Outpatient Management of Concussion

David Lessman, MD FAAP CAQSM
Primary Care Sports Medicine
Advocate Children’s Hospital – Park Ridge
Objectives

- Define, recognize, and diagnose a patient with a concussion
- Understand and implement “Return-to-Learn” and “Return-to-Play” guidelines
Primary Care Sports Medicine

- AKA:
  - Nonsurgical orthopedics
  - Musculoskeletal Medicine

- Training: Residency
  - FM, Pediatrics, IM, ER, PM & R
  - Fellowship (1-2 years)

- Certificate of Added Qualification (CAQ)
Primary Care Sports Medicine

- Focus on treating the patient to prevent injury, improve performance and enhance overall health
- Advocate Concussion Program
- Team physicians
Advocate Lutheran General Hospital
Primary Care Sports Medicine

- Phil Skiba, D.O.
- Kara Vormittag, M.D.
- David Lessman, M.D.

- Nesset and Yacktman Pavilion
- Yacktman Pavilion – Pediatrics
- Nesset Pavilion - FM
CONCUSSION

Look on the Bright side. For one brief, glorious moment, you forgot you were on the Cubs.
Just a little history...

- International Symposia for Concussion in Sport
  - Vienna, Austria in 2001
  - Prague, Czech Republic 2004
  - Zurich, Switzerland 2008
  - Zurich, Switzerland 2012
Legislation

- **Zackery Lystedt Law (2009)**
  - Washington became the first state to pass a concussion law

- **Since 2009, all 50 states and Washington, D.C. have developed concussion laws [last was Mississippi Jan 30, 2014]**
Illinois State Law July 2011
HB0200

- School boards to work with IHSA to educate coaches/athletes/parents about concussions
- Info sheet to be signed prior to participation
- Suspected concussions removed from play immediately
- No return to play until evaluated by a licensed health care provider trained in the evaluation and management of concussions and head injuries and the student athlete receives written clearance to return to play from that health care provider
**HOW DO YOU DEFINE CONCUSSION?**

Traumatically induced transient disturbance of brain function that involves a complex pathophysiological process.

A complex pathophysiological process affecting the brain, induced by biomechanical forces.

Concussion is recognized as a clinical syndrome of biomechanically induced alteration of brain function, typically affecting memory and orientation, which may or may not involve loss of consciousness (LOC).

“Concussion” was found to be unintentionally communicating to parents that a brain injury had not occurred resulting in less than adequate follow-up.

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Harmon 2013

McCrory 2012

Giza 2013, AAN

DeMatteo CA My child doesn’t have a brain injury, he only has a concussion. *Pediatrics*, 2010
<table>
<thead>
<tr>
<th>GRADE</th>
<th>GRADE 2</th>
<th>GRADE 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>MILD</td>
<td>MODERATE</td>
<td>SEVERE</td>
</tr>
<tr>
<td>MINIMAL CONCUSSION</td>
<td>MINIMAL CONCUSSION</td>
<td>MINIMAL CONCUSSION</td>
</tr>
<tr>
<td>OR CONCUSSION THAT DOESN'T LAST LONG</td>
<td>OR CONCUSSION THAT LASTS</td>
<td>OR CONCUSSION THAT LASTS</td>
</tr>
<tr>
<td>NO LOSS OF CONSCIOUSNESS</td>
<td>NO LOSS OF CONSCIOUSNESS</td>
<td>NO LOSS OF CONSCIOUSNESS</td>
</tr>
<tr>
<td>ALL SYMPTOMS RESOLVE IN LESS THAN 15 MINUTES</td>
<td>ALL SYMPTOMS RESOLVE IN MORE THAN 15 MINUTES</td>
<td>ALL SYMPTOMS RESOLVE IN MORE THAN 15 MINUTES</td>
</tr>
</tbody>
</table>
What is a Concussion?

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

Definition:

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

Definition:

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

Definition:

4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course. However, it is important to note that in some cases symptoms may be prolonged.

