CONCUSSION

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2018

CONFLICTS/DISCLOSURE

None to disclose

Primary investigator on current concussion research project

OBJECTIVES

1. Definition of Concussion
2. Pathology/Incidence of Concussion
3. S&S of concussion & evaluation of concussion
4. Treatment of Concussion
5. Cases


40
50

DEFINITION OF CONCUSSION

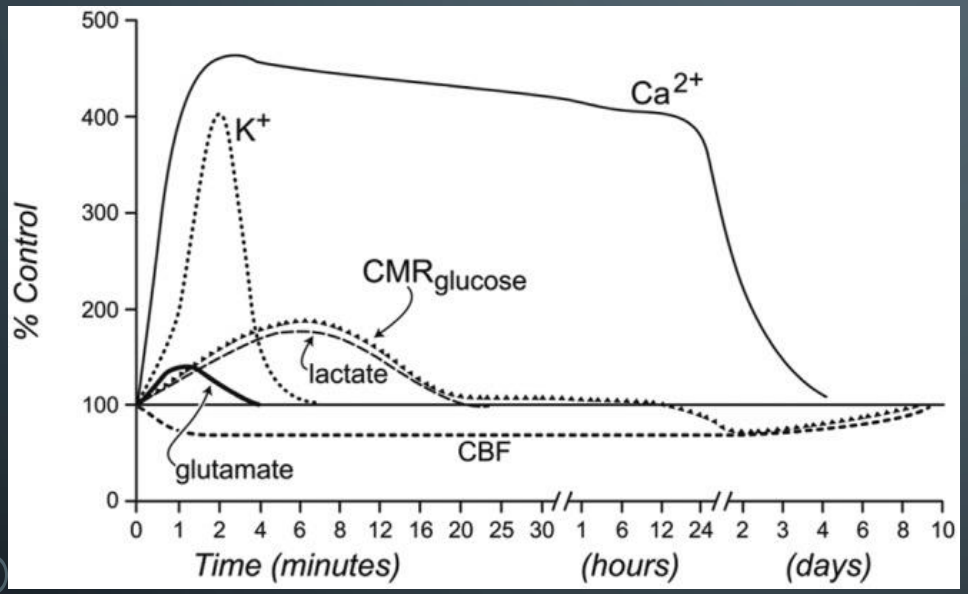
as per Berlin Panel Consensus 2016

Sport related concussion is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilised in clinically defining the nature of a concussive head injury include:

- *SRC 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.*
- *SRC typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some cases, signs and symptoms evolve over a number of minutes to hours.*
- *SRC may result in neuropathological changes, but the acute clinical signs and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.*
- *SRC results in a range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged.*

- *The clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction, etc) or other comorbidities (eg, psychological factors or coexisting medical conditions).*

PROPOSED PATHOPHYSIOLOGY OF CONCUSSION



Concussion is associated with autonomic dysregulation (increased sympathetic activity and decreased parasympathetic activity). With this cerebral blood flow itself is altered which may be why physical and/or mental exertion may worsen symptoms. Cerebral artery regulation is very sensitive to PaCO2 and the pulmonary ventilation physiologic process which may be altered as well in concussion, especially during exertion and this hypoperfusion may cause secondary injury.

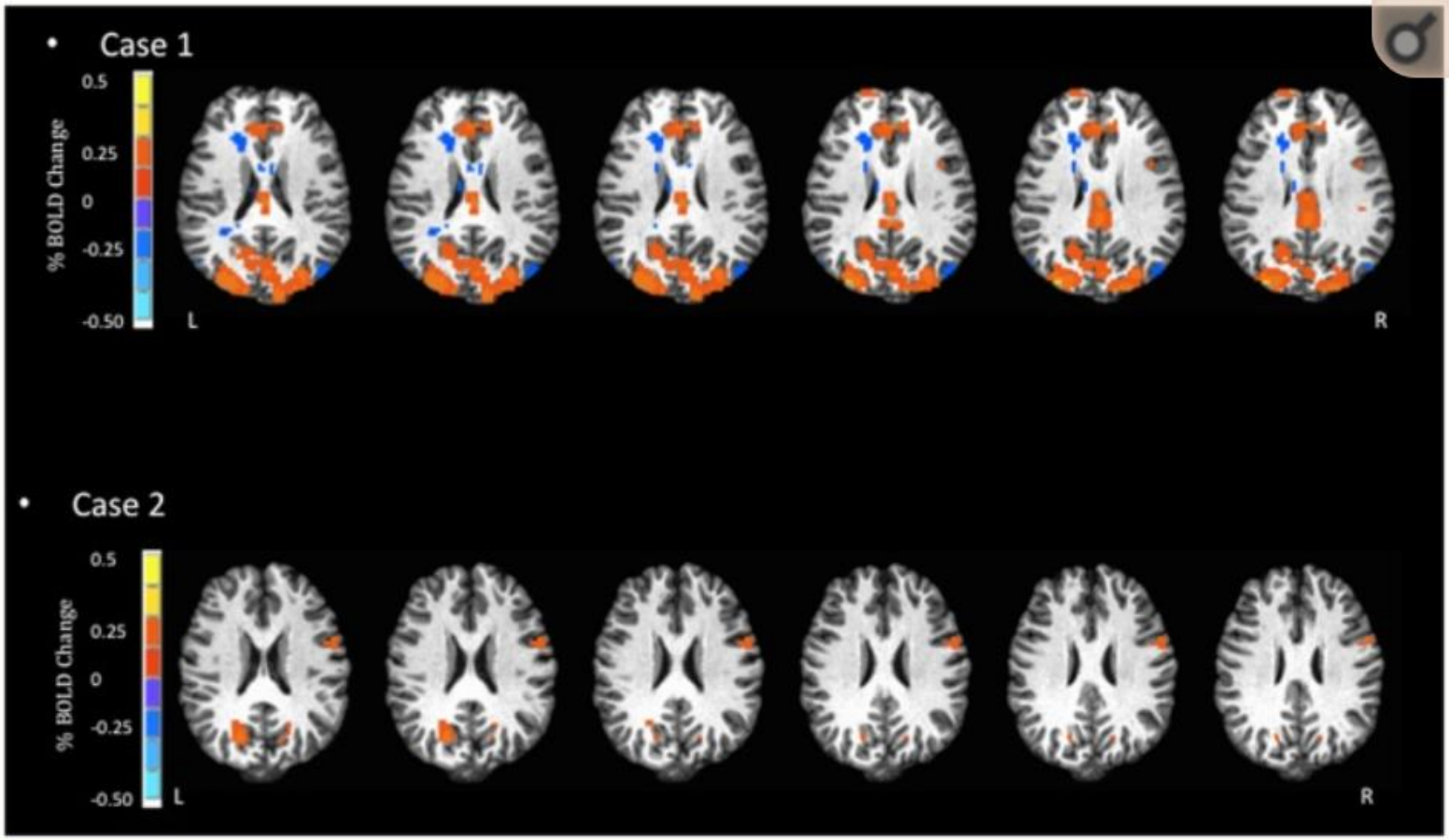
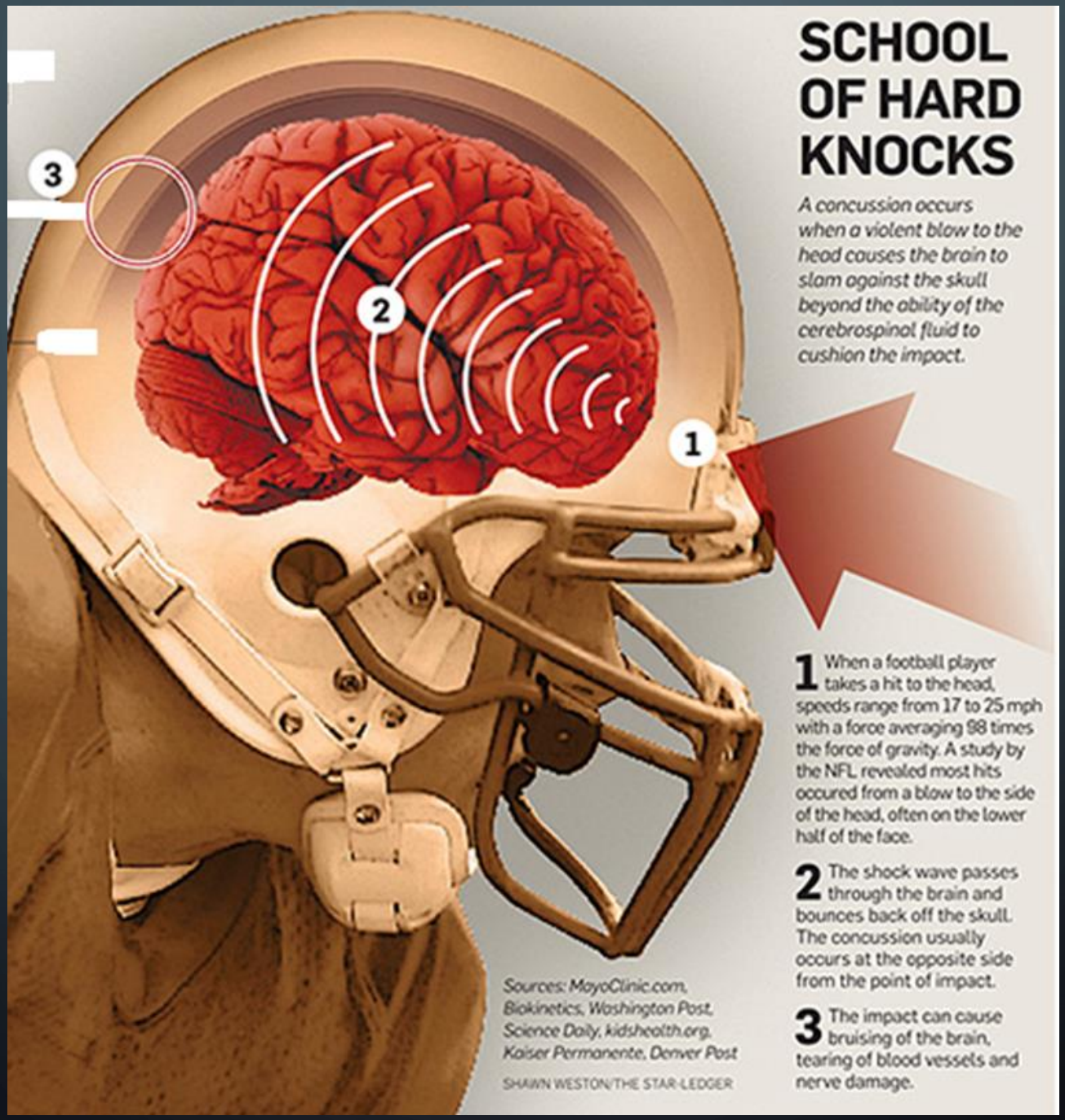
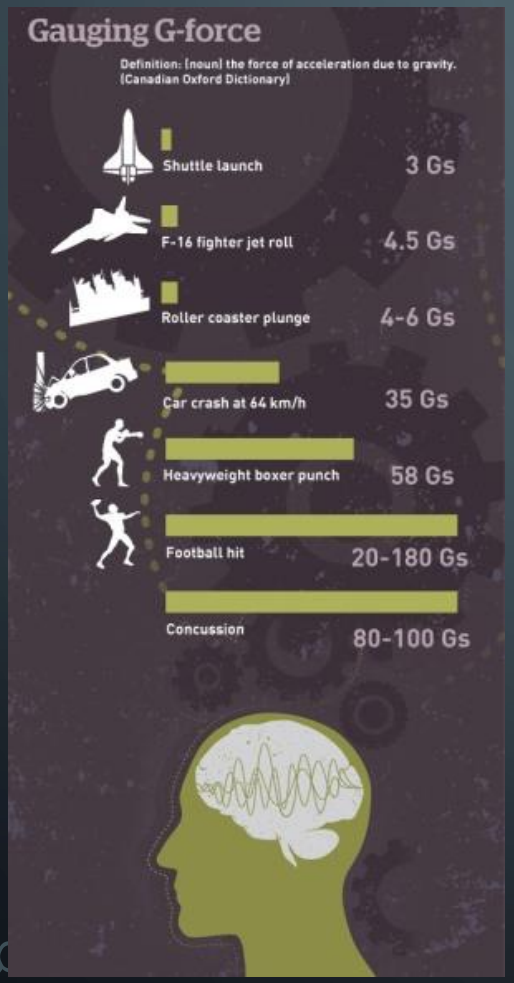


