Concussion Management for the General Pediatrician

Erin Swanson, MD
Objectives

1. Know how to effectively diagnosis and evaluate children who have sustained an acute concussive injury
2. Describe how recognition and management of concussion has changed over the past decade.
3. Recognize how ongoing concussion symptoms may negatively affect a child's school performance.
4. Individualize a concussion plan with accommodations for daily life and school
5. Be able to identify when concussion symptoms are becoming prolonged
CLASSIFICATION CONSENSUS STATEMENTS

Consensus statement on concussion in sport: the 4th International Conference on Concussion in Sport held in Zurich, November 2012

SECTION 1: SPORT CONCUSSION AND ITS MANAGEMENT
The Zurich 2012 Consensus statement recommends that the definition of concussion and its separation from mild traumatic brain injury (mTBI) be used, where this is the case. A classification of concussion is provided and the document includes a series of recommendations for the management of sport-related concussion.

PRELIMINARY
This paper is a revision and update of the recommendations developed following the 1st (Vienna 2001), 2nd (Basel 2004) and 3rd (Graz 2008) International Conference on Concussion in Sport and is based on the deliberations at the 4th International Conference on Concussion in Sport held in Zurich, November 2012.

PREFACE
The 2012 Zurich Consensus Statement is designed to build on the principles outlined in the previous documents and to develop further consensus- based understanding of this problem using a formal consensus-based approach. A detailed description of the consensus process is outlined at the end of this document under the Background section. This document is developed primarily for use by physicians and healthcare professionals who are involved in the care of injured athletes, whether at the recreational or professional level. While agreement exists pertaining to principal messages conveyed within this document, many authors acknowledge that the science of concussion is evolving, and researchers and scientists are still to do so. This document is intended as a guideline for regulatory bodies to consider when making clinical decisions.

PREFACE
The Zurich Consensus Statement on Concussion in Sport (ZCIC) was developed to provide a framework for the understanding and management of sport-related concussion. It offers a consensus-based approach to the management of sport-related concussion. The Zurich Consensus Statement on Concussion in Sport (ZCIC) is intended to guide healthcare professionals in the assessment, diagnosis, and management of sport-related concussion.

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Concussion - Definition

CDC defines a traumatic brain injury (TBI) as a disruption in the normal function of the brain that can be caused by a bump, blow, or jolt to the head, or penetrating head injury.
Concussion - Definition

**AAN** defines concussion as clinical syndrome characterized by immediate and transient alteration in brain function, including alteration of mental status and level of consciousness, resulting from mechanical force or trauma.
Changes to the Definition

1. Concussion may be caused by either a direct blow to the head or a blow to elsewhere on the body, with an "impulsive" force transmitted to the head.

2. Concussion typically results in the rapid onset of short lived impairment in neurological function that resolves spontaneously. However, in some cases, signs and symptoms evolve over a number of minutes to hours.

3. Concussion may result in neuropathological changes, but the acute clinical symptoms reflect a functional, rather than a structural injury and as such. No abnormality is seen on standard structural neuroimaging.

4. Concussion results in range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of clinical and cognitive features typically follows a sequential course. However, in some cases may be prolonged.

5. Clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction) or other comorbidities (psychological factors or coexisting medical conditions).
WHAT CAUSES A CONCUSSION?
Causes

• Falls
• Motor Vehicle Crash
• Unintentional being struck or against
• Assaults
• Sports
  – **Boys**: Football
  – **Girls**: Soccer and Basketball
  – Rugby, Ice Hockey and Lacrosse also high risk
WHAT DOES A CONCUSSION LOOK LIKE INITIALLY?
Signs

- Disorientation
- Confusion
- Retrograde/anterograde amnesia
- Loss of consciousness
- Combativeness
- Slowness to respond
- Inability to focus
- Loss of balance
- Atypical behavior
- Personality changes
- Vacant stare
- Nystagmus
Symptoms

