

Concussion Management for the General Pediatrician



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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



International Conference on Concussion Consensus Statements



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

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PREAMBLE

This paper is a revision and update of the recommendations developed following the 1st (Vienna 2001), 2nd (Prague 2004) and 3rd (Zurich 2008) International Consensus Conferences on Concussion in Sport and is based on the deliberations at the 4th International Conference on Concussion in Sport held in Zurich, November 2012.¹⁻³

The new 2012 Zurich Consensus statement is designed to build on the principles outlined in the previous documents and to develop further conceptual 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, elite or professional level.

While agreement exists pertaining to principal messages conveyed within this document, the authors acknowledge that the science of concussion is evolving, and therefore management and return to play (RTP) decisions remain in the realm of clinical judgement on an individualised basis. Readers are encouraged to copy and distribute freely the Zurich Consensus document, the Concussion Recognition Tool (CRT), the Sports Concussion Assessment Tool V3 (SCAT3) and/or the Child SCAT3 card and none are subject to any restrictions, provided they are not altered in any way or converted to a digital format. The authors request that the document and/or the accompanying tools be distributed in their full and complete format.

This consensus paper is broken into a number of sections:

1. A summary of concussion and its management, with updates from the previous meetings;
2. Background information about the consensus meeting process;
3. A summary of the specific consensus questions discussed at this meeting;
4. The Consensus paper should be read in conjunction with the SCAT3 assessment tool, the Child SCAT3 and the CRT (designed for lay use).

SECTION 1: SPORT CONCUSSION AND ITS MANAGEMENT

The Zurich 2012 document examines the sport concussion and management issues raised in the previous Vienna 2001, Prague 2004 and Zurich 2008 documents and applies the consensus questions from section 3 to these areas.¹⁻³

Definition of concussion

A panel discussion regarding the definition of concussion and its separation from mild traumatic brain injury (mTBI) was held. There was acknowledgement by the Concussion in Sport Group (CISG) that although the terms mTBI and concussion are often used interchangeably in the sporting context and particularly in the US literature, others use the term to refer to different injury constructs. Concussion is the historical term representing low-velocity injuries that cause brain 'shaking' resulting in clinical symptoms and that are not necessarily related to a pathological injury. Concussion is a subset of TBI and will be the term used in this document. It was also noted that the term *commotio cerebri* is often used in European and other countries. Minor revisions were made to the definition of concussion, which is defined as follows:

Concussion is a brain injury and is defined as a complex pathophysiological process affecting the brain, induced by biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilised in defining the nature of a concussive head injury include:

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;
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;
3. Concussion may result in neuropathological changes, but the acute clinical symptoms

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

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PREAMBLE

The 2017 Concussion in Sport Group (CISG) consensus statement is designed to build on the principles outlined in the previous statements¹⁻⁴ and to develop further conceptual understanding of sport-related concussion (SRC) using an expert consensus-based approach. This document is developed for physicians and healthcare providers who are involved in athlete care, whether at a recreational, elite or professional level. While agreement exists on the principal messages conveyed by this document, the authors acknowledge that the science of SRC is evolving and therefore individual management and return-to-play decisions remain in the realm of clinical judgement.

This consensus document reflects the current state of knowledge and will need to be modified as new knowledge develops. It provides an overview of issues that may be of importance to healthcare providers involved in the management of SRC. This paper should be read in conjunction with the systematic reviews and methodology paper that accompany it. First and foremost, this document is intended to guide clinical practice; however, the authors feel that it can also help form the agenda for future research relevant to SRC by identifying knowledge gaps.

A series of specific clinical questions were developed as part of the consensus process for the Berlin 2016 meeting. Each consensus question was the subject of a specific formal systematic review, which is published concurrently with this summary statement. Readers are directed to these background papers in conjunction with this summary statement as they provide the context for the issues and include the scope of published research, search strategy and citations reviewed for each question. This 2017 consensus statement also summarises each topic and recommendations in the context of all five CISG meetings (that is, 2001, 2004, 2008, 2012 as well as 2016). Approximately 60 000 published

articles were screened by the expert panels for the Berlin meeting. The details of the search strategies and findings are included in each of the systematic reviews.

