

Concussion- Return to Learn, Return to Play, and Cognitive Rehabilitation



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Objectives

1. Describe how recognition and management of concussion has changed over the past decade.
2. Recognize how ongoing concussion symptoms may negatively affect a child's school performance.
3. Give examples of modifications and adaptations, which if implemented, may help facilitate return to learn after Concussion.



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. A summary of 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).

To cite: McCrory P, Meeuwisse WH, Aubry M, et al. *Br J Sports Med* 2013;47:250-258.

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.¹⁻⁴

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 panelists and observers is covered in detail in an accompanying paper in this issue.⁵ A full list of scientific committee members, expert panelists, authors, observers and those who were invited but could not attend are detailed at 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

► Additional material is published online only. To view these files please visit the journal online (<http://dx.doi.org/10.1136/bjsports-2013-092313>).

For numbered affiliations see end of article.

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Accepted 6 March 2017



To cite: McCrory P, Meeuwisse WH, Dvořák J, et al. *Br J Sports Med* Published Online First: [please include Day/Month/Year], doi:10.1136/bjsports-2017-097699

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McCrory P, et al. *Br J Sports Med* 2017;0:1-10. doi:10.1136/bjsports-2017-097699

McCrory P, et al. *Br J Sports Med* 2013;47:250-258. doi:10.1136/bjsports-2013-092313

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Concussion- Definition

CDC defines a concussion as a type of TBI caused by a bump, blow, or jolt to the head or by a hit to the body that causes the head and brain to move rapidly back and forth causing the brain to bounce around or twist in the skull, creating chemical changes in the brain and sometimes stretching and damaging brain cells

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

Previous Concussion 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 **functional neurologic impairment** which is of brief duration and resolves spontaneously.
3. Concussion may result in neuropathological changes, but the acute clinical symptoms reflect a **functional**, rather than a **structural** disturbance
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 a small percentage of cases, post-concussive symptoms may be prolonged
5. No abnormality on standard structural **neuroimaging studies** is seen in concussion.

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



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, SCAT2, SCAT3, Child SCAT3

BACKGROUND

Name: _____ Date: _____
 Examiner: _____
 Sport/team/school: _____ Date/time of injury: _____
 Age: _____ Gender: M F
 Years of education completed: _____
 Dominant hand: right left neither
 How many concussions do you think you have had in the past? _____
 When was the most recent concussion? _____
 How long was your recovery from the most recent concussion? _____
 Have you ever been hospitalized or had medical imaging done for a head injury? Y N
 Have you ever been diagnosed with headaches or migraines? Y N
 Do you have a learning disability, dyslexia, ADD/ADHD? Y N
 Have you ever been diagnosed with depression, anxiety or other psychiatric disorder? Y N
 Has anyone in your family ever been diagnosed with any of these problems? Y N
 Are you on any medications? If yes, please list: Y N

SCAT3 to be done in resting state. Best done 10 or more minutes post exercise.

SYMPTOM EVALUATION

3 How do you feel?

"You should score yourself on the following symptoms, based on how you feel now."

	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
Trouble falling asleep	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

Total number of symptoms (Maximum possible 22) _____

Symptom severity score (Maximum possible 132) _____

Do the symptoms get worse with physical activity? Y N

Do the symptoms get worse with mental activity? Y N

self rated self rated and clinician monitored

clinician interview self rated with parent input

Overall rating: If you know the athlete well prior to the injury, how different is the athlete acting compared to his/her usual self?

Please circle one response

no different very different unsure N/A

Scoring on the SCAT3 should not be used as a stand-alone method to diagnose concussion, measure recovery or make decisions about an athlete's readiness to return to competition after concussion. Since signs and symptoms may evolve over time, it is important to consider repeat evaluation in the acute assessment of concussion.