- Headache
- Diplopia
- Blurred vision
- Tinnitus
- Sensitivity to light or noise
- Trouble concentrating
- Memory loss
- Trouble sleeping
- Irritability
- Emotional liability
- Sadness
- Nausea
- Balance issues
- Dizziness
**Signs & Symptoms**

**Physical**
- Headache
- Balance Problems
- Visual Problems
- Fatigue
- Photophobia
- Phonophobia
- Incoordination
- Dizziness

**Sleep**
- Drowsiness
- Sleeping more/less than usual
- Difficulty falling asleep.

**Cognitive**
- Feeling mentally foggy
- Feeling slowed down
- Poor concentration
- Inattention
- Poor memory
- Answers slowly
- Repeats questions

**Emotional**
- Irritable
- Sadness/Depression
- Emotional Liability
- Nervousness/Anxiety
CONCUSSION MANAGEMENT
Question 1

- 9 year old male basketball player, with no prior PMH runs into another player and appears to hit his head on the floor. Initially, he appears dazed and has blurry vision. He is taken to the side line and evaluated by the coach, who asks him to sit on the bench. 5 minutes later he feels fine is joking around with friends. He and his parents want him to play the second half of the game.

  Can he return to the game?

- A. Yes with his parent’s permission
- B. Yes, if there is an athletic trainer available to complete a SCAT
- C. Yes, if his family calls the pediatrician and the coach verifies clearance verbally
- D. No
Question 1 Answer

- D. NO
- Needs MD in office evaluation and clearance and completion of a return to play protocol at minimum
On Field Management

- Any athlete suspected of having a concussion should be immediately removed from play for screening.
- If concussion is diagnosed: there is no same day return in pediatrics.
Diagnosis

- Multiple tools have been developed to identify and track concussion symptoms
  - Impact, SCAT5, SCAT5 Child
IMMEDIATE OR ON-FIELD ASSESSMENT

The following elements should be assessed for all athletes who are suspected of having a concussion prior to proceeding to the neurocognitive assessment and ideally should be done on-field after the first-aid/ emergency care priorities are completed.

If any of the “Red Flags” or observable signs are noted after a direct or indirect blow to the head, the athlete should be immediately and safely removed from participation and evaluated by a physician or licensed healthcare professional.

Consideration to transportation to a medical facility should be at the discretion of the physician/licensed healthcare professional.

The GCS is an important standard measure for all patients and can be done easily if necessary in the event of determination in conscious state. The Maddocks questions and cervical spine exam are critical steps of the immediate assessment, however, these do not need to be done serially.

STEP 2: OBSERVABLE SIGNS

- Witnessed or Observed in video
- Lying motionless on the playing surface
- Unavailable to get up/ move, etc.
- Unresponsive
- Unresponsive verification, or an inability to respond appropriately to questions
- Mark on arrest clock
- Fixed injury after head impact

STEP 3: MEMORY ASSESSMENT MADDocks Questions®

If you are able to give the following questions (describe each and gage nonverbal answer) first, tell me what happened?

- What is your age?
- What is your address?
- What is your phone number?
- What is your last name?
- Did you win or lose the last game?

Note: Appropriate open-specific questions may be substituted.

STEP 4: EXAMINATION GLASSOMA COMA SCALE (GCS)®

**Time of assessment**

**Time of assessment**

Best eye response (E)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>No eye opening</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Compressing in response</td>
<td>2</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Compressing in sleep</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Eyes cannot open</td>
<td>4</td>
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Best verbal response (V)

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<tr>
<td>No verbal response</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Incomprehensible sounds</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Incomprehensible words</td>
<td>3</td>
<td>3</td>
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</tr>
<tr>
<td>Confused</td>
<td>4</td>
<td>4</td>
<td>4</td>
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<tr>
<td>Oriented</td>
<td>5</td>
<td>5</td>
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</table>

Best motor response (M)

<table>
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<tr>
<th></th>
<th>1</th>
<th>2</th>
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</thead>
<tbody>
<tr>
<td>No motor response</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Extensor response</td>
<td>2</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Abnormal response to pain</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Limping/ Inability to walk</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Good grasp</td>
<td>5</td>
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</tbody>
</table>

IMMEDIATE MEMORY

The Immediate Memory component can be completed using the traditional 5-word per trial list or optionally using 10-words per trial to minimize any ceiling effect. All 3 trials must be administered irrespective of the number correct on the first trial. Administrator at the rate of one word per second.