The details of the conference organisation, methodology of the consensus process, question development and selection on expert panellists and observers is covered in detail in an accompanying paper in this issue.⁵ A full list of scientific committee members, expert panellists, authors, observers and those who were invited but could not attend are detailed in the end of the summary document. The International Committee of Medical Journal Editors' conflict of interest declaration for all authors is provided in Appendix 1.

Readers are encouraged to copy and freely distribute this Berlin Consensus Statement on Concussion in Sport, the Concussion Recognition Tool version 5 (CRT5), the Sports Concussion Assessment Tool version 5 (SCAT5) and/or the Child SCAT5. None of these are subject to copyright restriction, provided they are used in their complete format, are not altered in any way, not sold for commercial gain or rebranded, not converted into a digital format without permission, and are cited correctly.

Medical legal considerations

The consensus statement is not intended as a clinical practice guideline or legal standard of care, and should not be interpreted as such. This document is only a guide, and is of a general nature, consistent with the reasonable practice of a healthcare professional. Individual treatment will depend on the facts and circumstances specific to each individual case. It is intended that this document will be formally reviewed and updated before 31 December 2020.

SRC AND ITS MANAGEMENT

The paper is laid out following the CISG's 11 'R's' of SRC management to provide a logical flow of

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

The GCS is important as a standard measure for all patients and can be done serially if necessary in the event of deterioration 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 1: RED FLAGS

RED FLAGS:

- Neck pain or tenderness
- Double vision
- Weakness or tingling/burning in arms or legs
- Severe or increasing headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious state
- Vomiting
- Increasingly restless, agitated or combative

STEP 2: OBSERVABLE SIGNS

Witnessed	Observed on Video	Y	N
Lying motionless on the playing surface		Y	N
Balance / gait difficulties / motor incoordination: stumbling, slow / laboured movements		Y	N
Disorientation or confusion, or an inability to respond appropriately to questions		Y	N
Blank or vacant look		Y	N
Facial injury after head trauma		Y	N

STEP 3: MEMORY ASSESSMENT MADDOCKS QUESTIONS²

"I am going to ask you a few questions, please listen carefully and give your best effort. First, tell me what happened?"

Mark Y for correct answer / N for incorrect	Y	N
What venue are we at today?	Y	N
Which half is it now?	Y	N
Who scored last in this match?	Y	N
What team did you play last week / game?	Y	N
Did your team win the last game?	Y	N

Note: Appropriate sport-specific questions may be substituted.

Name: _____
 DOB: _____
 Address: _____
 ID number: _____
 Examiner: _____
 Date: _____

STEP 4: EXAMINATION GLASGOW COMA SCALE (GCS)³

Time of assessment			
Date of assessment			

Best eye response (E)

	1	1	1
No eye opening	1	1	1
Eye opening in response to pain	2	2	2
Eye opening to speech	3	3	3
Eyes opening spontaneously	4	4	4

Best verbal response (V)

	1	1	1
No verbal response	1	1	1
Incomprehensible sounds	2	2	2
Inappropriate words	3	3	3
Confused	4	4	4
Oriented	5	5	5

Best motor response (M)

	1	1	1
No motor response	1	1	1
Extension to pain	2	2	2
Abnormal flexion to pain	3	3	3
Flexion / Withdrawal to pain	4	4	4
Localizes to pain	5	5	5
Obeys commands	6	6	6

Glasgow Coma score (E + V + M)

CERVICAL SPINE ASSESSMENT

Does the athlete report that their neck is pain free at rest?	Y	N
If there is NO neck pain at rest, does the athlete have a full range of ACTIVE pain free movement?	Y	N
Is the limb strength and sensation normal?	Y	N

In a patient who is not lucid or fully conscious, a cervical spine injury should be assumed until proven otherwise.

