Rehab
- Manual Therapy
- Headache Treatment
- Counseling
- Cognitive Behavioral Therapy

- Vestibular Rehabilitation
- Academic Modifications
- Cognitive Behavioral Therapy

Nutraceuticals

- Animal models of concussion that some supplements may protect or speed recovery
  - B vitamins
  - Omega-3 fatty acids
  - vitamin D, progesterone
  - N-Methyl-D-aspartate (NMDA)
  - Exogenous ketones and dietary manipulations (e.g. ketogenic diet)

- Supplements are not FDA regulated and potential for harm or contamination should be considered
Return to Sport

- Symptoms should be resolved before returning to sport

- A return to play progression involves a gradual, step-wise increase in physical demands and sport-specific activities without return of symptoms before the final introduction of exposure to contact

- The athlete should also demonstrate psychological readiness for returning to play
  - Athlete’s age
  - History of prior SRC and level of play
  - Ability to provide close supervision during the return to activity

- The return to sport progression presented by the CISG is widely accepted but empiric, without evidence to support either the progression sequence or the time spent in each stage

- In general, for young athletes, each stage of the progression should be at least 24 hours without return of symptoms before progressing to the next stage

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Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016

Br J Sports Med published online April 26, 2017

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Graduated return-to-sport (RTS) strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage</td>
<td>Aim</td>
</tr>
<tr>
<td>1</td>
<td>Symptom-limited activity</td>
</tr>
<tr>
<td>2</td>
<td>Light aerobic exercise</td>
</tr>
<tr>
<td>3</td>
<td>Sport-specific exercise</td>
</tr>
<tr>
<td>4</td>
<td>Non-contact training drills</td>
</tr>
<tr>
<td>5</td>
<td>Full contact practice</td>
</tr>
<tr>
<td>6</td>
<td>Return to sport</td>
</tr>
</tbody>
</table>

NOTE: An initial period of 24–48 hours of both relative physical rest and cognitive rest is recommended before beginning the RTS progression. There should be at least 24 hours (or longer) for each step of the progression. If any symptoms worsen during exercise, the athlete should go back to the previous step. Resistance training should be added only in the later stages (stage 3 or 4 at the earliest). If symptoms are persistent (eg, more than 10–14 days in adults or more than 1 month in children), the athlete should be referred to a healthcare professional who is an expert in the management of concussion.
Return to Learn

- Return to learn is the process of transitioning back to the classroom following concussion using individualized academic adjustments
- SRC can induce changes in attention, cognitive processing speed, learning, short term memory, and executive function that make learning difficult
- School personnel
  - Should be informed of the injury
  - Implement an initial school support plan without delay
- Many concussed athletes recover quickly enough to return to the classroom with no or very brief adjustment of academic activities
- Athletes with persisting symptoms should be provided an individualized return to learn accommodation plan that allows for symptom-limited learning activity

Factors Associated With Problems for Adolescents Returning to the Classroom After Sport-Related Concussion

John G. Baker, PhD¹, John J. Leddy, MD¹, Scott R. Darling, MD¹, Brian P. Rieger, PhD², Terry L. Mashtare, PhD¹, Tania Sharma, MS¹, and Barry S. Willer, PhD¹

- 91 Student Athletes (aged 13-19)
- The overall number and severity of symptoms at first clinic visit was associated with more problems in school
Number of Symptoms & Symptom Severity Correlated with More Problems at School

Students who reported difficulty remembering were nearly 2x more likely to report problems at school

Return to Learning After a Concussion and Compliance With Recommendations for Cognitive Rest

Robert P. Olympia, MD,* Jed T. Ritter, BS;† Jodi Brady, MD,‡ and Harry Bramley, DO‡

School’s Role | Affirmative Responses
---|---
Does your school district have a policy in place to help students recovering from a concussion succeed when they return to school? | 464/1010; 46% (43-49)