STEP 5: COGNITIVE SCREENING

** ориентирование**

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<tr>
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<tbody>
<tr>
<td>Name:</td>
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<td>Address:</td>
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<td>Examined:</td>
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<td>Date:</td>
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</table>

**концентрация и восприятие чисел**

Please circle the digit that is chosen (A, B, C, D, E, F). Administrator at the rate of one digit per second reading DOWN the selected column.

**многие месяцы в обратном порядке**

New York is the last month in the mnemonic order. Start with the last month and go backwards.

Dec- Nov- Oct- Sep- Aug- Jul- Jun- May- Apr- Mar- Feb- Jan

**Диагнозы**

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<table>
<thead>
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<tbody>
<tr>
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<td>List B</td>
<td>List C</td>
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<td>6</td>
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<td>9</td>
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<td>6</td>
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<td>4</td>
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<tr>
<td>3</td>
<td>2</td>
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**Children’s of Alabama®**
OFFICE OR OFF-FIELD ASSESSMENT

Please note that the neurocognitive assessment should be done in a distraction-free environment with the athlete in a resting state.

STEP 1: ATHLETE BACKGROUND

Sport / team / school
Date / time of injury
Years of education completed
Age:
Gender: M / F / Other
Dominant hand: left / neither / right
How many diagnosed concussions has the athlete had in the past?
When was the most recent concussion?
How long was the recovery time to being cleared to play?

Has the athlete ever been:
Hospitalized for a head injury?
Diagnosed / treated for headache disorder or migraine?
Diagnosed with a learning disability / dyslexia?
Diagnosed with ADHD / ADD?
Diagnosed with depression, anxiety or other psychiatric disorder?

Current medications? If yes, please list:

STEP 2: SYMPTOM EVALUATION

The athlete should be given the symptom form and asked to rate their symptoms on a scale of 0-5.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>0</th>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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</thead>
<tbody>
<tr>
<td>Headache</td>
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<tr>
<td>Presence in head</td>
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<tr>
<td>Neck Pain</td>
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<tr>
<td>Nausea or vomiting</td>
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<tr>
<td>Dizziness</td>
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<tr>
<td>Blurred vision</td>
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<tr>
<td>Balance problems</td>
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<tr>
<td>Sensitivity to light</td>
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<td>Hypersensitivity to noise</td>
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<tr>
<td>Feeling slowed down</td>
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<td>Feeling like you’re “out of sync”</td>
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<td>Difficulty concentrating</td>
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<td>Difficulty remembering</td>
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<td>Fatigue or low energy</td>
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<tr>
<td>Confusion</td>
<td></td>
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<tr>
<td>Irritability</td>
<td></td>
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<tr>
<td>Somnolence</td>
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<tr>
<td>Malaise</td>
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<td>Fatigue</td>
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<td>Sleeping problems</td>
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<td>Trouble falling asleep</td>
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</tbody>
</table>

Total number of symptoms:

STEP 3: NEUROLOGICAL SCREEN

See the instruction sheet (page 4) for details of test administration and scoring of the tests.

Can the patient read aloud (e.g. a sentence checklist) and follow instructions without difficulty?

Can the patient perform the Stroop test within the time limit?

Can the patient perform the Tug test correctly?

Can the patient perform the Finger test correctly?

Can the patient perform the Finger test correctly and rapidly?

Can the patient perform the Finger test correctly and rapidly and with control?

BALANCE EXAMINATION

Modified Balance Error Scoring System (mBESS) testing:

Unstable 

<table>
<thead>
<tr>
<th>Unstable</th>
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</thead>
<tbody>
<tr>
<td>Unstable</td>
</tr>
</tbody>
</table>

Time Scored

Total number of words recalled after reading:

STEP 6: DECISION

Date & time of assessment

Name:

Title:

Registration number (if applicable):

Date:

I am a physician or licensed healthcare professional and have personally administered or supervised the administration of this SCATS.