Signs and Symptoms

- **Physical**
  - HA, nausea, vomiting, dizziness, photophobia, phonophobia, balance problems

- **Cognitive**
  - ‘foggy’, memory problems, confusion

- **Emotional**
  - Irritability, sadness

- **Sleep**
  - Drowsiness, difficulty falling asleep
“If you’ve seen one concussion you’ve seen ONE concussion”  
(Herring, Seattle)
Neuronal Disruption

Potassium Efflux, Calcium Influx, Release of Glutamate

Increased Potassium Efflux

Increased Demand for ATP & Glucose

“Metabolic Crisis”
Epidemiology

- CDC estimates 1.6-3.8 million concussion per year in U.S. sports

- 1997-2007:
  - ER visits for sports concussion doubled (8-13 yrs)
  - Increased by greater than 200% (14-19 yrs)
    - (Peds 2010)

- Recurrence Risk
  - 4-6x increase for 2nd injury
Concussion Epidemiology

Common Symptoms

Dangers of Concussion

- Second Impact Syndrome
- Chronic Traumatic Encephalopathy
- Post-concussion syndrome
Second Impact Syndrome

- Cerebral swelling from a second concussion while the patient is still symptomatic from an earlier concussion.
- Disordered cerebral autoregulation causing cerebrovascular congestion and malignant cerebral edema with increased intracranial pressure, leading to herniation.
- Leads to death or devastating neurological injury
Second Impact Syndrome

- Symptoms usually immediately following second impact and progress rapidly
  - Dilated pupils
  - Altered mental status
  - Loss of consciousness
  - Coma
  - Death
Chronic Traumatic Encephalopathy (CTE)

- “Punch Drunk”
  - Martland, 1928
  - Symptom complex, result of repeated sublethal blows to the head

- “Dementia Pugilistica”
  - Millpaugh
CTE

- Progressive, degenerative disease of the brain found in those with a history of repetitive brain trauma.
- The symptoms of CTE are insidious, first manifest by deteriorations in attention, concentration, and memory, as well as disorientation and confusion, and occasionally accompanied by dizziness and headaches.
CTE

- Build-up of abnormal Tau protein
- Only seen on staining post-mortem
CTE At A Glance

Full Name: Chronic traumatic encephalopathy

Cause: Repetitive mild traumatic brain injury

Who's affected: Athletes in contact sports such as boxing, football, ice hockey, soccer, and wrestling; military veterans; victims of domestic abuse; headbangers

Symptoms: Memory loss, depression, suicidal thoughts, explosive or aggressive behavior, and in some cases, trouble walking or speaking

Pathology: Unlike in Alzheimer's disease, in CTE, tau protein tangles first accumulate in the brain's cortex. What also sets CTE apart from other brain disorders is that tau collects around blood vessels (above, left) and deep in the cortical sulci (above, right) of the brain.

Treatment: None

Stages Of Disease

Stage I: Hot spots of tangled tau pop up in isolated areas of the cortex (black circle).

Stage II: Multiple hot spots of tangled tau appear in the cortical sulci, and tau begins to migrate.

Stage III: Tau hot spots begin to blend with one another. Tangles appear more diffusely throughout the ridges of the brain. Tau begins to collect in the hippocampus (involved in learning and memory) and amygdala (involved in decision making and emotions).

Stage IV: Dense tau tangles cover the brain's cortex and appear in most other regions, including the spinal cord.

NOTE: Stages proposed by Ann C. McKee, Boston University, still need to be validated by other research groups. Based on Brain 2013, doi: 10.1093/brain/aws307.
‘Lights Went Out,’ but He Kept Playing
Uruguayan Player’s Return After Head Injury Stirs Debate
By ANDREW DAS  JUNE 20, 2014

Just when you think awareness is improving...

Chris Borland’s decision to retire from NFL at age 24 admirable

Ex-prep quarterback files concussion suit against IHSA
by John Keilman
Referral to Emergency Dept

- LOC – length of time?
- Focal neurological signs
- Worsening headaches
- Worsening mental status
- Seizures
- Repeated emesis
Assessment in the Office

HISTORY:
- Baseline
  - ADHD
  - Mood disorder
  - Sleep disturbances
  - Medications
- History of concussion
- Symptom score
- School difficulties

PHYSICAL:
- Complete neuro exam
  - BESS
- Balance assessment
- Vestibular assessment
Child-SCAT3™
Sport Concussion Assessment Tool for children ages 5 to 12 years
For use by medical professionals only

What is child5CAT3™?
The Child-SCAT3™ is a standardized tool for evaluating injured children for concussion and is used in children aged from 5 to 12 years. It is based on the original SCAT3™ published in 2005 and 2008, respectively. For older children, ages 13 years and over, please use the SCAT5™. The Child-SCAT3™ is designed for use by medical professionals. If you are not qualified, you should not use the SCAT3™.