COGNITIVE & PHYSICAL EVALUATION

4 Cognitive assessment

Standardized Assessment of Concussion (SAC)*

Orientation (1 point for each correct answer)

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

List	Trial 1	Trial 2	Trial 3	Alternative word list					
elbow	0	1	0	1	0	1	candle	baby	finger
apple	0	1	0	1	0	1	paper	monkey	penny
carpet	0	1	0	1	0	1	sugar	perfume	blanket
saddle	0	1	0	1	0	1	sandwich	sunset	lemon
bubble	0	1	0	1	0	1	wagon	iron	insect

Total _____

Immediate memory score total _____ of 15

Concentration: Digits Backward

List	Trial 1	Alternative digit list			
4-9-3	0	1	6-2-9	5-2-6	4-1-5
3-8-1-4	0	1	3-2-7-9	1-7-9-5	4-9-6-8
6-2-9-7-1	0	1	1-5-2-8-6	3-8-5-2-7	6-1-8-4-3
7-1-8-4-6-2	0	1	5-3-9-1-4-8	8-3-1-9-6-4	7-2-4-8-5-6

Total of 4 _____

Concentration: Month in Reverse Order (1 pt. for entire sequence correct)

Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan	0	1
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Concentration score _____ of 5

5 Neck Examination:

Range of motion Tenderness Upper and lower limb sensation & strength

Findings: _____

6 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: _____ Errors

Single leg stance (non-dominant foot): _____ Errors

Tandem stance (non-dominant foot at back): _____ Errors

And/Or

Tandem gait*

Time (best of 4 trials): _____ seconds

7 Coordination examination

Upper limb coordination

Which arm was tested: Left Right

Coordination score _____ of 1

8 SAC Delayed Recall*

Delayed recall score _____ of 5

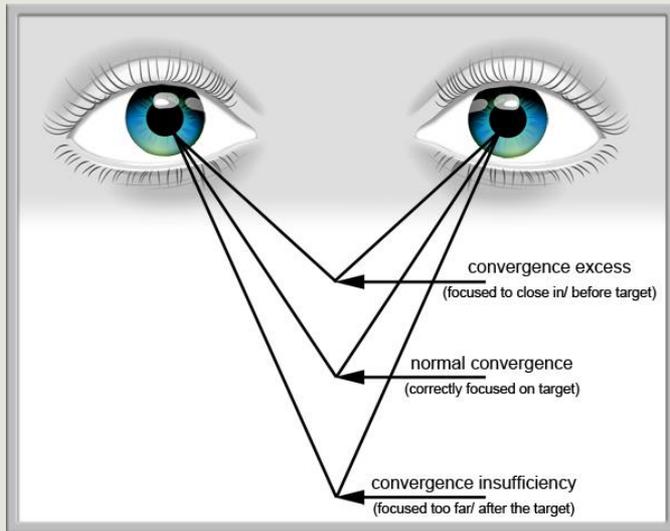


Physical Exam

- 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

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

When is a CT needed?

- When a more severe injury is suspected
 - Intracranial Hemorrhage
 - Skull fracture
 - Cervical spine injury

When is a “Concussion” and Emergency?