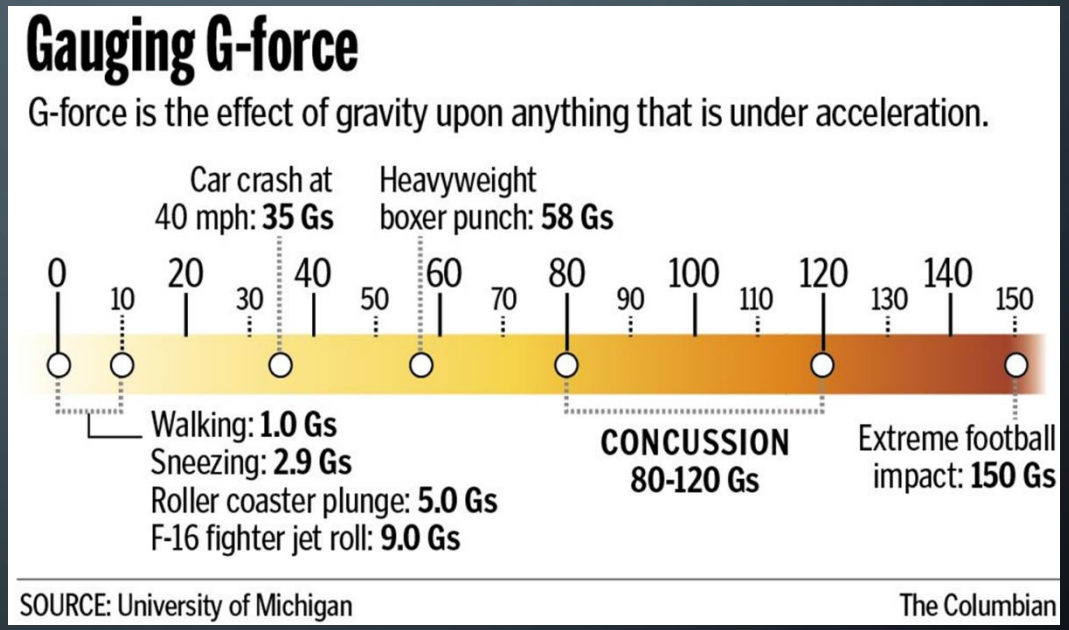
Figure 3

Blood oxygen level dependent signal activation for match-to-sample task. In the most complex task, Case 1 has substantially larger BOLD activation compared to Case 2, in the areas of the occipital cortex, paracentral lobule, and anterior cingulate.


SCHOOL OF HARD KNOCKS
A concussion occurs when a violent blow to the head causes the brain to slam against the skull beyond the ability of the cerebrospinal fluid to cushion the impact.
1
2
3
1 When a football player takes a hit to the head, speeds range from 17 to 25 mph with a force averaging 98 times the force of gravity. A study by the NFL revealed most hits occured from a blow to the side of the head, often on the lower half of the face.
2 The shock wave passes through the brain and bounces back off the skull. The concussion usually occurs at the opposite side from the point of impact.
3 The impact can cause bruising of the brain, tearing of blood vessels and nerve damage.
Sources: MayoClinic.com, Biokinetics, Washington Post, Science Daily, kidshealth.org, Kaiser Permanente, Denver Post
SHAWN WESTON/THE STAR-LEDGER

BIOMECHANICS: G FORCE AND CONCUSSION





*This is can be variable person to person

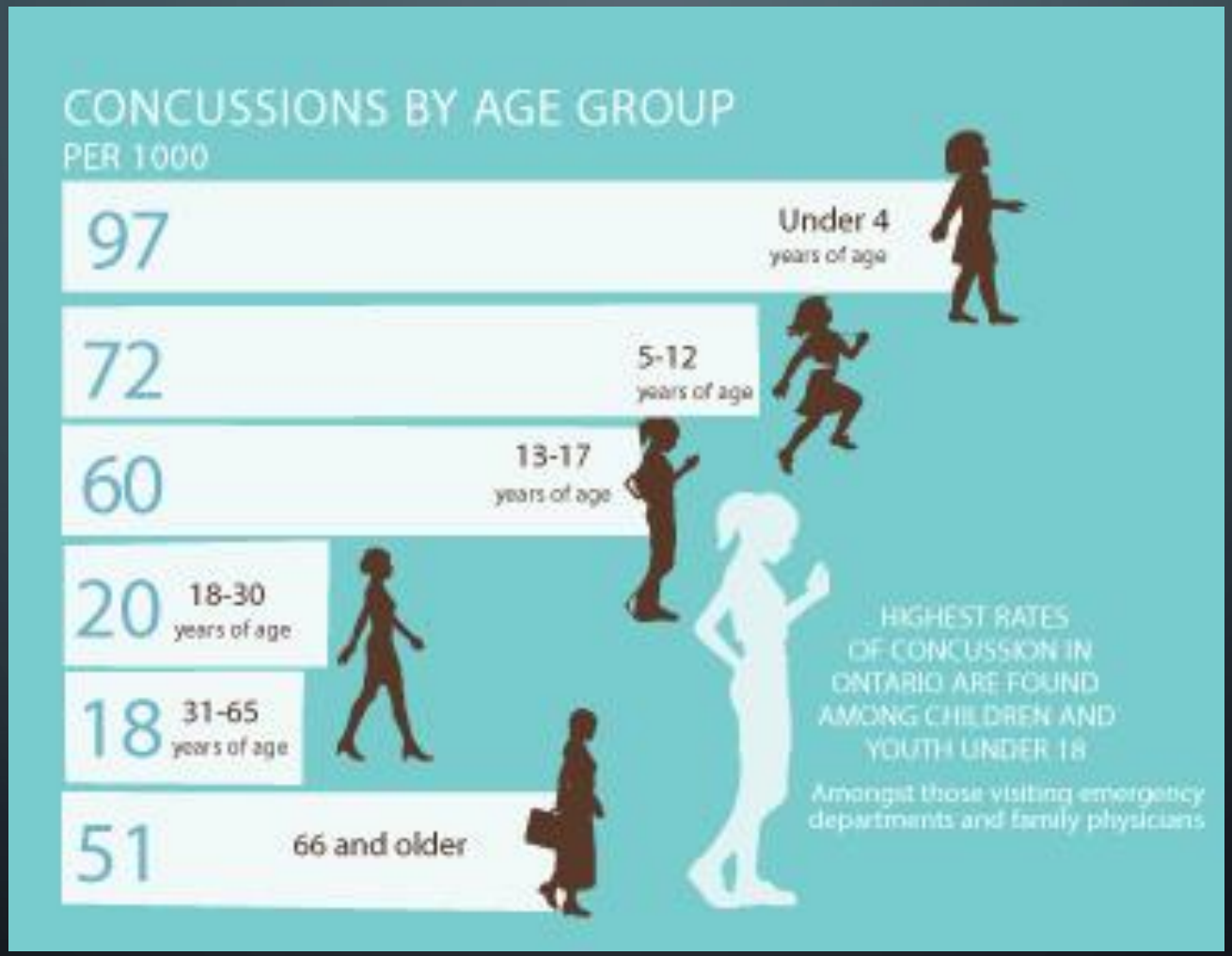
INCIDENCE OF CONCUSSION

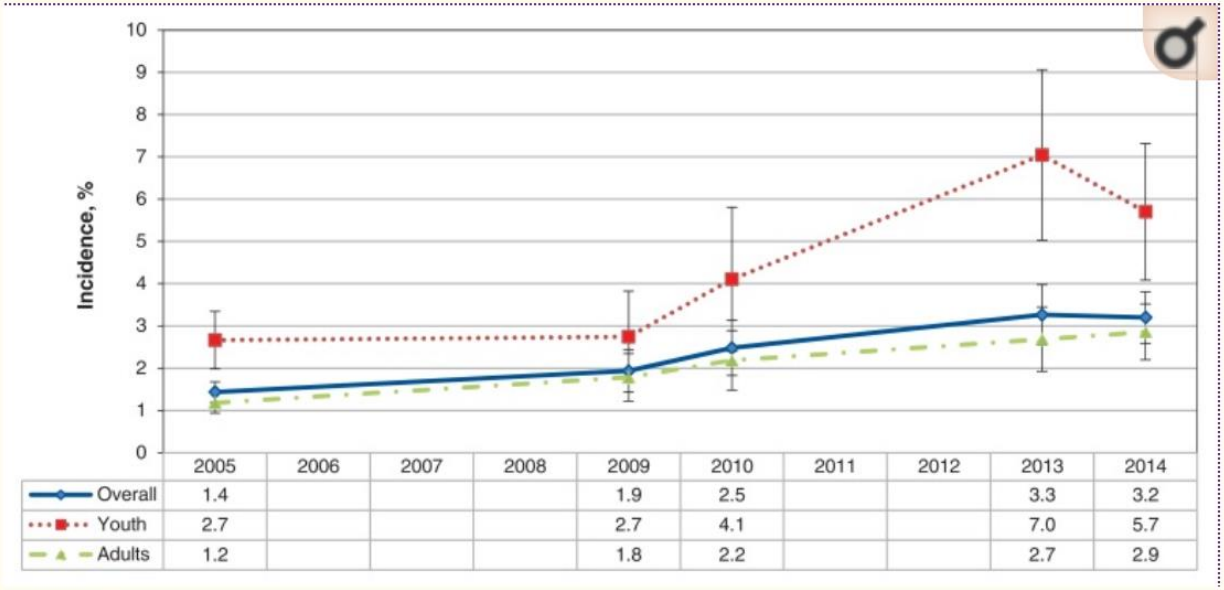
Concussions in sport are a recognized public health issue because of their frequency and their potential short- and long-term consequences.