Guideline or Protocol | Affirmative Responses (N = 548)
---|---
Excuse from team sport practices and gym activities | 477; 87% (84-90)
Extension of assignment deadlines | 479; 87% (84-90)
Excused absence from class | 462; 84% (81-87)
Rest periods during the school day | 461; 84% (81-87)
Postponement or staggering of tests | 412; 75% (71-79)
Extended testing time | 405; 74% (70-77)
Reduced workload | 402; 73% (70-77)
Accommodation for light or noise sensitivity | 350; 64% (60-68)
Excuse from (or unweight) specific tests and assignments | 265; 48% (44-53)
Potential disconnect between who is identified as the point person for academic progress and who ATC's believe the lead professional should be.

Barriers to School Nurses Functioning on the School Academic Team

- Inadequate concussion training
- Inadequate time necessary to care for student with concussion
- Perception that being a member of the school academic team for students with concussion is not a school nurse's role
- There are no barriers.
Facilitate communication and transition back to school

- Notify school personnel after injury to prepare for return to school
  - Obtain consent for communication between medical and school teams
  - Designate point person to monitor student’s status related to academics, recovery and coping with injury and communicate with medical team
    - School health professional, guidance counselor, administrator, athletic trainer
    - Develop plan for missed assignments and exams
  - Adjust schedule to accommodate reduced or modified attendance if needed

- Breaks as needed during school day
- Reduce in-class assignments and homework
- Allow increased time for completion of assignments and testing
- Delay exams until student is adequately prepared and symptoms do not interfere with testing
- Allow testing in a separate, distraction-free environment
- Modify due dates or requirements for major projects
- Provide pre-printed notes or allow peer notetaker
- Avoid high risk or strenuous physical activity

- Allow use of headphones/ear plugs to reduce noise sensitivity
- Allow use of sunglasses/hat to reduce light sensitivity
- Limit use of electronic screens or adjust screen settings, including font size, as needed
- Allow student to leave class early to avoid crowded hallways
- Avoid busy, crowded or noisy environments – music room, hallways, lunch room, vocational classes, assemblies

*Clinicians should individualize adjustments based on patient-specific symptoms, symptom severity, academic demands, as well as pre-existing conditions, such as mood disorder, learning disability, or attention deficit/hyperactivity disorder.

* Athletes with complicated or prolonged recovery may require a multi-disciplinary team with specific expertise across the scope of concussion management.

Return to Learn

Family Team
- Assess for serious injury
- Assist in decisions regarding cognitive & physical activity
- Coordinate return to cognitive exertion
- Facilitate academic adjustments and the increase in mental activity

Academic Team
- Enforce Rest
- Reduce Stimulation
- Prevent further injury
- Facilitate safe return to play

Medical Team
- Teacher
- Guidance Counselor
- School Psychologist

Athletic Team
- Physic...
Student Athlete

Family Team
- Assess for serious injury
- Assist in decisions regarding physical activity
- Coordinate return to cognitive exertion
- Facilitate academic adjustments and the increase in mental activity
- Enforce Rest
- Reduce Stimulation

Academic Team
- Coordinate return to cognitive exertion
- Facilitate academic adjustments and the increase in mental activity
- Prevent further injury
- Facilitate safe return to play

Medical Team
- Assess for serious injury
- Assist in decisions regarding cognitive & physical activity

Athletic Team
- Increase light mental activity until symptoms occur
- Parents communicate with school, sign release, & help coordinate academic adjustments

Consider return to school

Remain at home

Parents
Grandparents
Siblings

ATC
Coach
Athletic Director

Physician
Nurse
ATC

School Psychologist
Guidance Counselor
Teacher

Concentrate for 30‐45 minutes?
YN
Increase light mental activity until symptoms occur
Parents communicate with school, sign release, & help coordinate academic adjustments
Consider return to school
Remain at home
School Academic Team should reassess progress at weekly intervals (minimum)

Teachers can choose academic adjustments most amenable to their teaching style

Maximize learning in 30-45 minutes increments

Consider 30 minutes of learning with 15 minutes of rest

Observe which classes exacerbate symptoms, which can allow for further adjustments
Academic adjustment refers to non-formalized, flexible, adjustments made to the student’s environment during the typical recovery period of 1-3 weeks that does not jeopardize the curriculum or require alterations in standard testing.