STEP 3: COGNITIVE SCREENING Standardised Assessment of Concussion (SAC)⁴

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
What time is it right now? (within 1 hour)	0	1
Orientation score	of 5	

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 minimise any ceiling effect. All 3 trials must be administered irrespective of the number correct on the first trial. Administer at the rate of one word per second.

Please choose EITHER the 5 or 10 word list groups and circle the specific word list chosen for this test.

I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order. For Trials 2 & 3: I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before.

List	Alternate 5 word lists				Score (of 5)			
					Trial 1	Trial 2	Trial 3	
A	Finger	Penny	Blanket	Lemon	Insect			
B	Candle	Paper	Sugar	Sandwich	Wagon			
C	Baby	Monkey	Perfume	Sunset	Iron			
D	Elbow	Apple	Carpet	Saddle	Bubble			
E	Jacket	Arrow	Pepper	Cotton	Movie			
F	Dollar	Honey	Mirror	Saddle	Anchor			
Immediate Memory Score					of 15			
Time that last trial was completed								

List	Alternate 10 word lists				Score (of 10)			
					Trial 1	Trial 2	Trial 3	
G	Finger	Penny	Blanket	Lemon	Insect			
	Candle	Paper	Sugar	Sandwich	Wagon			
H	Baby	Monkey	Perfume	Sunset	Iron			
	Elbow	Apple	Carpet	Saddle	Bubble			
I	Jacket	Arrow	Pepper	Cotton	Movie			
	Dollar	Honey	Mirror	Saddle	Anchor			
Immediate Memory Score					of 30			
Time that last trial was completed								

Name: _____
 DOB: _____
 Address: _____
 ID number: _____
 Examiner: _____
 Date: _____

CONCENTRATION DIGITS BACKWARDS

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

I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7.

Concentration Number Lists (circle one)					
List A	List B	List C			
4-9-3	5-2-6	1-4-2	Y	N	0
6-2-9	4-1-5	6-5-8	Y	N	1
3-8-1-4	1-7-9-5	6-8-3-1	Y	N	0
3-2-7-9	4-9-6-8	3-4-8-1	Y	N	1
6-2-9-7-1	4-8-5-2-7	4-9-1-5-3	Y	N	0
1-5-2-8-6	6-1-8-4-3	6-8-2-5-1	Y	N	1
7-1-8-4-6-2	8-3-1-9-6-4	3-7-6-5-1-9	Y	N	0
5-3-9-1-4-8	7-2-4-8-5-6	9-2-6-5-1-4	Y	N	1
List D	List E	List F			
7-8-2	3-8-2	2-7-1	Y	N	0
9-2-6	5-1-8	4-7-9	Y	N	1
4-1-8-3	2-7-9-3	1-6-8-3	Y	N	0
9-7-2-3	2-1-6-9	3-9-2-4	Y	N	1
1-7-9-2-6	4-1-8-6-9	2-4-7-5-8	Y	N	0
4-1-7-5-2	9-4-1-7-5	8-3-9-6-4	Y	N	1
2-6-4-8-1-7	6-9-7-3-8-2	5-8-6-2-4-9	Y	N	0
8-4-1-9-3-5	4-2-7-9-3-8	3-1-7-8-2-6	Y	N	1
Digits Score:			of 4		

MONTHS IN REVERSE ORDER

Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November. Go ahead.

Dec - Nov - Oct - Sept - Aug - Jul - Jun - May - Apr - Mar - Feb - Jan	0	1
Months Score	of 1	
Concentration Total Score (Digits + Months)	of 5	



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) from the most recent concussion?: _____ (days)

Has the athlete ever been:

	Yes	No
Hospitalized for a head injury?		
Diagnosed / treated for headache disorder or migraines?		
Diagnosed with a learning disability / dyslexia?		
Diagnosed with ADD / ADHD?		
Diagnosed with depression, anxiety or other psychiatric disorder?		

Current medications? If yes, please list:

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

2

STEP 2: SYMPTOM EVALUATION

The athlete should be given the symptom form and asked to read this instruction paragraph out loud then complete the symptom scale. For the baseline assessment, the athlete should rate his/her symptoms based on how he/she typically feels and for the post injury assessment the athlete should rate their symptoms at this point in time.