For example

- 64% of visits to hospital emergency departments among 10-18 year-olds are related to participation in sports, physical activity and recreation.
    - Among children and youth (10-18 years) who visit an emergency department for a sports-related head injury, 39% were diagnosed with concussions, while a further 24% were possible concussions.
    - Football, soccer and hockey have all shown a greater than 40% increase in rates of reported head injury (relative to other injuries) between 2004 and 2014 for children and youth.

INCIDENCE


CONCUSSIONS BY AGE GROUP
PER 1000
97
Under 4
years of age
72
5-12
years of age
60
13-17
years of age
20
18-30
years of age
18
31-65
years of age
51
66 and older
HIGHEST RATES OF CONCUSSION IN ONTARIO ARE FOUND AMONG CHILDREN AND YOUTH UNDER 18
Amongst those visiting emergency departments and family physicians



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Overall	1.4				1.9	2.5			3.3	3.2
Youth	2.7				2.7	4.1			7.0	5.7
Adults	1.2				1.8	2.2			2.7	2.9

Figure 2

Trends in the incidence of traumatic brain injury among Canadians, overall and by age group, 2005-2014. Estimates are reported among all respondents who reported any type of injury in the previous year.

THE INCREASE IS ATTRIBUTED TO INCREASED AWARENESS AND TRAINING/RECOGNITION

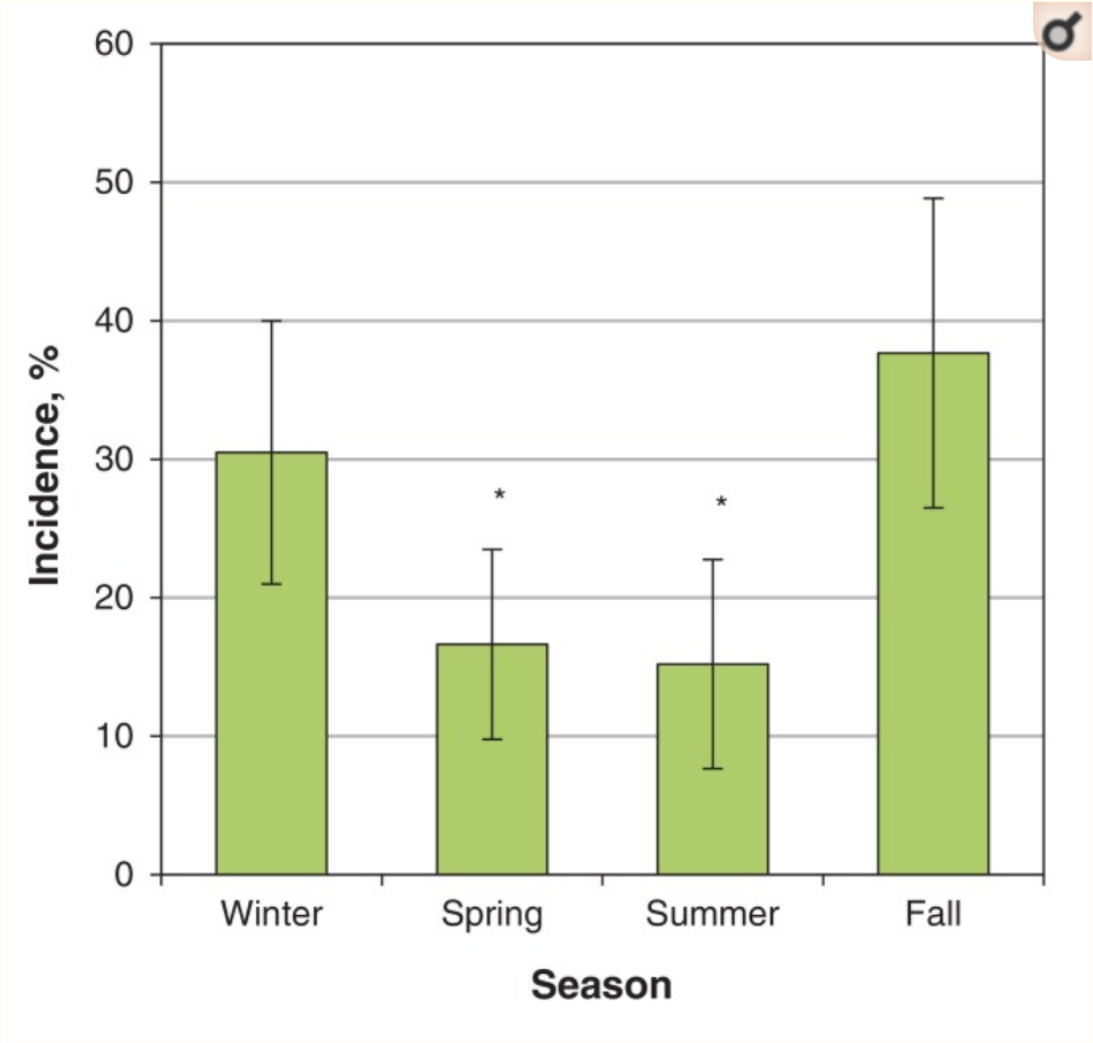
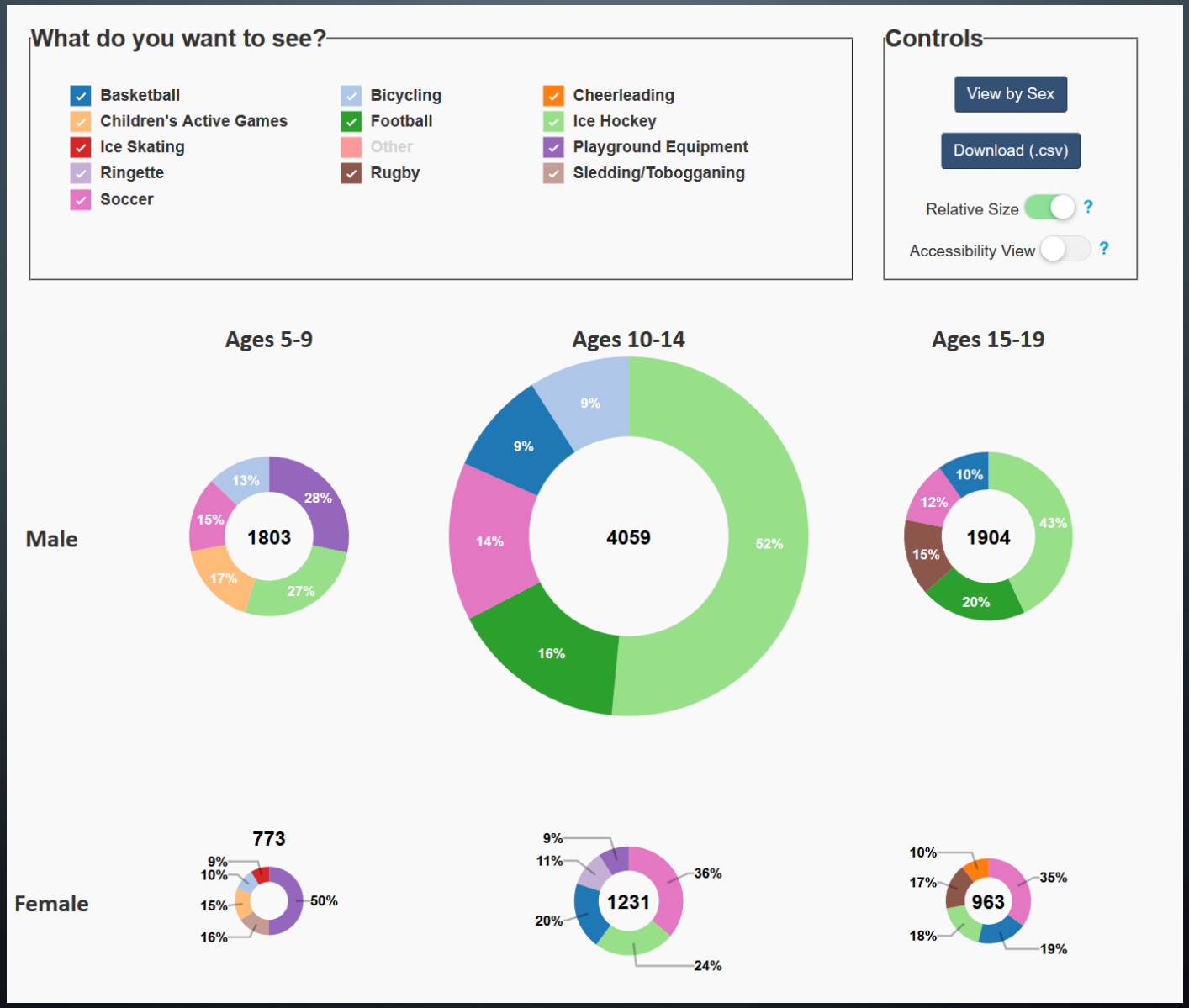


Figure 3

Incidence of traumatic brain injury among youth by season. *Interpret with caution owing to high sampling variability (coefficient of variation 16.6%-33.3%).