Academic accommodations address longer term needs beyond 3 weeks, which might include standardized testing arrangements, extra time on work, changes in class schedule, and may be formalized in a 504 plan.

Academic modification delineates more prolonged and permanent changes to an educational plan that necessitates special education with needs specified in an IEP.

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Consensus statement on concussion in sport — the 5th international conference on concussion in sport held in Berlin, October 2016

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Table 2: Graduated return-to-school strategy

<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 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>
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Return to Drive

• Driving is a complex process involving coordination of cognitive, visual and motor skills as well as concentration, attention, visual perception, insight and memory that can all be affected by SRC

• Subtle deficits could compromise safety

• Most physicians do not counsel athletes with SRC about driving

• No widely accepted return to driving protocols exist; however, in athletes who drive, discussing the potential risks and harms is appropriate

Short-Term Risks of Premature Return to Play

• Risk of continuing to play
  – Increased symptom burden
  – Worsening of the injury
  – Prolonged recovery
  – Increased risk of repeat concussion
  – Increased rate of musculoskeletal injury

• “Second Impact Syndrome” is both rare and controversial
  – Potentially life-threatening complication of re-injury
  – Limited to pediatric and adolescent athletes
Mental Health Issues and Concussion

- Sport and exercise are protective against depression
- Suicide is lower in former NFL athletes compared to controls
- Former high school football athletes have lower rates of depression
- Several studies have suggested an increased risk of depression in NFL/college athletes with a history of concussion

Chronic Traumatic Encephalopathy

- CTE has been described in former athletes with a history of concussion
- The incidence and prevalence of CTE is unknown
- A cause and effect relationship between post-mortem changes and ante-mortem behavioral/cognitive manifestations has not been demonstrated
- It is unknown if:
  - CTE is a progressive disease
  - Tau deposition is the cause or a byproduct/marker of disease
Disqualification from Sport

- No evidence-based guidelines for disqualifying an athlete from sport after concussion
  - Each athlete should be individually assessed to determine safety and potential long-term consequences
  - No “set” number of concussions that should force retirement from a season or from sport

- Considerations for retirement from sport
  - Length of concussion recovery (progressively longer time intervals for symptom resolution)
  - Patterns of developing concussion
    - Less force
    - Increasing severity of concussions
    - Persistent neurological deficit
  - Imaging findings suggesting additional pathology
  - Individual and family tolerance of risk and perception of the benefit of sport participation

Prevention

- Technique
  - Initial evidence that practice modification and changes in tackling technique may reduce injury
  - Introduction of body checking in youth hockey reduces concussion rates

- Mouthguards
  - Conflicting evidence regarding mouthguards and concussion reduction
  - Primary use is preventing dental trauma

- Helmets
  - Prevent skull trauma and intracranial bleeding
  - Protective effects for concussion are less pronounced
Practice Recommendations

1. Concussion is a complex, heterogeneous brain injury that typically clinically resolves in 1 to 4 weeks.

2. The diagnosis of concussion is challenging as it relies on self-reported symptoms that can be caused by other common conditions and there are no readily available objective diagnostic tests to confirm the diagnosis.

3. Multi-modal assessment and treatment tools are key.

4. After a brief period of rest, acutely concussed patients can be encouraged to gradually and progressively increase physical and cognitive activity while staying below their symptom-exacerbation thresholds.

5. In cases of prolonged symptoms, a multi-disciplinary team experienced in the diagnosis and treatment of concussion should be considered.
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Questions