Signature:

I agree with the contents of the report as presented.

Title:

Date:

Please hand form back to examiner.
Physical Exam

- There may or may not be physical exam finding
- Standard neurologic exam including reflexes is usually normal
- However, may have
  - nystagmus
  - difficulties with smooth eye movements
  - changes in pupil reaction
  - difficulties with coordination/Balance
  - Convergence insufficiency
  - VestibularOcular dysfunction
Convergence Insufficiency

Double vision makes it difficult to read and comprehend.
Vestibular Occular Dysfunction

- The way the inner ears, brain, and eyes work together to detect motion, and head position in space
- Needed for balance, stable vision, and to track a target
- Increased prevalence after concussion in kids
  - 28-60% depending on the study
- Even higher prevalence in patient’s with post concussion
When to Refer to the Emergency Department

- Headaches that worsen
- Seizures
- Focal neurologic signs
- Looks very drowsy/ can’t be awakened
- Repeated vomiting
- Slurred speech
- Can’t recognize people or places
- Increasing confusion or irritability
- Weakness or numbness in arms/legs
- Neck pain
- Unusual behavioral change
- Change in state of consciousness
12 yo female with PMH of common headaches and asthma sustained a concussion 6 days ago and was evaluated in your office 5 days ago with ongoing intermittent moderate headaches, blurry vision, and decreased attention, normal neurologic exam with the exception of end range lateral nystagmus and mild impairments in balance. She returned to full days of school yesterday and went to her friend’s birthday party after which she has had a headache that has not gone away, along with photophobia, phonophobia, and nausea, but no emesis. She returns to your office, after not going to school due to the severity of the headache. Her exam is unchanged. Mom is very concerned and wants a CT.

True or False, This patient needs an urgent head CT.

A. True
B. False
Question 2 Answer

- B. False
- After 6 hours the chance of finding a clinically significant intracranial hemorrhage is 0.03% (without deterioration in Level of consciousness)
CT or No CT?

- In general children do not need a CT after concussion
- CT’s do not rule in or out a concussion
- CT’s diagnosis bleeding inside the skull or fractures
Initial Presentation:
Is imaging needed?

- Concussion results in *functional deficits*
- Imaging is helpful only if *structural damage* is suspected
  - Intracranial Hemorrhage
  - Skull fracture
  - Cervical spine injury
Symptoms that have the Highest Risk for Structural Brain Injury

- GCS < 15
- Altered Mental Status
  - Agitation
  - Somnolence, repetitive questions
  - Slow response
- Signs of Basal Skull Fracture
- GCS of 15
  - Fall from >3 feet
  - MVC or bike crash
  - Struck by high impact object
  - Vomiting
  - Severe headache
I have confirmed a diagnosis of Concussion

What now?
Head Protection

- No return to play the same day
- No return to play while symptomatic
  - Graded return to play once Asymptomatic
- Avoiding higher risk activities
  - Impaired reaction time, balance, vision
- Driving Restriction
  - Impaired Attention/Concentration, reaction time, Coordination
Concussion Management

SYMPTOMS

PHYSICAL
- Headache
- Nausea
- Fatigue
- Visual Problems
- Balance Problems

Cognitive
- Mental Fogginess
- Concentration problems
- Memory problems
- Slowed processing speed

EMOTIONAL
- Irritability
- Sadness
- Emotional lability
- Anxiety

SLEEP
- Drowsiness
- Sleeping more / less than usual
- Trouble falling or staying asleep
Initial Concussion Management

**“Strict rest”**
- Avoid activities that increase symptoms
- Out of school
- Limit tests/standardized tests
- Limit screen time - computer, video games, texting

**“Relative rest”**
- New studies are suggesting that strict rest may prolong symptoms
- In school with accommodations
  - Out only 1-2 days
- Involved in daily activities to tolerance
- Physical rest