- 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

I have confirmed a diagnosis of Concussion

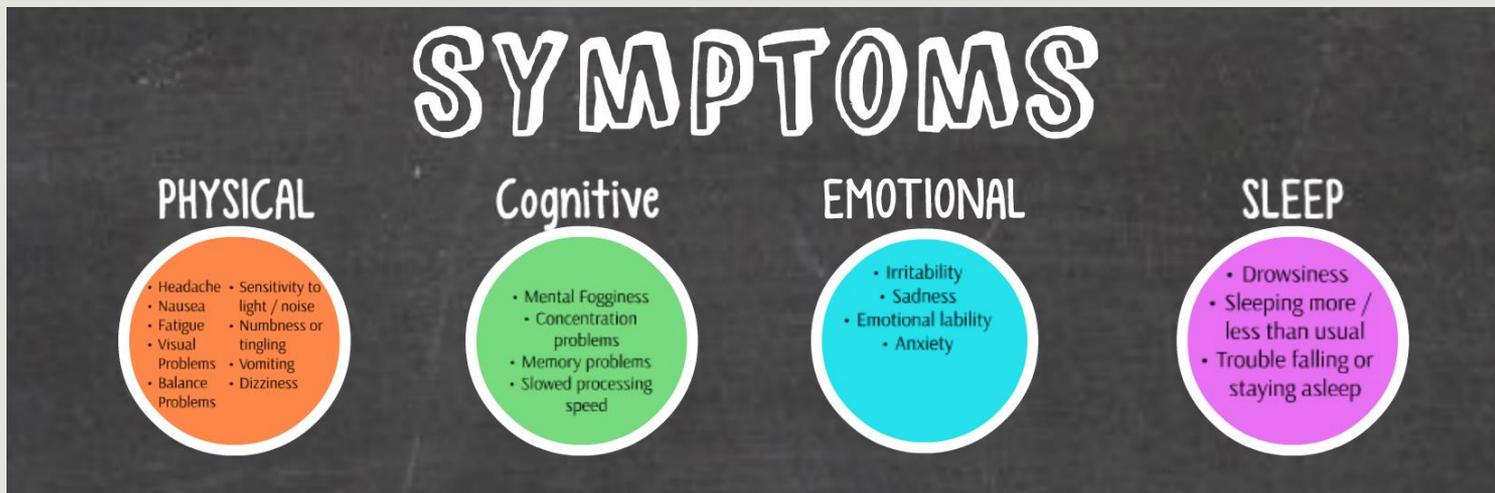
What now?



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



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	

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
- Female gender ?
- Younger age
- History of cognitive dysfunction
- History of migraines
- Pre- Injury affective disorders
 - Anxiety
 - Depression

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 worsen at any time
- Symptoms not significantly improved after 10-14 days
- 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.

Multidisciplinary Team

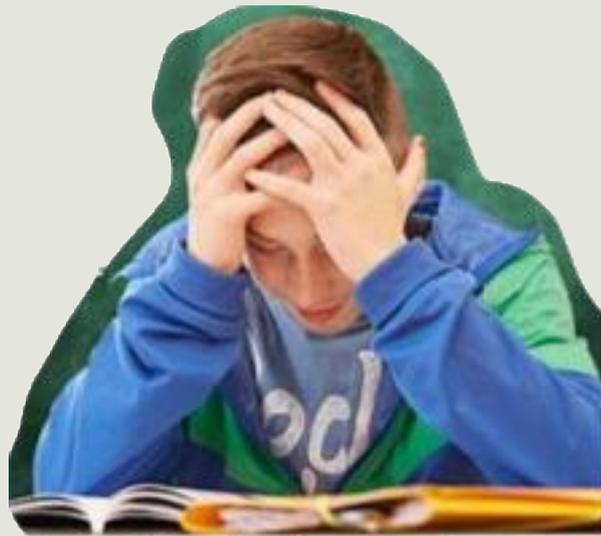
- Physician
- Neuropsychologist
- Physical Therapist
- Occupational Therapist
- Speech Therapist
- Vision Specialist
- Audiology
- Psychologist
- Counselor
- Brain Injury Case Manager



Avoiding Common Concussion Management Pitfalls

- Returning to Athletics early
- Prolonged “House Arrest”
- Academic Overload
- Not Acknowledging the emotional component

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.