CMAJ Open

TOP 5 SPORTS AND RECREATIONAL ACTIVITIES RESPONSIBLE FOR CONCUSSION AND OTHER BRAIN INJURY RELATED HOSPITAL VISITS



SYMPTOMS & SIGNS OF ACUTE CONCUSSION

The suspected diagnosis of concussion can include one or more of the following clinical domains:

1. Symptoms- somatic (eg headache), cognitive (eg feeling like in a fog) and/or emotional symptoms (eg lability)
2. Physical signs (eg loss of consciousness LOC, amnesia)
3. Behavioural changes (eg irritability)
4. Cognitive impairment (eg slowed reaction times)
5. Sleep disturbance (eg insomnia)

Table A. Common Symptoms of mTBI

Physical	Behavioural/Emotional	Cognitive
Headache Nausea Vomiting Blurred or double vision Seeing stars or lights Balance problems Dizziness Sensitivity to light or noise Tinnitus	Drowsiness Fatigue/lethargy Irritability Depression Anxiety Sleeping more than usual Difficulty falling asleep	Feeling “slowed down” Feeling “in a fog” or “dazed” Difficulty concentrating Difficulty remembering

Adapted from Willer B, Leddy JJ. Management of concussion and post-concussion syndrome. *Current Treatment Options in Neurology.* 2006;8:415-426; with kind permission from Springer Science and Business Media.

SIDELINE EVALUATION

- If an appropriate HCP is available then appropriate disposition of the player must be determined (the player should be taken away from any distractions to perform the exam – 1st ensure no cervical compromise otherwise C spine precautions are needed and transfer to hospital)
- SCAT5 is what is recommended by the Berlin 2016 consensus but at minimum perform a neurologic exam and musculoskeletal exam including cervical spine examination.
  - Examine the head for site of injury
  - Examine the cervical spine exam for range of motion
  - Conduct a brief cognition and language screen during your interview
  - Examine cranial nerve 2 (pupil symmetry and reactivity),visual fields, check to ensure no optic edema is present
  - Examine cranial nerves 3, 4, 6 (no abnormalities in eye movements, diplopia, nystagmus)
  - Conduct a motor screen to check for pronator drift, asymmetrical weakness and symmetry of reflexes
  - Conduct a sensory exam to check that no extinction to bilateral tactile stimuli occurs
  - Test coordination such as finger to nose movements, gait and tandem gait
- If any concerns arise (ie signs of skull #, focal neurological deficit or worsening symptoms) then must send to ED for CT imaging
- If no HCP, then ***"If in doubt, sit them out"*** *or if there is a need for a sideline evaluation , then they are NOT to RTP and should be seen by a HCP prior to RTP*

WHERE DO THE INFORMATION AND GUIDELINES COME FROM?

4 separate conferences aimed at reaching consensus of understanding and management of sports concussions

- Vienna 1st 2001
- Prague 2nd 2004
- Zurich 3rd 2008
- Zurich 4th 2013
- Berlin 5th 2016

SCAT5©

SPORT CONCUSSION ASSESSMENT TOOL – 5TH EDITION

DEVELOPED BY THE CONCUSSION IN SPORT GROUP
FOR USE BY MEDICAL PROFESSIONALS ONLY

supported by

Patient details

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date of Injury: _____ Time: _____

WHAT IS THE SCAT5?

The SCAT5 is a standardized tool for evaluating concussions designed for use by physicians and licensed healthcare professionals[1]. The SCAT5 cannot be performed correctly in less than 10 minutes.

If you are not a physician or licensed healthcare professional, please use the Concussion Recognition Tool 5 (CRT5). The SCAT5 is to be used for evaluating athletes aged 13 years and older. For children aged 12 years or younger, please use the Child SCAT5.

Preseason SCAT5 baseline testing can be useful for interpreting post-injury test scores, but is not required for that purpose.Detailed instructions for use of the SCAT5 are provided on page 7. Please read through these instructions carefully before testing the athlete. Brief verbal instructions for each test are given in italics. The only equipment required for the tester is a watch or timer.

Recognise and Remove

A head impact by either a direct blow or indirect transmission of force can be associated with a serious and potentially fatal brain injury. If there are significant concerns, including any of the red flags listed in Box 1, then activation of emergency procedures and urgent transport to the nearest hospital should be arranged.

Key points

- Any athlete with suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration. No athlete diagnosed with concussion should be returned to play on the day of injury.
- If an athlete is suspected of having a concussion and medical personnel are not immediately available, the athlete should be referred to a medical facility for urgent assessment.
- Athletes with suspected concussion should not drink alcohol, use recreational drugs and should not drive a motor vehicle until cleared to do so by a medical professional.
- Concussion signs and symptoms evolve over time and it is important to consider repeat evaluation in the assessment of concussion.
- The diagnosis of a concussion is a clinical judgment, made by a medical professional. The SCAT5 should NOT be used by itself to make, or exclude, the diagnosis of concussion. An athlete may have a concussion even if their SCAT5 is "normal".

Remember:

- The basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Do not attempt to move the athlete (other than that required for airway management) unless trained to do so.
- Assessment for a spinal cord injury is a critical part of the initial on-field assessment.
- Do not remove a helmet or any other equipment unless trained to do so safely.

1

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.

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

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 ☐

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 QUESTIONS[2]

"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

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.

STEP 4: EXAMINATION GLASGOW COMA SCALE (GCS)[3]

Time of assessment			
Date of assessment			
Best eye response (E)			
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)			
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)			
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.

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:

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

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

STEP 3: COGNITIVE SCREENING

Standardised Assessment of Concussion (SAC)[4]

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

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 Candle	Penny Paper	Blanket Sugar	Lemon Sandwich	Insect Wagon			
H	Baby Elbow	Monkey Apple	Perfume Carpet	Sunset Saddle	Iron Bubble			
I	Jacket Dollar	Arrow Honey	Pepper Mirror	Cotton Saddle	Movie Anchor			
					Immediate Memory Score			of 30
					Time that last trial was completed			

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

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[5]

Which foot was tested (i.e. which is the non-dominant foot) ☐ Left ☐ 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

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

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

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 SCAT5.

Signature: _____

Name: _____

Title: _____

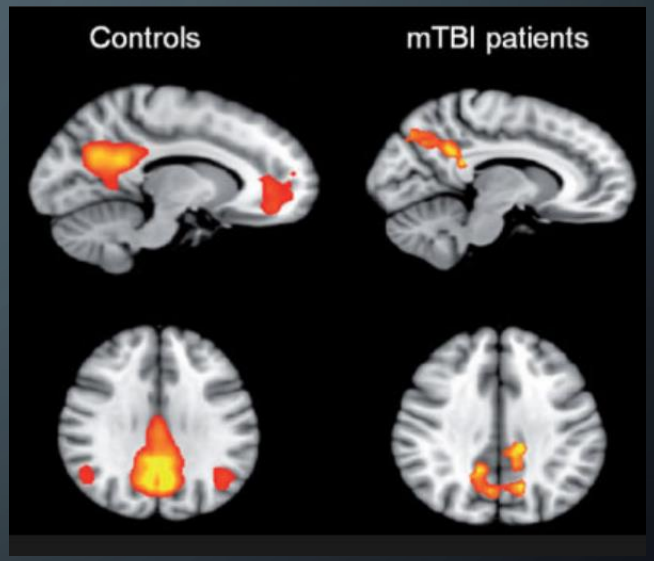
Registration number (if applicable): _____

Date: _____

SCORING ON THE SCAT5 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.

IMAGING

- No major role to play in concussion as traditional imaging doesn't show any structural changes (functional disturbance, not structural)
- Times to image would include…
  - Neurological deficit on exam
  - Battle signs or signs of skull fracture
  - Prolonged symptoms without explanation to rule out an underlying condition
  - Research purposes (functional MR playing more of a role)



CATCH HEAD CT RULES

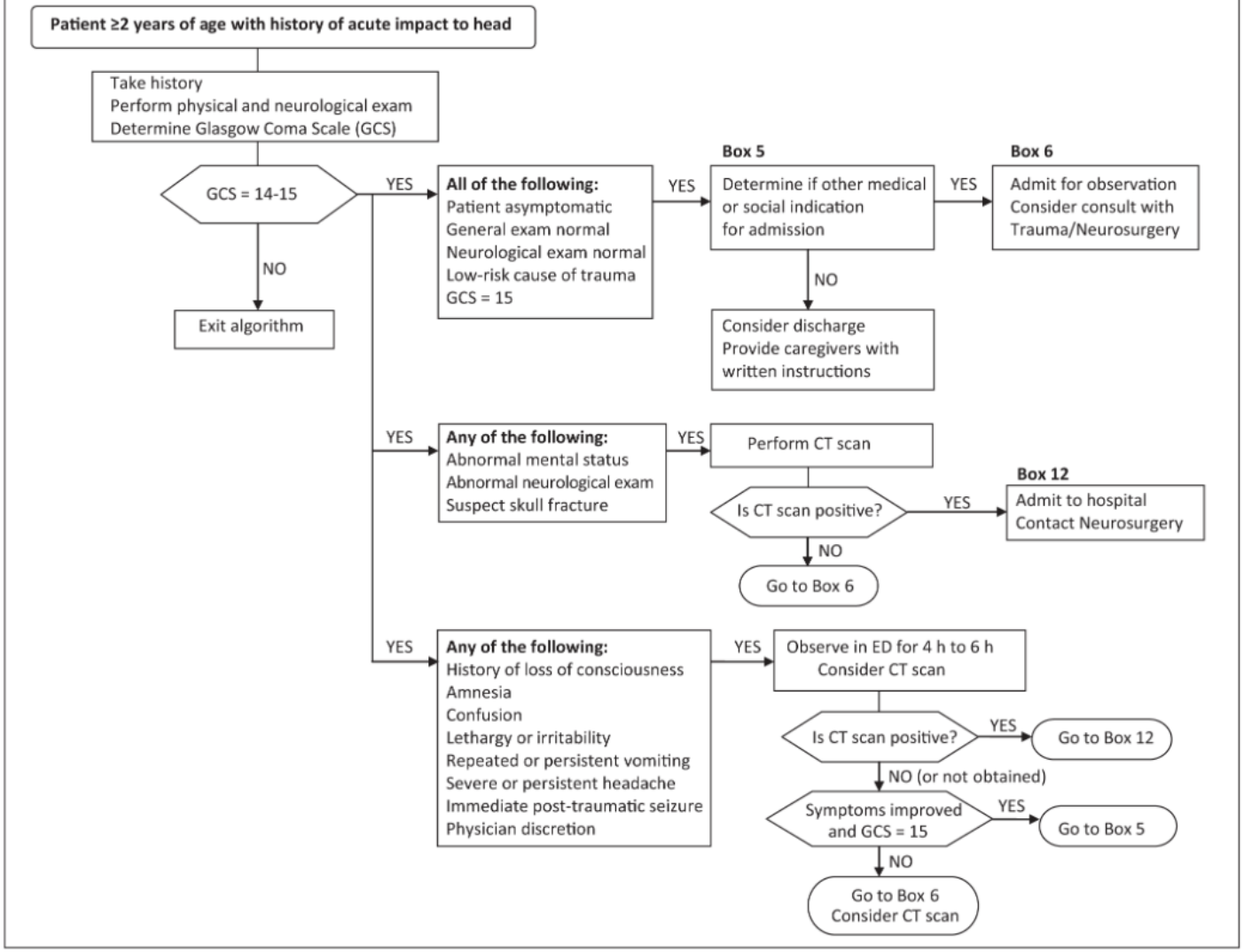


Figure 1) *Algorithm for the management of the paediatric patient ≥2 years of age with minor head trauma. CT Computed tomography; ED Emergency department*