Sleep schedule
- Early exercise may be detrimental

Step-wise progression back to activity (cognitive & physical) as patient becomes asymptomatic

(DiFazio, 2015; Thomas et al, 2015)
Physical Symptoms

- Headache is a very common symptom
- May be accompanied by nausea, light and noise sensitivity, visual symptoms
- Encourage child to take a break/step away from activities that increase symptoms
- Hydration: 64 oz/day
- Medications: Tylenol & Ibuprofen
- Avoiding Triggers – Bright Loud Places
Sleep

- Sleep hygiene
- Consistent bedtime and waking time
- Same routine every night
- Dark quiet space
- No screen time (phone, computer, videogame, tablet) 1 hour prior to Bed
- +/- Melatonin*
Emotional

- Relaxation techniques
- Coping Skills
- Counseling
- Psychology
- Psychiatry
Medications

- No change to pre injury medications
- Tylenol/ Ibuprofen
  - Ibuprofen is okay after 48-72 hours
  - OR after evaluation by physician
- Melatonin
- Typically do not start other medications until 1 month out from injury
Cognitive Symptoms and School Return

- Gradual Return to School
- Time Based vs Activity Based
- Individualized Based on the needs of each child
- Careful when “Clearing” for full academics (ie Homework and tests)
Return to Play Criteria

Prior to Return to play (RTP), concussed athletes should not only be symptom-free, but also should not be taking any pharmacological agents/medications that may mask or modify the symptoms of concussion.
My Return to Play Criteria

- Symptom Free
- Normal Exam
  - Including eye tracking, vestibular, balance and coordination
- Returned to full academics and baseline academic achievement
- Off medications that could be covering up symptoms
Return to Play

<table>
<thead>
<tr>
<th>Rehabilitation stage</th>
<th>Functional exercise at each stage of rehabilitation</th>
<th>Objective of each stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No activity</td>
<td>Physical and cognitive rest</td>
<td>Recovery</td>
</tr>
<tr>
<td>Light aerobic exercise</td>
<td>Walking, swimming or stationary cycling keeping intensity, 70% maximum predicted heart rate. No resistance training</td>
<td>Increase heart rate</td>
</tr>
<tr>
<td>Sport-specific exercise</td>
<td>Skating drills in ice hockey, running drills in soccer. No head impact activities</td>
<td>Add movement</td>
</tr>
<tr>
<td>Non-contact training drills</td>
<td>Progression to more complex training drills, eg passing drills in football and ice hockey. May start progressive resistance training</td>
<td>Exercise, coordination, and cognitive load</td>
</tr>
<tr>
<td>Full contact practice</td>
<td>Following medical clearance participate in normal training activities</td>
<td>Restore confidence and assess functional skills by coaching staff</td>
</tr>
<tr>
<td>Return to play</td>
<td>Normal game play</td>
<td></td>
</tr>
</tbody>
</table>
Question 3

- 14 year old male who sustained his 2nd concussion during a football game 2 and a half weeks ago. Followed weekly with reassuring exams, gradual return to school with accommodations has been successful and he is back in school full time. Symptoms are improving but he continues to have intermittent headaches at the end of the school day lasting 10-15 minutes, difficulty falling asleep, fatigue, and still feels “slow”. Dad is very concerned that he is taking so long to recover and is worried about him being able to return to football before the end of the season.

- What is the normal recovery time for concussion in pediatrics and how do you counsel the family?

- A. This is concerning and symptoms are becoming prolonged as he has not recovered in 2 weeks
- B. This is not concerning and he is mostly recovered so he can start the return to play protocol
- C. This is not concerning as average recovery time is about 4 weeks, are continuing to improve, but he is not ready to start return to play
- D. This recovery is abnormal and he needs and urgent head CT as headaches have continued.
Question 3 Answer

- C. Normal recovery time in pediatrics is about 4 weeks
  - Younger children and adolescents take longer to recover than college athletes.
  - Patient is still within the normal recovery time and having reassuring recovery
  - Still not ready to return to play
When do Concussion Symptoms Become Prolonged?