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

The Team

Traditional “protocol” did not fit the needs of this population

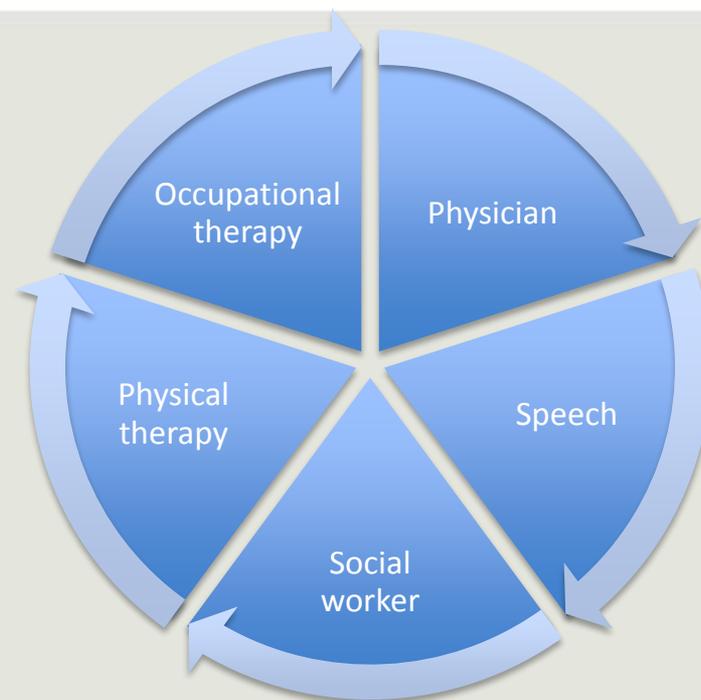
Individualize care

Areas of deficits are based on clinical findings on evaluation

This has evolved over time as more patients have been seen

Creates a framework for treatment progression

Broken out by categories of deficits that can start and progress at different rates – helps guide clinical decision making



Speech Therapy

Why would someone with a concussion need speech???

Speech-Language Pathologists have a broad scope of practice:

Speech: articulation, voice, fluency, AAC

Language: receptive, expressive, pragmatic

Literacy: phonological and phonemic awareness skills

Feeding and Swallowing

Cognition and Executive Function Skills

*Areas most frequently targeted: Memory, Attention, Processing, Organization

Speech Therapy Concussion Initial Evaluation

- **Symptom check list and history**
 - Parent questionnaire and detailed school performance history
- **Cognitive examination**
 - Immediate recall, delayed recall
 - Test of Memory and Learning - TOMAL-2™
 - Portions of CELF 5 and TAPS (Verbal Memory)
- **Executive Function Skills check list**

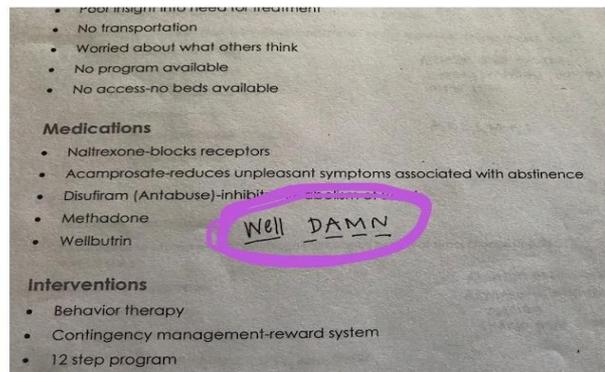
Executive Function Skills

- Response Inhibition
- Working Memory
- Emotional Control
- Sustained Attention
- Task Initiation
- Planning/Prioritization
- Organization
- Time Management
- Goal-directed persistence
- Flexibility
- Metacognition
- Stress Tolerance



Memory

- Immediate and delayed recall
- Use of strategies
 - Chunking, rehearsal, subvocalizing, categorizing, acronym, motor strategies, rhythm/song, visualize



Memory Strategies

- **Chunking**—dividing a large amount of information into smaller units for easier storage and retrieval (ex. phone numbers)
- **Categorization**—putting items into groups
- **Visualizing**—make a picture of what you’re trying to remember
- **Rehearsal**—practice over and over
- **Subvocalizing**—say it quietly out loud to tap into the auditory channel
- **Tapping and Tracing**—tap your finger on key words or trace them on your palm to utilize fine motor
- **Rhythm**—use a rhythm or song for things to tap into your right brain
- **Kinesthetic**—using gross motor movements like jumping, bouncing a ball, skywriting, etc. to engage memory
- **Mnemonic Devices**—using first letters to make a word or sentence for important concepts; like HOMES (Huron, Ontario, Michigan, Erie, Superior), and “King Phillip Came Over For Great Steaks” (Kingdom Phylum, Class, Order, Family, Genus, Species)
- **Use of external aids**—making lists, using a planner, use of devices, etc. to keep track of information