Canadian CT Head Rule

CT head is only required for minor head injury patients with any one of these findings:

High Risk (for Neurological Intervention)

1. GCS score < 15 at 2 hrs after injury
2. Suspected open or depressed skull fracture
3. Any sign of basal skull fracture*
4. Vomiting ≥ 2 episodes
5. Age ≥ 65 years

Medium Risk (for Brain Injury on CT)

6. Amnesia before impact ≥ 30 min
7. Dangerous mechanism ** *(pedestrian, occupant ejected, fall from elevation)*

***Signs of Basal Skull Fracture**

- **hemotympanum, 'racoon' eyes, CSF otorrhea/ rhinorrhea, Battle's sign**

**** Dangerous Mechanism**

- **pedestrian struck by vehicle**
- **occupant ejected from motor vehicle**
- **fall from elevation ≥ 3 feet or 5 stairs**

Rule Not Applicable If:

- Non-trauma cases
- GCS < 13
- Age < 16 years
- Coumadin or bleeding disorder
- Obvious open skull fracture

POST CONCUSSION INSTRUCTIONS

- If disposition is for conservative treatment, then ensure that the player has an escort and are not left alone as they will need serial monitoring for the initial few hours for deterioration (then should seek medical attn.)
- They are NOT to return to play
- Instruct to avoid ETOH/drugs or anything that can alter cognition
- Avoid NSAIDs or aspirin that may increase risk of bleed (and mask worsening symptoms)
- 2 days of ADLs/symptom limited activity (mental and physical)
- Pt should be seen within 1-2 weeks for follow up

Brain Injury Advice Card (Long Version)

Important Points about Mild Brain Injury

- You had a mild brain injury or what is sometimes called a concussion. Most people recover quickly following a mild brain injury. A few people may experience symptoms over a longer period.
- There is a small risk of you developing serious complications so you should be watched closely by another adult for 24 hours after the accident.
- Please read the following. It outlines what signs to look for after a brain injury and what you need to do if you have problems.

Warning Signs

If you show any of these symptoms or signs after your brain injury, or you get worse, go to the nearest hospital, doctor or call 911 immediately.

- Fainting or blacking out, drowsiness, or can't be woken up
- A constant severe headache or a headache that gets worse
- Vomiting or throwing up more than twice
- Cannot remember new events, recognise people or places (increased confusion)
- Acting strange, saying things that do not make sense (change in behaviour)
- Having a seizure (any jerking of the body or limbs)
- Inability to move parts of your body, weakness in arms or legs, or clumsiness
- Blurred vision or slurred speech
- Being unsteady on your feet or loss of balance
- Continual fluid or bleeding from the ear or nose

The First 24-48 Hours After Injury

- Warning Signs: **You should be observed and return to hospital if you develop any of the above warning signs.**
- Rest/Sleeping: Rest (both physical and mental) and avoid strenuous activity for at least 24 hours. It is alright for you to sleep tonight but you should be checked every four hours by someone to make sure you are alright.
- Driving: Do not drive for at least 24 hours. You should not drive until you feel much better and can concentrate properly. Talk to your doctor.
- Drinking/Drugs: Do not drink alcohol or take sleeping pills or recreational drugs in the next 48 hours. All of these can make you feel worse. They also make it hard for other people to tell whether the injury is affecting you or not.
- Pain Relief: Use **acetaminophen** or **acetaminophen**/codeine for headaches (e.g., Tylenol).
- Sports: Do not return to sports until you have received medical clearance from your health care provider.

See your local doctor if you are not starting to feel better within a few days of your injury.

WHY DO WE CARE?

SECOND IMPACT SYNDROME (SIS)

A controversial term first described by Saunders and Harbaugh in 1984, Second Impact Syndrome (SIS) consists of two events. Typically, it involves an athlete suffering post-concussive symptoms following a head injury. If, within several weeks, the athlete returns to play and sustains a second head injury, diffuse cerebral swelling, brain herniation, and death can occur. SIS can occur with any two events involving head trauma. While rare, it is devastating in that young, healthy patients may die within a few minutes.

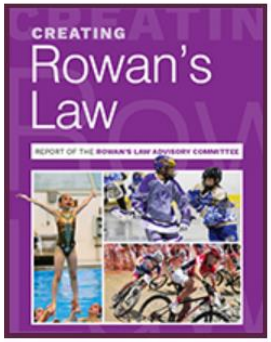
Thus far, all cases of second impact syndrome have been described in relatively young patients (age < 20 y). Significant controversy exists over the etiology of this condition, although it is thought to be secondary to loss of autoregulation of cerebral blood flow in an already injured brain. It has a very grim prognosis.

Sport

- Game ON – The Ontario Government's Sport Plan
- Women and Girls in Sport
- Concussions
  - Rowan's Law Advisory Committee
- Cycling in Ontario
- Provincial Sport Organizations
- Amateur Combative Sport
- Sport Hosting Program
- Games Ontario
- Programming for Indigenous Communities
- Quest for Gold
- Ontario Sport, Recreation and Communities Fund
- After School Program
- Trails in Ontario

Report of the Rowan's Law Advisory Committee

Ontario passed the Rowan's Law Advisory Committee Act, on June 7, 2016 to establish the Rowan's Law Advisory Committee to review the jury recommendations made as a result of the Coroner's inquest into the death of 17-year-old high school rugby player Rowan Stringer. The Act required the Committee to provide advice to the government with respect to head injury prevention and treatment.



Download This Report

The Rowan's Law Advisory Committee is chaired by Dr. Dan Cass, Vice President-Medical at St Joseph's Health Centre in Toronto and includes membership from parents, medical experts, researchers and sport leaders. View the list of Rowan's Law Advisory Committee members.

Under the Legislation, the Committee was required to submit a report to the Minister of Tourism, Culture and Sport by September 9, 2017. The report is below, and contains 21 recommended actions directed to all organized amateur sports, both school-based and non-school-based, in Ontario. The Committee's recommendations are grouped into five themes: surveillance, prevention, detection, management and awareness.

ROWAN'S LAW

The coroner's inquest into Rowan's death resulted in 49 recommendations, including (but not limited to):

- Increased education and awareness for parents, coaches, athletes, and teachers surrounding concussion injuries
- Better tools for coaches and trainers to identify concussions
- Concussion policies in place at all school boards and sports associations across Ontario
- Increased education and training for healthcare professionals to better treat and manage concussions

Los Angeles Times

LOCAL U.S. WORLD BUSINESS SPORTS ENTERTAINMENT HEALTH STYLE TRAVEL OPINION SHOP

SPORTS NOW LAKERS CLIPPERS DODGERS ANGELS NFL KINGS NHL/DUCKS USC UCLA PREPS SCORES

Doctor Says Ali's Brain Injuries Due to Boxing

July 16, 1987 | From Associated Press

Muhammad Ali suffers from Parkinson's syndrome because of injuries to the brain he sustained during his 22-year boxing career, his doctor said Wednesday.

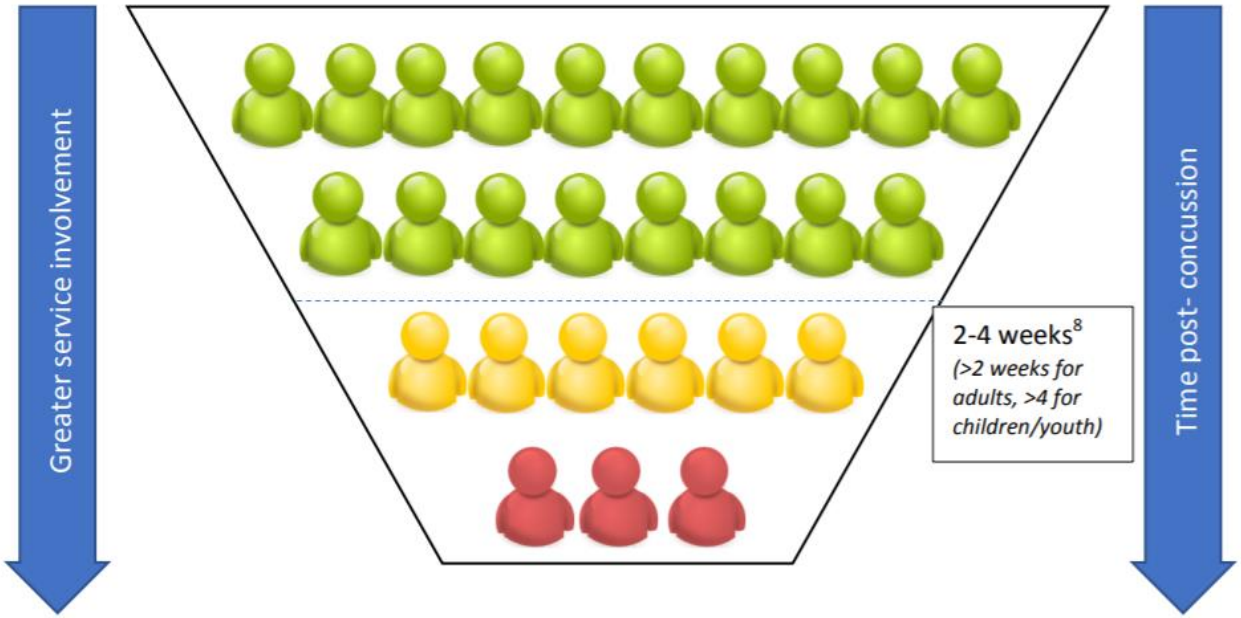
CHRONIC TRAUMATIC ENCEPHALOPATHY (CTE)

A progressive degenerative disease which afflicts the brain of people who have suffered repeated concussions and traumatic brain injuries, such as athletes who take part in contact sports, members of the military and others. The term *encephalopathy* derives from Ancient Greek *en-* "in," *kephale* "head," and *patheia* "suffering." Chronic traumatic encephalopathy is a condition of brain damage which persists over a period of years or decades and which is the result of traumatic impacts to the cranium.