- Berlin expert consensus: failure of normal clinical recovery—that is, symptoms that persist beyond expected time frames (ie, >10–14 days in adults and >4 weeks in children)
Who is at Risk for Prolonged Symptoms?

- History of prior concussion
- **Additional head impact with in 24 hours**
  - 52 vs 36 days
- **Patients who returned to game practice after injury**
  - 44 days vs 22 days if played an avg of 20 minutes afterwards
- **Female gender**
- Younger age
- History of cognitive dysfunction
- History of migraines
- Pre- Injury affective disorders
  - Anxiety
  - Depression
  - Somatization
Initial Symptoms that May Predict a Prolonged Recovery

- Headache
- Fatigue
- Dizziness
- Taking longer to think
- Visual impairment
- Amnesia at the time of injury
What are the Most Common Symptoms that Linger?

- Sleep disturbance
- Frustration
- Forgetfulness
- Fatigue
I think my patient may need a specialist

- Symptoms not significantly improved after 2 weeks
- The patient has a history of multiple concussions or risk factors for prolonged recovery.
  - history of migraines
  - depression, mood disorders, or anxiety
  - developmental disorders such as learning disabilities or ADHD.
Question 4

- 15 year old female soccer player completed return to play and has returned to full academic and activity after a concussion 2 months ago. Mom wants to prevent further head injuries and has read about mouth guards and soft helmets to prevent concussions in soccer.
- Which equipment has demonstrated the most evidence to prevent concussions in soccer?
  - A. Mouth guards
  - B. Soft helmets/headgear
  - C. Soft neck collars
  - D. None of the above
Question 4 Answer

- D. None of the above
  - Mouth guards prevent maxillofacial and dental trauma
  - Soft head gear may increase the risk of injury
    - Increase rotation forces to the head
    - Increased risk for more aggressive style of play
RETURN TO LEARN
# Symptoms and Effects on School Participation

<table>
<thead>
<tr>
<th>Signs/ Symptoms</th>
<th>Potential Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Headache</strong></td>
<td>Most common symptom reported with concussions. Can distract from concentration. Can vary throughout the day and may be triggered by various exposure, such as fluorescent lighting, loud noises, and focusing on task</td>
</tr>
<tr>
<td><strong>Dizziness/Lightheadedness</strong></td>
<td>May be indication of injury to the vestibular system. May make standing quickly or walking in crowded environment challenging. Often provoked by visual stimulus (rapid movements, videos, etc.)</td>
</tr>
</tbody>
</table>
| **Visual Symptoms: Light sensitivity, Double, Blurry vision** | Trouble with various aspects of the school building: Slide presentations, movies, smart boards, computers, handheld computers (tablets), artificial Lighting  
  - Difficulty reading and copying.  
  - Difficulty paying attention to visual tasks |
| **Noise sensitivity**                   | Trouble with various aspects of the school building:  
  - Lunchroom, shop classes, music classes (band/choir), PE, Hallways, organized sports practices. |
| **Difficulty Concentrating or remembering** | Difficulty learning new task and comprehending new materials.  
  Difficulty with recalling and applying previously learned material.  
  Lack of focus in the classroom  
  Troubles with test taking  
  Troubles with standardized testing.  
  Reduced ability to take drivers education classes |
| **Sleep Disturbance**                  | Excessive fatigue can hamper memory for new or past learning or ability to attend and focus  
  Insufficient sleep can lead to tardiness or excessive absences  
  Difficulty getting to sleep or frequent waking at night may lead to sleeping in class.  
  Excessive napping due to fatigue may lead to further disruptions of sleep cycle. |
Return to Learn/School
Academic Adjustments

- Non-formalized adjustments made to school environment
  - During typical 1-3 week recovery period
  - Do not jeopardize curriculum
- Include:
  - Homework – reduction in workload
    - Printed notes
    - No SMART Board® or other blue screens
  - Avoid highly stimulating environments
    - Lunch in nurse’s office or library
    - No assemblies
    - No gym
    - Transition between classes 5 minutes earlier
  - Breaks in nurse’s office
  - Testing
    - One large test or assignment due per day
    - Extended time
Return to Learn/School Academic Adjustments