Please Check: Baseline Post-Injury

Please hand the form to the athlete

	none	mild	moderate	severe			
Headache	0	1	2	3	4	5	6
"Pressure in head"	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or Anxious	0	1	2	3	4	5	6
Trouble falling asleep (if applicable)	0	1	2	3	4	5	6
Total number of symptoms:							of 22
Symptom severity score:							of 132
Do your symptoms get worse with physical activity?							Y N
Do your symptoms get worse with mental activity?							Y N
If 100% is feeling perfectly normal, what percent of normal do you feel?							

If not 100%, why?

Please hand form back to examiner

4

STEP 4: NEUROLOGICAL SCREEN

See the instruction sheet (page 7) for details of test administration and scoring of the tests.

Can the patient read aloud (e.g. symptom check-list) and follow instructions without difficulty?	Y	N
Does the patient have a full range of pain-free PASSIVE cervical spine movement?	Y	N
Without moving their head or neck, can the patient look side-to-side and up-and-down without double vision?	Y	N
Can the patient perform the finger nose coordination test normally?	Y	N
Can the patient perform tandem gait normally?	Y	N

BALANCE EXAMINATION

Modified Balance Error Scoring System (mBESS) testing*

Which foot was tested (i.e. which is the non-dominant foot)	<input type="checkbox"/> Left <input type="checkbox"/> Right
Testing surface (hard floor, field, etc.)	_____
Footwear (shoes, barefoot, braces, tape, etc.)	_____
Condition	Errors
Double leg stance	of 10
Single leg stance (non-dominant foot)	of 10
Tandem stance (non-dominant foot at the back)	of 10
Total Errors	of 30

6

STEP 6: DECISION

Domain	Date & time of assessment:		
Symptom number (of 22)			
Symptom severity score (of 132)			
Orientation (of 5)			
Immediate memory	of 15 of 30	of 15 of 30	of 15 of 30
Concentration (of 5)			
Neuro exam	Normal Abnormal	Normal Abnormal	Normal Abnormal
Balance errors (of 30)			
Delayed Recall	of 5 of 10	of 5 of 10	of 5 of 10

Date and time of injury: _____

If the athlete is known to you prior to their injury, are they different from their usual self?
 Yes No Unsure Not Applicable
 (if different, describe why in the clinical notes section)

Concussion Diagnosed?
 Yes No Unsure Not Applicable

If re-testing, has the athlete improved?
 Yes No Unsure Not Applicable

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

Signature: _____

Name: _____

Title: _____

Registration number (if applicable): _____

Date: _____

5

STEP 5: DELAYED RECALL:

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section. Score 1 pt. for each correct response.

Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.

Time Started _____

Please record each word correctly recalled. Total score equals number of words recalled.

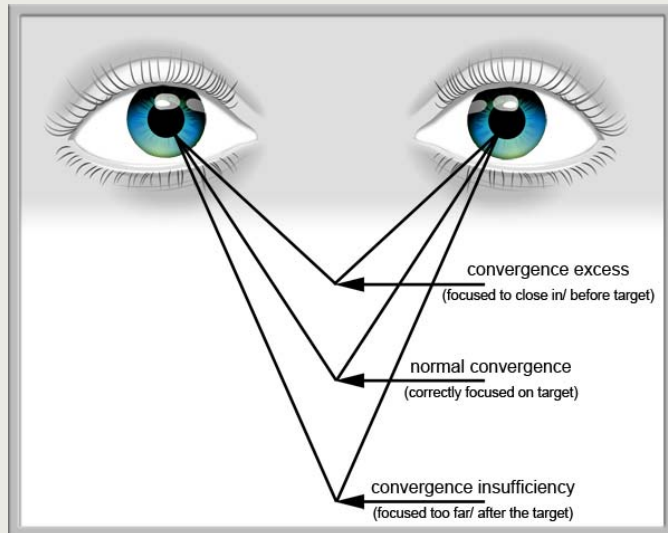
Total number of words recalled accurately: _____ of 5 or _____ of 10

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.