Specific instructions for use of the Child-SCAT3™ are provided on page 3. If you are unfamiliar with the Child-SCAT3™, please read through these instructions carefully. This tool may be freely copied in its current form for distribution to individuals and groups. Any modification or compilation into a digital form requires approval by the Concussion in Sport Group.

What is a concussion?
A concussion is a functional brain injury caused by a direct or indirect force to the head. It results in a variety of non-specific signs and/or symptoms (see those listed below) and may often occur without initial loss of consciousness. Concussion should be suspected in the presence of any or more of the following:
- Symptoms (e.g., headache, or sleep disturbance; or
- Physical signs (e.g., emotional or cognition, or
- Impaired balance function (e.g., coordination, or
- Abnormal behaviors, e.g., change in personality).

SIDELINE ASSESSMENT
Indications for Emergency Management

NOTE: A hit to the head can sometimes be associated with a more severe brain injury. If the concussed child displays any of the following, then do not proceed with the Child-SCAT3™, instead activate emergency procedures and urgent transportation to the nearest hospital:
- Glasgow Coma Score less than 15
- Deteriorating mental status
- Potential spinal injury
- Progressive, worsening symptoms or new neurologic signs
- Persistent vomiting
- Evidence of skull fracture
- Post-traumatic seizures
- Loss of consciousness
- History of neurosurgery (e.g., ZMT)
- Multiple injuries

Potential signs of concussion?
If any of the following signs are observed after a direct or indirect blow to the head, the conscious level participation, be examined by a medical professional, and should not be permitted to return to sport the same day if a concussion is suspected.

- Any loss of consciousness?
- If so, how long?
- Balance or motor coordination (doubles, slow/abused movements, etc.)
- Orientation or confusion (ability to respond appropriately to questions)
- Loss of naming
- If so, how long?
- Before or after the injury?
- Blank or vacant look
- Visible facial injury in combination with any of the above.

Sideline Assessment – child-Maddocks Score
I am going to ask you a few questions, please listen carefully and give your best effort. Answer the Maddocks questions (cross out correct answer):

<table>
<thead>
<tr>
<th>Question</th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where are we at now?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is it before or after lunch?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What did you have last week/days?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is your teacher’s name?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>child-Maddocks score</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Child-Maddocks score is for sideline diagnosis of concussion only and is not used for serial testing.

Any child with a suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration (i.e., should not be left alone). No child diagnosed with concussion should be returned to sports participation on the day of injury.

BACKGROUND

<table>
<thead>
<tr>
<th>Name:</th>
<th>Date/Time of Injury:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Examiner:</th>
<th>Date of Assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sport/team/school:</th>
<th>Gender:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M: F</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age:</th>
<th>Current school year/gender:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dominant hand:</th>
<th>Mechanism of Injury:</th>
</tr>
</thead>
<tbody>
<tr>
<td>right</td>
<td>left/other</td>
</tr>
</tbody>
</table>

For Parent/carer to complete:

- How many concussions has the child had in the past?
- When was the most recent concussion?
- How long was the recovery from the most recent concussion?
- Has the child ever been hospitalized or has medical imaging (CT or MRI) for a head injury?

- Y | N | Y | N

- Y | N | Y | N
# Symptom Evaluation

## Child report

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have trouble paying attention</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I get distracted easily</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I have a hard time concentrating</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I have problems remembering what people tell me</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I have problems following directions</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I daydream too much</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I get confused</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I forget things</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I have problems finishing things</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I have trouble figuring things out</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>It's hard for me to learn new things</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I have headaches</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I feel dizzy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I feel like the room is spinning</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I feel like I'm going to faint</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Things are blurry when I look at them</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I see double</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I feel sick to my stomach</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I get tired, even if I have rested</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total number of symptoms (Maximum possible 20)**

**Symptom severity score (Maximum possible 20x3 = 60)**

## Parent report

The child

- has trouble sustaining attention
- is easily distracted
- has difficulty concentrating
- has problems remembering what he/she is told
- has difficulty following directions
- tends to daydream
- gets confused
- is forgetful
- has difficulty completing tasks
- has poor problem solving skills
- has problems learning
- has headaches
- feels dizzy
- has a feeling that the room is spinning
- feels faint
- has blurred vision
- has double vision
- experiences nausea
- gets tired, even if I have rested