RECOVERY OF CONCUSSION

- Depending on the resource, the majority (80-90%) of concussion resolve in a short (7-10 day) period, some resources state that 80-85% will recover to neurological baseline within 1-2 weeks
- Others state that most patients with MTBI recover in 48-72 hours, even with detailed neuropsychological testing, and are headache free within 2-4 weeks of the injury
- Children/adolescents this time frame can be longer (depending on symptoms these can range from 21-40 days with the average being 24 days) yet 80-90% of children can usually return to school within 1 week
- Consensus statement on concussion in sport – the 5th international conference on concussion in sport held in Berlin, October 2016 states that ***most athletes who sustain a concussion will make a complete recovery within 1-2 weeks while most youth athletes will recover within 1-4 weeks. Approximately 15-30% of patients will experience persistent symptoms (>2 weeks for adults; >4 weeks for youth) that may require additional medical assessment and management.***
- Bottom line is very few people tend to have prolonged symptoms and return to their baseline with no further issues
- Other factors may play a role in recovery, although they need to be studied further

Concussion Recovery Pattern



Follow-up with primary care provider – majority will recover over a few days to weeks, with education about symptom management.

Follow-up required, further assessment may be required if symptoms are not resolving fully or considered as higher risk for a prolonged recovery.

Persistent symptoms, interdisciplinary care required

Table 2 Concussion modifiers

Factors	Modifier
Symptoms	Number Duration (>10 days) Severity
Signs	Prolonged loss of consciousness (LOC) (>1 min), Amnesia
Sequelae	Concussive convulsions
Temporal	Frequency—repeated concussions over time Timing—injuries close together in time 'Recency'—recent concussion or traumatic brain injury (TBI)
Threshold	Repeated concussions occurring with progressively less impact force or slower recovery after each successive concussion
Age	Child and adolescent (<18 years old)
Comorbidities and premorbidities	Migraine, depression or other mental health disorders, attention deficit hyperactivity disorder (ADHD), learning disabilities (LD), sleep disorders
Medication	Psychoactive drugs, anticoagulants
Behaviour	Dangerous style of play
Sport	High-risk activity, contact and collision sport, high sporting level

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

PERSISTENT CONCUSSION SYMPTOMS (PCS)

The Berlin expert consensus is that use of the term 'persistent symptoms' following Sport Related Concussion should reflect 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).

SUBTYPES OF PERSISTENT CONCUSSION DISORDERS

PHYSIOLOGIC PCD	VESTICULO-OCULAR PCD	CERVICOGENIC PCD
Persistent alterations in neuronal depolarization, cell membrane permeability, mitochondrial function, cellular metabolism and cerebral bloodflow	Dysfunction of the vestibular and oculomotor systems	Muscle trauma and inflammation as well as dysfunction of cervical spine proprioception

VESTIBULAR-OCULAR REFLEX (VOR)

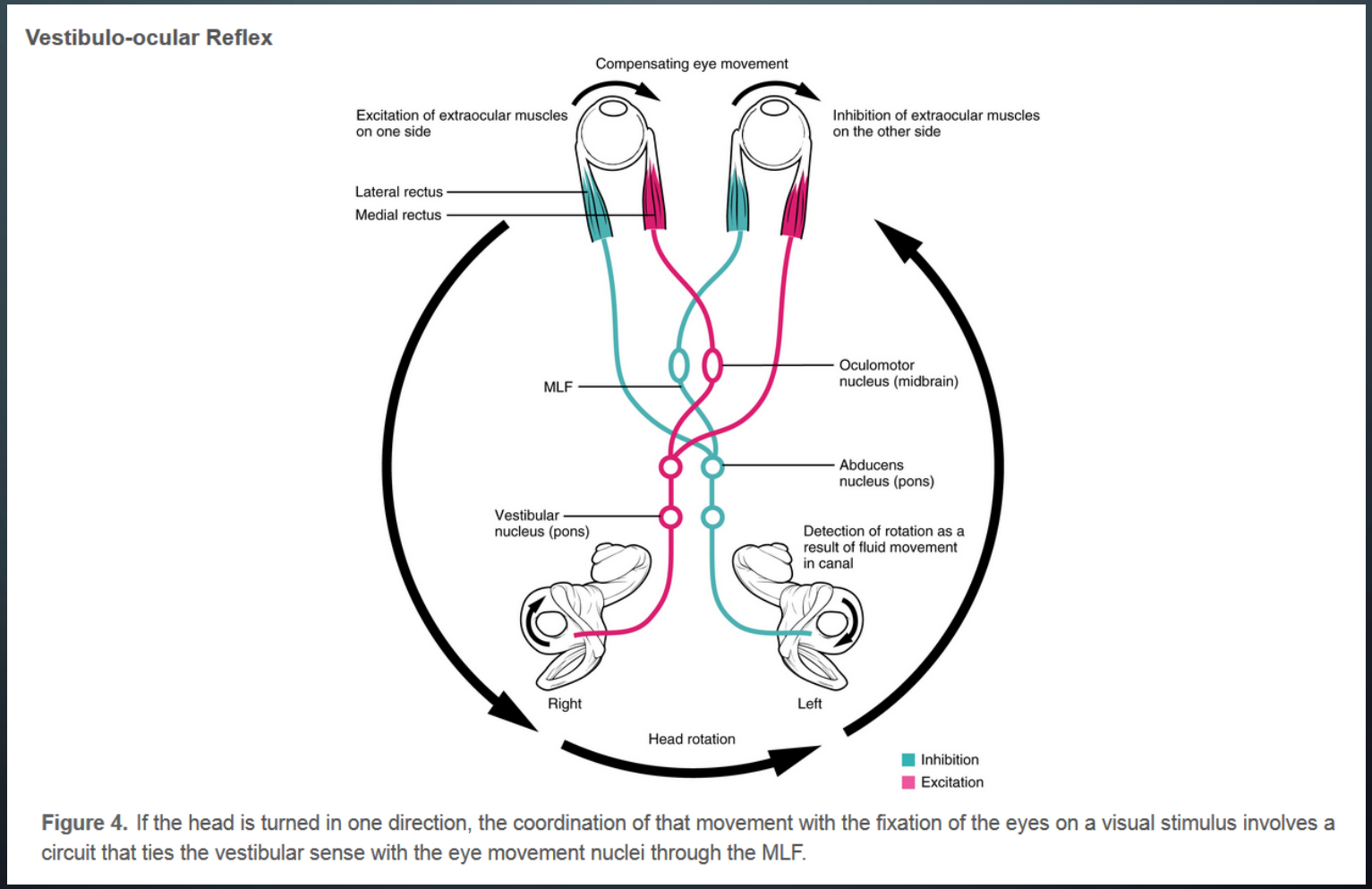


Figure 4. If the head is turned in one direction, the coordination of that movement with the fixation of the eyes on a visual stimulus involves a circuit that ties the vestibular sense with the eye movement nuclei through the MLF.

VOR AND THE VESTIBULO-OCULAR SYSTEM

This system consists of special sense organs (the retina, semi-circular canals and otolithic organs and joint mechanoreceptors) with primary processing units that share rich direct, indirect and reciprocal projections to the spinal cord, ANS, brainstem nuclei, cerebellum, thalamus, basal ganglia and cerebral cortex. Components of these systems include the vestibulo-ocular reflex (VOR) which regulates gaze stabilization during head acceleration and the vestibulo-spinal reflex (VSR) which co-ordinates head, neck and trunk positioning during dynamic body movements. Dysfunction within components of these neurological subsystems can have adverse effects on related sub-systems, thereby generating complex symptoms and impairments that are difficult to localize to one specific neural substrate. Symptoms of dizziness, gait instability, fogginess, blurred vision and difficulty focusing can arise from dysfunction at multiple levels of the vestibulo-ocular system, the exact pathophysiology of which remains poorly understood.

The detection of VOD at initial consultation is a significant risk factor for the development of PCS.

VOR TESTS/SCREENING

- Smooth Pursuit (essentially CN testing)
- VOR Reflex Test (Pt rotates head 20-30* while focusing on thumb)
- VOR Cancellation (Body & head moving while thumb arms length moving with the body)
- Saccade Testing ((Eyes moving from target to target)
- Vergence/Convergence (Move thumb from arms length towards nose) - abnormal if >6cm when see 2 distinct thumbs

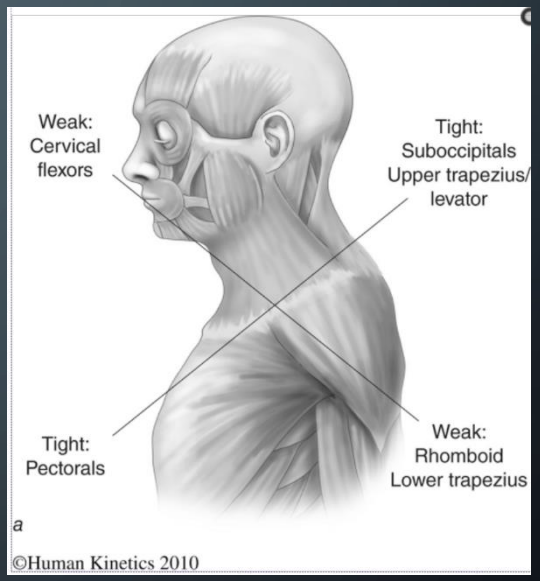
(I omit head thrust due to most patients having cervical/neck region pain)

CERVICOGENIC

- A headache of cervical origin

The neck pain precedes or co-exists with the headache, and is aggravated by specific neck movements or sustained postures. Several factors to aid in differentiating CGHs, include:

- Unilateral pain with a facet 'lock' irradiating from the back of the head
- Evidence of cervical dysfunction presenting during manual examination
- May occur with trigger point palpation in the head or neck
- Aggravated by sustained neck positions
- Normal imaging