VestibularOcularDysfunction

- 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



Question 2

- 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
- Sensitivity to light / noise
- Numbness or tingling
- Vomiting
- Dizziness

Cognitive

- Mental Foginess
- 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

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



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

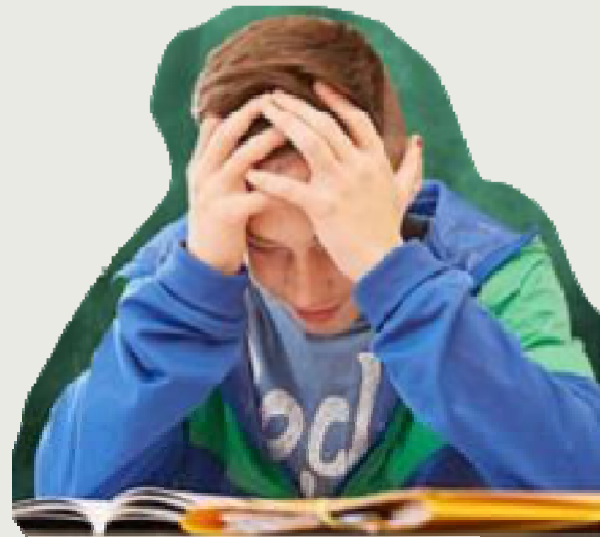


Question 4 Answer

- 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

Signs/ Symptoms	Potential Implications
Headache	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
Dizziness/Lightheadness	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.)
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 <ul style="list-style-type: none"> - Difficulty reading and copying. - Difficulty paying attention to visual tasks
Noise sensitivity	Trouble with various aspects of the school building: <ul style="list-style-type: none"> - 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

Academic Accommodations



- Long Term needs (>3 weeks)
- Can include:
 - standardized testing arrangements
 - Extra time on work
 - Changes in class schedule
- May include a 504 Plan or formal IEP Plan

Academic Modifications

- More prolonged and more permanent change to educational plan
- Modifications depend on severity and type of symptoms as well as teaching style in the classroom
- Special education with specific items in Formal IEP/504 plan



Return to Learn/School Academic Adjustments

 
Children's of Alabama UAB SPORTS MEDICINE
Telephone (205) 934-1041

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

Scholastic:

Return to Think Modification Form Please start 504 Plan
 Rest breaks as needed due to concussion symptoms
 Limit screen time to _____ / 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 max)
 Allow sunglasses/earplugs in the classroom 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 _____ hour(s)/shift 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 someplace 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.)
 Goal: 9 hours of sleep per night
 Same sleep and wake up time every night (even on the weekends)
 Melatonin _____ mg at _____ PM/ _____ mg _____ min(s)/hr(s) before bedtime

Physician's Signature: _____
Sara Gould, MD
Kenneth McCollough, MD
Erin Swanson, MD

1600 7th Ave South, Lowder 402
Birmingham, AL 35233
P: (205) 934-1041 F: (205) 975-6109



Return to Learn/School Academic Adjustments

STAGE 1 – ½ 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 – ½ DAY PASSIVE LEARNING & ½ 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 _____



Return to Learn/School Academic Adjustments

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>

Brain Steps www.brainsteps.net

REAP Program

<https://rockymountainhospitalforchildren.secure.ehc.com/service/concussion-management-reap-guidelines>

Remove/reduce

Educate

Adjust/accommodate

Pace



Summary

Changing definition of concussion

- Often no loss of consciousness
- Not always from a head hit

Common pitfalls

- Returning to Athletics early
- **Prolonged “House Arrest”, strict vs. relative rest**
- Academic Overload
- Not Acknowledging the emotional component
- **Restriction of ALL screens**

An interdisciplinary model

- Physicians, Therapists, Schools
- The role of speech therapists has expanded treating children & adolescents with prolonged symptoms after a concussion

Address “whole” patient

- Each concussion is unique and how symptoms manifest is different for each patient with each injury
- Accommodations as needed

Questions?



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