**Total number of symptoms (Maximum possible 20)**

**Symptom severity score (Maximum possible 20x3 = 60)**

## Cognitive & Physical Evaluation

### Cognitive assessment

**Standardized Assessment of Concussion – Child Version (SAC-C)**

**Orientation**

- What month is it? [0, 1]
- What is the date today? [0, 1]
- What is the day of the week? [0, 1]
- What year is it? [0, 1]

**Orientation score**

**Immediate memory**

<table>
<thead>
<tr>
<th>List</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Alternative word list</th>
</tr>
</thead>
<tbody>
<tr>
<td>elbow</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>candle, baby, finger</td>
</tr>
<tr>
<td>apple</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>paper, monkey, penny</td>
</tr>
<tr>
<td>carpet</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>sugar, perfume, blanket</td>
</tr>
<tr>
<td>saddle</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>sandwich, sunset, lemon</td>
</tr>
<tr>
<td>bubble</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>wagon, iron, insect</td>
</tr>
</tbody>
</table>

**Total Immediate Memory score total**

**Concentration: Digits Backward**

<table>
<thead>
<tr>
<th>List</th>
<th>Trial 1</th>
<th>Alternative digit list</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-2</td>
<td>0</td>
<td>5-2</td>
</tr>
<tr>
<td>4-9-3</td>
<td>1</td>
<td>6-2</td>
</tr>
<tr>
<td>3-8-1-4</td>
<td>0</td>
<td>3-2-7-9</td>
</tr>
<tr>
<td>6-2-9-7-1</td>
<td>0</td>
<td>5-2-8-6-7</td>
</tr>
<tr>
<td>7-1-8-4-6-2</td>
<td>0</td>
<td>5-3-9-1-4-8</td>
</tr>
</tbody>
</table>

**Total of 5**

**Concentration: Days in Reverse Order**

- Sunday-Saturday
- Friday-Thursday
- Wednesday-Tuesday
- Monday

**Concentration score**

### Neck Examination

- Range of motion
- Tenderness
- Upper and lower limb sensation & strength

**Findings**

### Balance examination

- Do one or both of the following tests.
  - Footwear (shoes, barefoot, braces, tape, etc.)
- **Modified Balance Error Scoring System (BESS) testing**
  - Which foot was tested (i.e. which is the non-dominant foot): Left, Right
  - Testing surface (hard floor, field, etc.)
  - Condition
    - Double leg stance (hard floor, field, etc.): Error
    - Tandem stance (non-dominant foot at back): Error
  - **Tandem gate**
    - Time taken to complete (set of 4 trials): ______ seconds
    - If child attempted, but unable to complete tandem gait, mark here
<table>
<thead>
<tr>
<th>Symptom</th>
<th>none</th>
<th>mild</th>
<th>moderate</th>
<th>severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>“Pressure in head”</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Neck Pain</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Nausea or vomiting</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Dizziness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Blurred vision</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Balance problems</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Sensitivity to light</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Sensitivity to noise</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Feeling slowed down</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Feeling like “in a fog”</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>“Don’t feel right”</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Difficulty concentrating</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Difficulty remembering</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Fatigue or low energy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Confusion</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Trouble falling asleep</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>More emotional</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Irritability</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Sadness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Nervous or Anxious</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

*You should score yourself on the following symptoms, based on how you feel now*. 
Neurocognitive Testing

- ImPACT testing
- Automated Neuropsychological Assessment Metrics (ANAM) – military
- Concussion vital signs
- Headminder
- King-Devick testing
- Neuropsychologist referral
Treatment

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

- Physical
  - Restriction of activity
    - PE/recess
    - Athletics
    - Working out

- Cognitive
  - May require time off school
  - “Screen time”
  - Driving
Risk Factors for Prolonged Recovery Following Sports Concussion

- **Age**
  - Field, Lovell, Collins et al. *J of Pediatrics* 2003
  - (Pellman, Lovell et al. *Neurosurgery* 2006
  - Guskiewicz. 2011 *Pm R*

- **Previous concussion**
  - Hollis. 2009 *Am J of SM*

- **Migraine History**
  - Lipton. *JAMA* 2004

- **Genetics**

- **Gender Differences**
  - Females have higher rate of concussion 1:7:1
  - Females more prone to post-concussion symptoms
    - Neck strength differences?