<table>
<thead>
<tr>
<th>Academic Accommodations</th>
<th>Academic Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Long Term needs (&gt;3 weeks)</td>
<td>• More prolonged and more permanent change to educational plan</td>
</tr>
<tr>
<td>• Can include:</td>
<td>• Modifications depend on severity and type of symptoms as well as teaching style in the classroom</td>
</tr>
<tr>
<td>– standardized testing arrangements</td>
<td></td>
</tr>
<tr>
<td>– Extra time on work</td>
<td>• Special education with specific items in Formal IEP/504 plan</td>
</tr>
<tr>
<td>– Changes in class schedule</td>
<td></td>
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</tbody>
</table>
Daily Concussion Modifications

Patient Name: ____________________________

Date: ____________

May return to school / work on:

☐ Not released to return to school / work / gym / sports / recess at this time
☐ Not released to drive at this time

School:
☐ Return to Think Modification Form
☐ Rest breaks as needed due to concussion symptoms
☐ Limit screen time to _____ hours / day (Please give paper handouts / printed class notes for all classes)
☐ Allow extra time for homework / tests
☐ Allow extra time between classes (leave 5 min before the bell)
☐ Allow lunch in a quiet place with a friend (allowed 2 times)
☐ Allow sunglasses/sleeping hats in the classrooms as needed
☐ Allow a water bottle in the classroom (2 liters of water or sports drink per day)

Physical Activity/Work:
☐ No gym / sports / recess
☐ Limit gym / sports / recess to ________________

☐ Please allow only ____ hours/24h and should symptoms arise be able to return home.

Headache Protocol:
☐ Take a 5-10 minute break – can put head down in class
☐ If headache not relieved, please allow to leave class and go to somewhere quiet (ie. nurse’s station, library, etc.)
☐ If headache not relieved by dark and quiet, please allow patient to take (in office):
  Tylenol _____ mg _____ times per day
  Advil _____ mg _____ times per day
  Aleve _____ mg _____ times per day

Sleep Protocol:
☐ No screens 1 hour before bed (TV, computer, iPad, phone, etc.)
☐ Limit naps or deep per night
☐ Same sleep and wake up time every night (even on the weekends)
☐ Melatonin _____ mg at ______PM/ _____ mg _____ mins/hr(s) before bedtime

Physician’s Signature:
Sara Koseki, MD
Kenneth McCulloch, MD
Erin Swanson, MD

Children’s of Alabama®
## Return to Learn/School Academic Adjustments

### Stage 1 - 1/2 Day Passive Learning - Getting acclimated to the school setting
1. No reading, writing, homework or tests
2. Students should attempt to absorb information through auditory learning only
   - Additional accommodations may be necessary
   - Goal is to stay in school, even if frequent rest breaks are required.

**Progress to Stage 2 on**

### Stage 2 - Full Day Passive Learning - Increasing tolerance for the school setting
1. No reading, writing, homework or tests
2. May substitute gym or computer classes for verbal tutoring (repetition of current concepts)
   - Additional accommodations may be necessary
   - Goal is to stay in school and be exposed to new information
   - The student should not be doing make-up work at this stage

**Progress to Stage 3 on**

### Stage 3 - 1/2 Day Passive Learning & 1/2 Day Active Learning - Beginning an active cognitive load
1. Student may alternate half days to distribute workload
2. During the active portion of the day, they may read and write
3. **NO HOMEWORK OR TESTS AT THIS STAGE**
   - May substitute gym/computer classes for tutoring (repetition of current concepts)

**Progress to Stage 4 on**

### Stage 4 - Full Day Active Learning - Expanding the cognitive workload
1. No homework or tests
2. No make-up work. Concentrate on current concepts in school
   - May substitute gym/computer classes for tutoring (repetition of current concepts)