	PHYSIOLOGIC	VESTIBULO-OCULAR (VOR)	CERVICOGENIC
Symptoms	Headache exacerbated by physical and cognitive activity Nausea, photophobia, phonophobia, dizzy, fatigue and/or poor concentration	Dizzy, vertigo, nausea, poor gait Blurred or double vision, eye strain	Neck pain, decreased ROM Lightheaded and postural imbalance
Physical Exam	No focal neurological findings and elevated resting HR	Impairments on standardized balance and gait testing and impaired VOR, fixation, convergence, horizontal/vertical saccades	Decreased cervical lordosis and range of motion, paraspinal and sub-occipital muscle tenderness and impaired head-neck position sense
Treadmill Test	Positive	Negative	Negative
Treatment Options	Symptom limited activity (cognitive/physical) Sub-symptom threshold aerobic exercise	Vestibular rehab or vision therapy program Sub-symptom threshold aerobic exercise	Manual cervical spine therapy Head-neck proprioception retraining, and exercises for balance and gaze stabilization Sub-symptom threshold aerobic exercise

Treatment should be individualised and target-specific medical, physical and psychosocial factors identified on assessment. There is preliminary evidence supporting the use of:

- a. *an individualised symptom-limited aerobic exercise programme in patients with persistent post-concussive symptoms associated with autonomic instability or physical deconditioning, and*
- b. *a targeted physical therapy programme in patients with cervical spine or vestibular dysfunction, and*
- c. *a collaborative approach including cognitive behavioural therapy to deal with any persistent mood or behavioural issues.*

SYMPTOM EVALUATIONS /MONITORING

The Rivermead Post Concussion Symptoms Questionnaire

After a head injury or accident some people experience symptoms which can cause worry or nuisance. We would like to know if you now suffer from any of the symptoms given below. As many of these symptoms occur normally, we would like you to compare yourself now with before the accident. For each one, please circle the number closest to your answer.

0 = Not experienced at all
1 = No more of a problem
2 = A mild problem
3 = A moderate problem
4 = A severe problem

Compared with before the accident, do you now (i.e., over the last 24 hours) suffer from:

Headaches	0	1	2	3	4
Feelings of Dizziness	0	1	2	3	4
Nausea and/or Vomiting	0	1	2	3	4
Noise Sensitivity, easily upset by loud noise	0	1	2	3	4
Sleep Disturbance	0	1	2	3	4
Fatigue, tiring more easily	0	1	2	3	4
Being Irritable, easily angered	0	1	2	3	4
Feeling Depressed or Tearful	0	1	2	3	4
Feeling Frustrated or Impatient	0	1	2	3	4
Forgetfulness, poor memory	0	1	2	3	4
Poor Concentration	0	1	2	3	4
Taking Longer to Think	0	1	2	3	4
Blurred Vision	0	1	2	3	4
Light Sensitivity, Easily upset by bright light	0	1	2	3	4
Double Vision	0	1	2	3	4
Restlessness	0	1	2	3	4

Are you experiencing any other difficulties?

1. _____	0	1	2	3	4
2. _____	0	1	2	3	4

King NS, Crawford S, Wenden FJ, Moss NE, Wade DT. The Rivermead Post Concussion Symptoms Questionnaire: a measure of symptoms commonly experienced after head injury and its reliability. *Journal of Neurology*. 1995;242(9):587-592.

SEVERITY RATING

Please use this scale to rate each symptom.

None 0 | Mild 1 2 | Moderate 3 4 | Severe 5 6

PATIENT'S NAME: _____

POST-CONCUSSION SYMPTOM SCALE

Symptoms	Date:	Date:	Date:	Date:	Date:	Date:	Date:
Headache							
Nausea							
Vomiting							
Balance Problems							
Dizziness (spinning or movement sensation)							
Lightheadedness							
Fatigue							
Trouble falling asleep							
Sleeping more than usual							
Sleeping less than usual							
Drowsiness							
Sensitivity to light							
Sensitivity to noise							
Irritability							
Sadness							
Nervous/Anxious							
Feeling more emotional							
Numbness or tingling							
Feeling slowed down							
Feeling like "in a fog"							
Difficulty concentrating							
Difficulty remembering							
Visual problems							
Other							
Total							

	HEADACHES	SLEEP	CONCENTRATION	MOOD
Symptoms	Can be migraine, tension type or cervicogenic in nature (may be constant)	Mostly manifests as insomnia or can be a circadian rhythm issue. May be drowsiness as well.	Foggy or fatigue feeling, forgetful, decreased processing speed. Difficulty making decisions	Feelings of anxiety and depression as well as increased irritability
Management Strategies	Self-regulated strategies (ie. Breathing/mindfulness, go to a quiet place, lie down, get some fresh air, etc) Can add medications	Promote good sleep hygiene (same bed/wake time daily with naps only if day time sleepiness and usually more so in the acute faze, fixed bed time routine, avoid caffeine within 4-6hrs of bedtime, avoid ETOH and late heavy meals, dark/cool room, etc)	Encourage shorter spans (read for shorter duration and come back after a break) and memory aid devices. Postpone activities or assignments that may require complete concentration or important decisions until feeling better.	Self-regulated strategies (remove self from situation if possible, breathing/mindfulness exercises, ensure loved ones are aware and explain to them your feelings).

LIFESTYLE STRATEGIES TO MINIMIZE SYMPTOMS

SLEEP: Encourage proper sleep as deprivation can lead to/exacerbate most symptoms

REGULAR MEALS: Nutrition can impact recovery. Certain foods or skipping meals can trigger symptoms

HYDRATION: Dehydration can lead to headaches in some individuals and caffeine should be avoided

STRESS: Relaxation strategies (yoga, medication, exercise) can aid in symptom management

EXERCISE: After the initial rest period, exercise can aid in symptom management as discussed later

MEDICATIONS

Prophylactic Therapy

Note that all therapies utilized for the prophylaxis of post-traumatic headaches are off-label. Prophylactic therapies should be utilized using a "start-low and go slow" approach. Patients should advised that prophylactic therapies are not a cure and they may not perceive any benefit for weeks and maximal benefit may take up to 12 weeks to be realized. A therapeutic trial of a prophylactic therapy should last 12 weeks unless there are intolerable medication side-effects. The only useful way to evaluate the effectiveness of a prophylactic therapy is review of the patient's headache and medication calendar. If the prophylactic therapy is efficacious, it should be continued for a minimum of 3-6+ months and then consideration could be given to gradually weaning off, if possible

Patients must be advised of realistic goals with regards to prophylactic therapy – the goal is not to "cure" the individual's headaches; rather, the goal is to try to decrease the individual's headache frequency and/or headache intensity and/or headache duration and/or acute medication requirements. Patients should also be advised that there are no "designer" drugs for headache prophylaxis – all medications utilized were created for other reasons and were subsequently found to be effective in headache prophylaxis in some, but not all, patients. This will pre-empt unnecessary patient confusion and non-compliance.

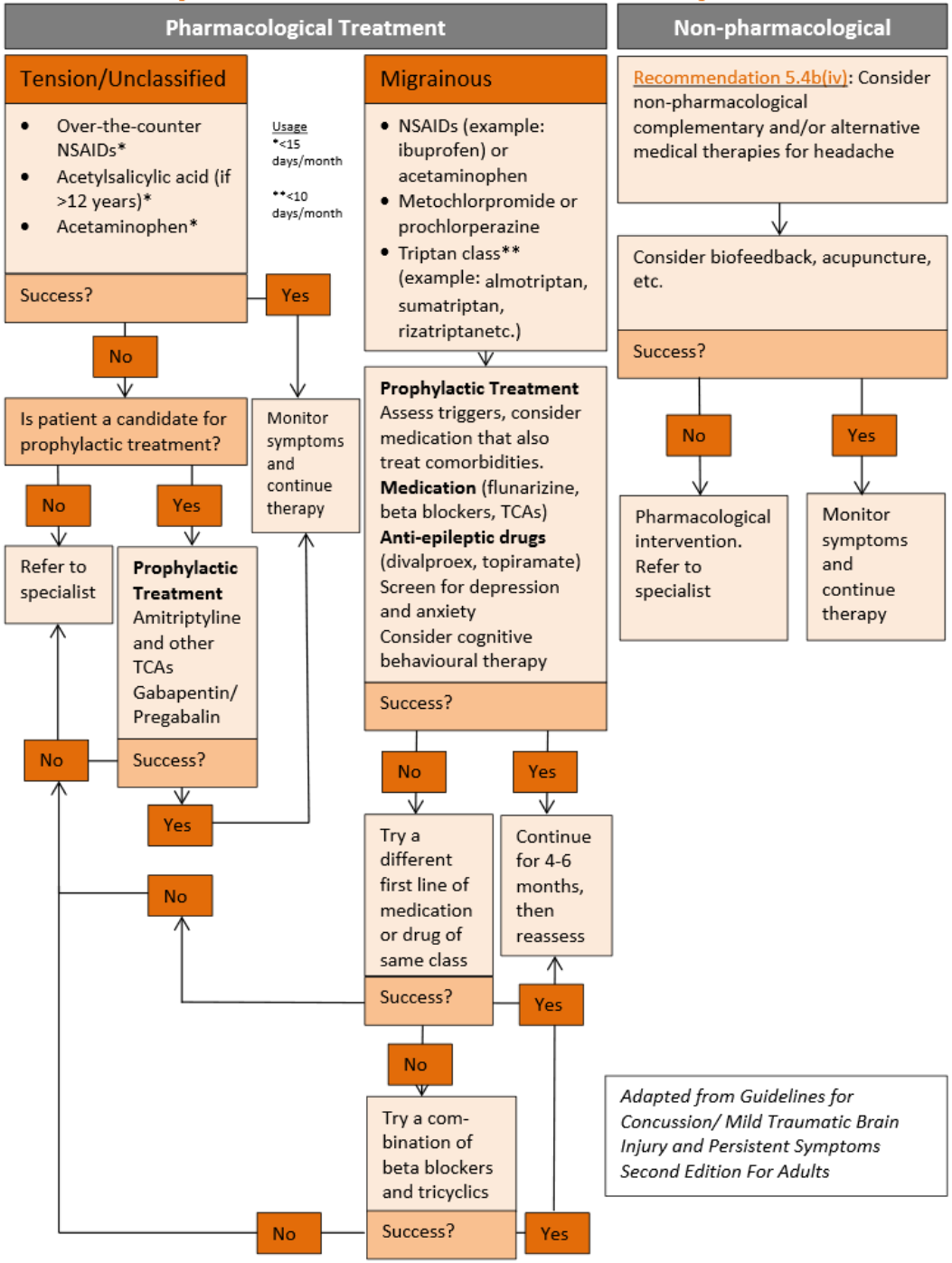
If the headaches are tension-type in nature or unclassifiable, first-line therapy is Amitriptyline or Nortriptyline (starting at 10 mg po qhs and increasing by 10 mg q1-2 weeks as necessary/tolerated to a maximum of 50- (and occasionally up to 100 mg po qhs). Amitriptyline is more sedating than Nortriptyline so should be utilized if there are concomitant sleep disturbances. Second-line therapy to consider is Gabapentin (starting at 100-300 mg po qhs and increasing by 100-300 mg q5 days as necessary/tolerated on a TID schedule to a maximum of approximately 600 mg po TID)