For more complex memory tasks:

- **Connections/Associations**—finding links to make information more meaningful
- **Key Words**—finding the most important information for focus to reduce cognitive load
- **Priming**—done prior to start of task, focuses attention on important aspects of information
- **Graphic Organizers**—help organize and make information visual (ex. Venn diagram, Cause/Effect Design, Word and Concept Webs)
- **Paraphrasing/Summarizing**—trying to put the information into your own words and explain it to someone else

****Other contributing factors:** Proper rest, low levels of anxiety/stress, adequate nutrition





Attention

- Building awareness of distraction
 - Chips, secret signal
 - Interval timer, bracelet
- Increasing ability to work with distractions
- Medical management



Card Games

25

Flip Up

Attention

King's Corners

Speed

N-Back



Language Processing

- Following multistep commands
 - increasing from a low stimulus environment to a distracting environment
- Comprehension
 - Written and auditory
 - Increasing from sentences to paragraphs
 - Main idea versus details
 - Key Words
 - Pre Reading (THIEVES)
- Writing
 - Outlining
 - Graphic organizers



Comprehension (Fiction)

Good readers make connections, ask questions, visualize, and infer.

Making Connections

Good readers make connections while they're reading. There are three main types of connections we make.

- **Text-to-Self (T-S)** refers to connections made between the text and the reader's personal experience.
- **Text-to-Text (T-T)** refers to connections made between a text being read to a text that was previously read.
- **Text-to-World (T-W)** refers to connections made between a text being read and something that occurs in the world.

It is important to use children's background knowledge before, during, and after reading.

Questioning

Good readers ask themselves questions while they read.

- I wonder why...?
- What does this mean?

Visualizing

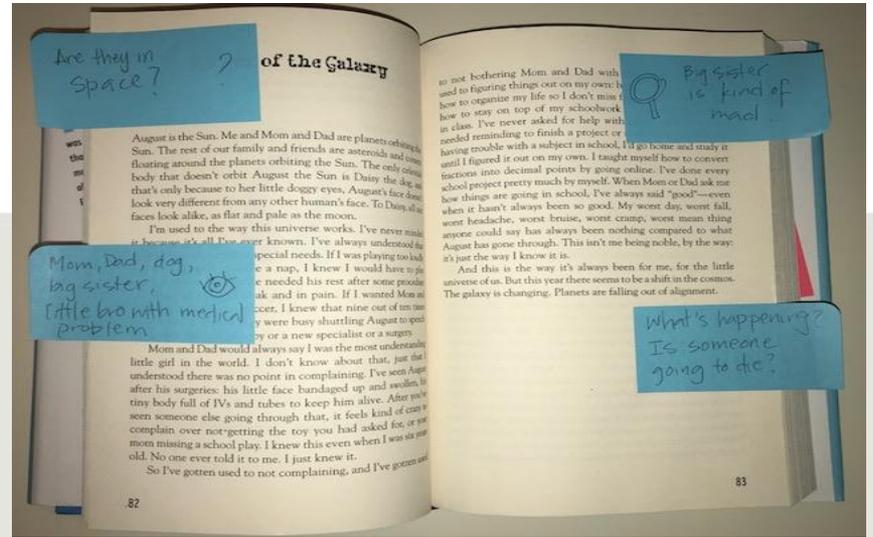
Good readers picture what is happening while they read.

- It's the movie in your mind that plays while you're reading.
- The images might change as you continue to read.