**Progress to Stage 5 on**
STAGE 5 – FULL ACTIVE LEARNING – may resume homework at 50% of the normal workload
1. Concentrate on current homework concepts; may attempt make-up work if tolerating current workload, but overall homework should not exceed 50% of the normal workload
2. No tests
3. May substitute gym class for tutoring (repetition of current concepts)
Progress to Stage 6 on

STAGE 6 – FULL ACTIVE LEARNING – normal amount of homework
1. Student should not do more than the normal amount of work. For example, if student begins make-up work, it should be 50% make-up work and 50% current concepts.
2. No tests
   * May substitute gym class for tutoring (repetition of current concepts)
Progress to Stage 7 on

STAGE 7 – FULL ACTIVE LEARNING – add tests
1. May add _______ tests per day
2. No standardized tests
3. Give additional time for completion of tests, if needed
4. If student is still unable to participate in gym class due to symptoms, they may use this time for completion of make-up work
Progress to Stage 8 on

STAGE 8 – FULL ACTIVE LEARNING – no restrictions
1. Please allow _______ weeks for student to complete make-up work.
   * Student should be given _______ hour(s) or less of make-up work per night.
Concussion/mTBI: often “Invisible”

- Student looks “fine”

- Students may be viewed as:
  - malingering
  - lazy
  - disorganized
  - “just adolescent”, “hormonal”

- Even when schools are aware of the TBI, many don’t associate certain behaviors with the injury
Accommodations for daily life

- School /return to learn
- Activity/sport
- Work
- Driving
- Headache management
- Sleep schedule
Concurrent Accommodations for Daily Life

Return to work

- Depends on the demands of the job
- Areas to address
- Ability to tolerate sensory rich and distracting environments
- Risk at job for re-injury

Return to driving

- No clear criteria in literature
- Areas to address –
  - Reaction time
  - Quick head turns
  - Optokineticsensitivity
  - Far point visual scanning – Peripheral vision
  - Ability to filter extraneous sensory information
Resources

HEADS UP by CDC [https://www.cdc.gov/headsup/index.html](https://www.cdc.gov/headsup/index.html)

Brain Steps [www.brainsteps.net](http://www.brainsteps.net)


- Remove/reduce
- Educate
- Adjust/accommodate
- Pace
**Summary**

<table>
<thead>
<tr>
<th>Changing definition of concussion</th>
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<tbody>
<tr>
<td>• Often no loss of consciousness</td>
</tr>
<tr>
<td>• Not always from a head hit</td>
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<tr>
<th>Common pitfalls</th>
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</thead>
<tbody>
<tr>
<td>• Returning to Athletics early</td>
</tr>
<tr>
<td>• <strong>Prolonged “House Arrest”, strict vs. relative rest</strong></td>
</tr>
<tr>
<td>• Academic Overload</td>
</tr>
<tr>
<td>• Not Acknowledging the emotional component</td>
</tr>
<tr>
<td>• <strong>Restriction of ALL screens</strong></td>
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<thead>
<tr>
<th>An interdisciplinary model</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Physicians, Therapists, Schools</td>
</tr>
<tr>
<td>• The role of speech therapists has expanded treating children &amp; adolescents with prolonged symptoms after a concussion</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Address “whole” patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Each concussion is unique and how symptoms manifest is different for each patient with each injury</td>
</tr>
<tr>
<td>• Accommodations as needed</td>
</tr>
</tbody>
</table>
Questions?
References

• Mark E. Halstead, Karen McAvoy, Cynthia D. Devore, Rebecca Carl, Michael Lee, Kelsey Logan, Council on Sports Medicine and Fitness, Council on School Health
• HEADS UP TO Healthcare providers
References

References

References

- Mark E. Halstead, Kevin D. Walter, Kody Moffatt and COUNCIL ON SPORTS MEDICINE AND FITNESS Pediatrics December 2018, 142 (6) e20183074; DOI: https://doi.org/10.1542/peds.2018-3074
References

- KingD,ClarkT,GissaneC.Useofarapidvisualscreeningtoolfortheassessmentofconcussioninamateurrugby
References