- **Mood Disorders**
  - Kontos. *Arch Phys Med Rehab* 2012
Return to Learn

- Team Concept
  - Family Team
  - Medical Team
  - School Teams
    - academic team
      - 504 plan
      - IEP
    - physical activity team
Guidance for Determining Student Readiness to Return to Learning

Student tolerance of cognitive stimulation or concentration

**SYMPTOM ONSET <30-45 minutes**
- **REST AT HOME**
  - Encourage sleep
  - Light mental activity
  - Light reading or light TV
  - Light interaction with family

**SYMPTOM ONSET >30-45 minutes**
- School Attendance
- **ADJUSTMENTS AS NEEDED FOR SYMPTOM EXACERBATION**
  - 45 min. of instruction
  - 15 min. rest period
  - Additional instruction as tolerated

- Late start/early dismissal, planned/as needed rests, increase activity as tolerated, no extracurricular until back to full curricular program. For missed instruction consider class notes, easing assignments, reduced course load, etc.

No driving, no employment, no malls, decreased screen time/social networks/video games/computer work
Return to Play

- Progressive, step-wise approach
- Must be completely asymptomatic at rest
- Cognitive return to baseline with school
- Asymptomatic with removal of any medication to treat symptoms
## Return to Play Protocol

<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>1. No activity</td>
<td>Complete physical and cognitive rest</td>
<td>Recovery</td>
</tr>
<tr>
<td>2. Light aerobic exercise</td>
<td>Walking, swimming or stationary cycling keeping intensity &lt;70% maximum predicted heart rate</td>
<td>Increase heart rate</td>
</tr>
<tr>
<td></td>
<td>No resistance training</td>
<td></td>
</tr>
<tr>
<td>3. 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>4. Non-contact training</td>
<td>Progression to more complex training drills, eg passing drills in football and ice hockey</td>
<td>Exercise, coordination, and cognitive load</td>
</tr>
<tr>
<td>drills</td>
<td>May start progressive resistance training</td>
<td></td>
</tr>
<tr>
<td>5. 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>6. Return to play</td>
<td>Normal game play</td>
<td></td>
</tr>
</tbody>
</table>
# Return to Learn Protocol

**TABLE 1 Cognitive Activity Scale**

<table>
<thead>
<tr>
<th>Level</th>
<th>Activity Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Complete cognitive rest</td>
</tr>
<tr>
<td>1</td>
<td>Minimal cognitive activity</td>
</tr>
<tr>
<td>2</td>
<td>Moderate cognitive activity</td>
</tr>
<tr>
<td>3</td>
<td>Significant cognitive activity</td>
</tr>
<tr>
<td>4</td>
<td>Full cognitive activity</td>
</tr>
</tbody>
</table>

- Complete cognitive rest: No reading, homework, text messaging, video game playing, online activity, crossword puzzles, or similar activities. The most stimulating activities at this level would be watching television, watching movies, or listening to music.
- Minimal cognitive activity: No reading, homework, crossword puzzles, or similar activities. Less than 5 text messages per day, less than 20 min per day combined of online activity and video games.
- Moderate cognitive activity: Reading less than 10 pages per day, less than 20 text messages per day, and doing less than 1 h combined of homework, online activity, and video games per day.
- Significant cognitive activity: Reading less, doing less homework, working less online, text messaging less, and doing crossword or other activities than you would normally do, but more than listed in level 2.
- Full cognitive activity: You have not limited cognitive activity at all.

Clinical Trajectories - UPMC

- Cognitive/Fatigue
- Vestibular
- Ocular

- Post-traumatic Migraine
- Cervical
- Anxiety/Mood

Where do we go from here?

- Prevention
- Medications
- Disqualification
Vitamin Regimen?

- Cognitive Function
  - Fish Oil/Omega3
  - Zinc
  - Gingko Biloba

- Headaches
  - Coenzyme Q
  - Riboflavin
  - Mg Oxide

- Insomnia
  - Melatonin

- Depression/Anxiety
  - St Johns Wort
    - Branched Chain AA
    - Zinc
    - Alpha Lipoic Acid
    - N-Acetyl Cysteine
    - Turmeric/Curcumin (Polyphenols)
Additional Resources

- Center for Disease Control and Prevention
  - cdc.gov/concussion – Heads Up program
- Rethinkconcussions.com - UPMC
- pediatriccareonline.org
- REAP concussion program - Colorado
References

- McGrath N. Supporting the student athlete’s return to the classroom after a sport-related concussion. J Athl Train. 2010;45(5):492–498
- Martland HS: Punch drunk. JAMA 91:1103–1107, 1928