Inferring

"Reading between the lines"

- Making predictions
- Finding meaning of unknown words
- Forming a best guess using evidence – context clues, picture clues, etc.



Comprehension (Non-Fiction)

The Elements of THIEVES

Title

What is the title?

What do I already know about this topic?

What does this topic have to do with the preceding chapter?

Does the title express a point of view?

What do I think I will be reading about?

Headings

What does this heading tell me I will be reading about?

Introduction

What does the introduction tell me I will be reading about?

Do I know anything about this topic already?

- **Every first sentence**
 - Usually the first sentence under a heading is the topic sentence.
- **Visuals and vocabulary**
 - Does the chapter include photographs, drawings, maps, charts, or graphs?
 - What can I learn from the visuals in a chapter?
 - Do I know what the bold words mean? Can I make a good guess?
- **End-of-chapter questions**
 - What do the questions ask?
 - What information do they think is important?
 - Let me keep in mind the end-of-chapter questions for note-taking.
- **Summary**
 - Can I summarize this chapter?



Strategies:

- Compensatory strategies for ADLs – timing/planning of daily routines, sleep hygiene, medication routine, phone reminders/planners
 - Habitica
 - Google Keep, Evernote
- Strategies for academics – focus on key words, sticky notes, use of highlighters, note cards, outlines, graphic organizers

Notecards

prefix | base word | suffix

disembark

shortest definition
possible

picture

sentence

free choice
(synonym, antonym,
any other)

get off vehicle



The passengers
disembark from
the airplane.

dis = away

Sometimes it's not me

Sometimes it's about getting kids
connected with the most necessary
services...



Accommodations for daily life

School /return
to learn

Activity/sport

Work

Driving

Headache
management

Sleep
schedule

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):\n
 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
Kennieth 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.

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

CASE STUDY

- 16 year old female, strong student
- History of 2 concussions 20 months apart: the first symptoms lasted 3 months, prolonged symptoms after the second concussion
- At initial evaluation patient and family reported difficulties with memory, attention, vision, headaches, fatigue, depression, anxiety
- Started speech 3 months after second concussion, received PT and counseling concurrently, then vision therapy
- Passive learning, summer, full return to school, accommodations



Testing Information

Scores on TOMAL 2 are listed from initial evaluation to discharge 3 months later:

- Memory for Stories
 - Scaled Score: 5, 14
- Word Selective Reminding
 - Scaled Score: 2, 12
- Object Recall
 - Scaled Score: 3, 12
- Paired Recall
 - Scaled Score: 9, 14
- Memory for Stories Delayed
 - Scaled Score: 3, 12
- Word Selective Reminding Delayed
 - Scaled Score: 1, 9
- **Verbal Memory Index: 65, 120**

****So why did she come back 3 months later? Executive Function training**



CASE STUDY 2

- 8 year old male, in gifted but some indications of ADHD prior to concussion that was managed without medication
- At initial evaluation patient and family reported difficulties with decreased attention span, aggressive behavior, difficulty following directions, memory, poor sleep, night incontinence, headaches and neck pain.
- Started speech 4.5 months after concussion, received PT and counseling concurrently
- A lot of school challenges



Testing Information

Scores on TOMAL 2 are listed from initial evaluation to discharge 4 months later:

- Memory for Stories
 - Scaled Score: 7, 12
- Word Selective Reminding
 - Scaled Score: 7, 10
- Object Recall
 - Scaled Score: 6, 13
- Paired Recall
 - Scaled Score: 9, 14
- Memory for Stories Delayed
 - Scaled Score: 5, 13
- Word Selective Reminding Delayed
 - Scaled Score: 4, 12

- **Verbal Memory Index: 82, 115**

Summary

Changing definition of concussion

- Often no loss of consciousness
- Not always from a head hit
- Symptoms can last a long time

Common pitfalls

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

An interdisciplinary model

- Physicians, Therapists, Schools, Parents
- 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 will need to be tailored to each patient

Questions?



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