If the headaches are migrainous in nature:

a) First-line therapy would be a Tricyclic Antidepressant (i.e.Amitriptyline or Nortriptyline starting at 10 mg po qhs and increasing by 10 mg q1-2 weeks as necessary/tolerated to a maximum of 50-100 mg po qhs) or a beta-blocker (i.e. Nadolol starting at 20 mg po BID and increasing by 20 mg q5days as necessary/tolerated to 40-80 mg po BID or Propranolol 20 mg po TID and increasing by 20 mg q5days as necessary/tolerated to a maximum of 80 mg po TID).
b) Second-line therapy includes Topiramate (starting at 12.5 mg po qhs and increasing by 12.5 mg po qhs qweekly as necessary/tolerated to a maximum of 100 mg po qhs) or, failing this, Gabapentin (starting at 100-300 mg po qhs and increasing by 100-300 mg q5 days as necessary/tolerated on a TID schedule to a maximum of approximately 600 mg po TID).
c) Third-line therapies would include Verapamil (stating at 40 mg po TID and titrating to 80 mg po TID as necessary/ tolerated), Pizotifen (starting at 0.5 mg po qhs and increasing by 0.5 mg qweekly as necessary/tolerated to 3.0 mg po qhs) and Flunarizine (starting at 5 mg po qhs and increasing to 10 mg po qhs after 10-14 days).
d) Notably, should trials of a couple oral prophylactic agents prove ineffective, or should oral prophylactic medications be contraindicated by concomitant medical issues or by significant polypharmacy, consideration could certainly be given to interventional therapy. Botulinum Toxin Type A (onabotulinum toxin) up to 200 units q3months using a fixed-dose, follow-the-pain treatment paradigm has proven beneficial in recent phase 3 RCT trials for the prophylaxis of chronic migraine and is an approved treatment for chronic migraine.
e) Nerve blocks (i.e. occipital nerve blocks) should be restricted to intractable daily post-traumatic headache and should be discontinued if the repetitive nerve blocks are ineffective after weekly treatment for 4-6 weeks.

The choice of prophylactic therapy depends on comorbid symptoms (i.e., consider Amitriptyline if concomitant insomnia, a Beta-blocker if concomitant hypertension, Topiramate if concomitant obesity) and contraindications (avoid Beta-blocker/ Calcium-channel blocker if hypotensive, Tricyclic if excessive fatigue, Topiramate if excessive cognitive symptoms, Flunarizine if depression etc).

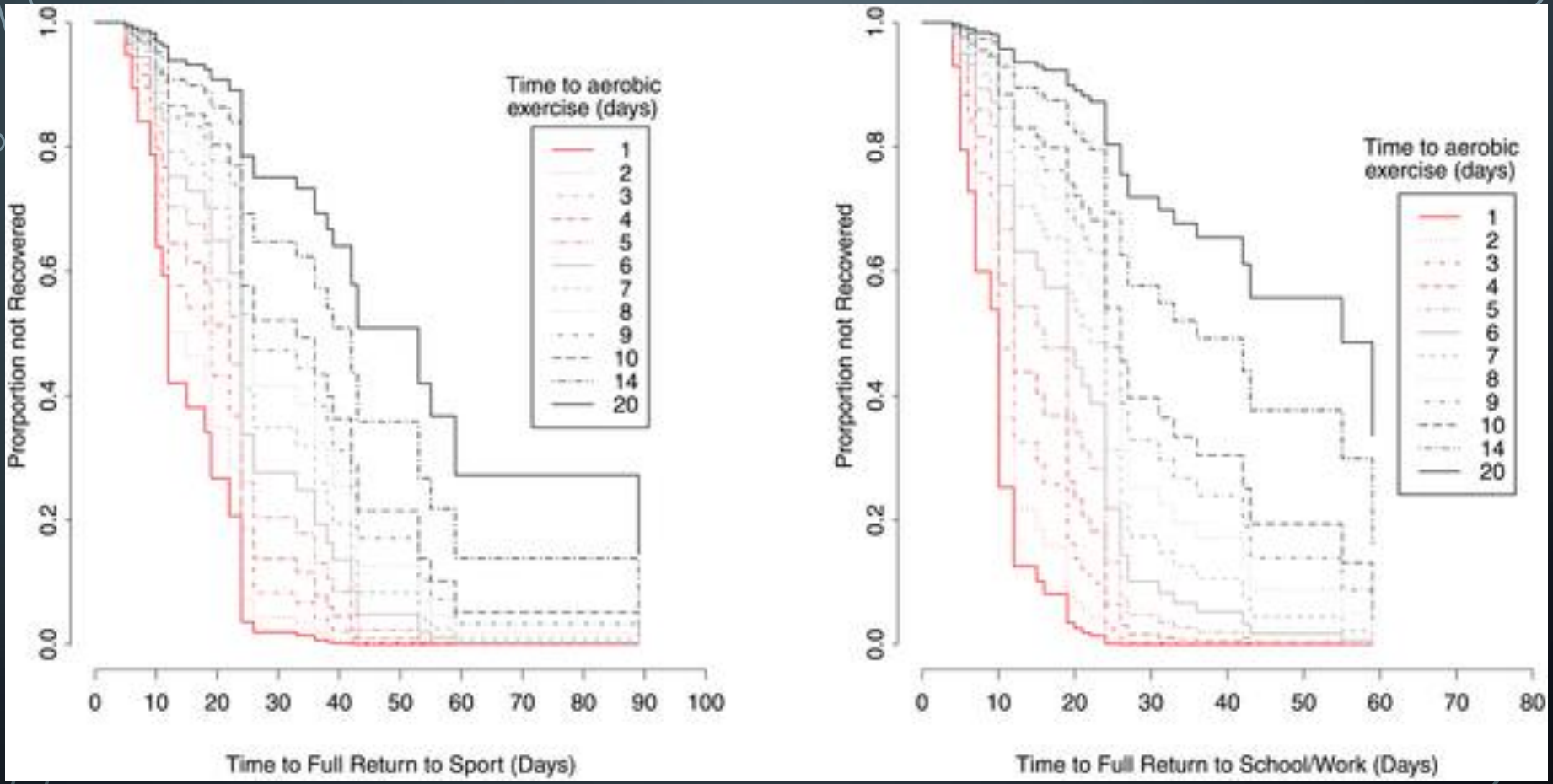
Tool 5.1: Management of Persistent Headache in Children Algorithm



EXERCISE AS TREATMENT

- Prolonged rest, especially in athletes, can lead to physical deconditioning, metabolic disturbances, and secondary symptoms such as fatigue and reactive depression. There is no scientific evidence that prolonged rest for more than several weeks in concussed patients is beneficial.
- Benefits of exercise…
  - Reconditioning
  - Improved mood
  - Improved sleep
  - Improved energy level
  - Decreased stress

Fig 3. Kaplan-Meier survival curves for time to full return to A. sport and B. school/work based on the time to initiation of aerobic exercise, after adjustment for all covariates including propensity score strata.



Lawrence DW, Richards D, Comper P, Hutchison MG (2018) Earlier time to aerobic exercise is associated with faster recovery following acute sport concussion. PLOS ONE 13(4): e0196062. https://doi.org/10.1371/journal.pone.0196062
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0196062

NEUROPSYCHOLOGICAL TESTING

If problems linger, a neuropsychologist can help. A clinical neuropsychologist is a licensed psychologist with expertise in how behavior and skills are related to brain structures and systems.

Neuropsychologists have two main roles when it comes to concussions:

Assessment. The first step in determining why symptoms aren't going away is to review the patient's background. May have had previous concussions or the patient may have depression, anxiety, medication use, sleep disturbance or other factors that can slow recovery or masquerade as concussion symptoms.

The neuropsychologist conducts a neuropsychological evaluation to assess memory, attention, reasoning and other cognitive skills. Personality and mood tests can help the neuropsychologist understand if psychological factors are at work. Results of this evaluation will help identify ongoing cognitive impairments and specify what abilities have been most affected. Repeat testing can be useful to document improvement over time.

Treatment. A neuropsychologist will provide psychoeducation, teaching patients about common concussion symptoms and normal recovery patterns. Even a single session can stop patients from wrongly attributing normal memory slips or other everyday problems to their concussions, one research review suggests. For cases in which patients develop an abnormal focus on their symptoms or other problems, cognitive behavioral therapy can help.

Table. Referring patients for neuropsychological assessment.

Reason for referral	Examples of referral questions
For diagnostic clarification	• Is this an attentional problem or a memory retrieval deficit? • Are there other factors present (e.g., depression) that could be contributing to the cognitive presentation? • Are the patient's complaints incongruent with the nature of the injury (i.e., the complaints far exceed what is expected either in intensity or number)?
To establish a baseline, which can be used later to confirm improvement/change and provide an evaluation of the efficacy of a particular rehabilitation plan	• Does the patient have deficits? • How severe are the deficits?
To retest the patient to objectively compare current status to earlier assessment	• Have the patient's deficits changed in nature or severity?
To determine cognitive strengths and weaknesses to implement appropriate rehabilitation and cognitive interventions	• Does the patient require any rehab? • How can the rehabilitation best be done and by whom? • Is information needed to educate the professionals involved and family members so that there is consistent understanding of the patient's presentation?
To establish a cognitive profile for prognostic recommendations regarding return to work, return to school, or the ability to handle functioning at home	• Will subtle cognitive deficits have an impact on the patient's ability to work? • Should the patient return to full-time work or part-time work? • Can the patient (a student) handle the courses and course load being considered? • Does the patient (an elderly person) need an occupational therapy consultation regarding how to manage activities of daily livin

Head injuries are on the rise for athletes at all levels of play. An estimated 4 to 5 million concussions occur annually, with increases emerging among middle school athletes.

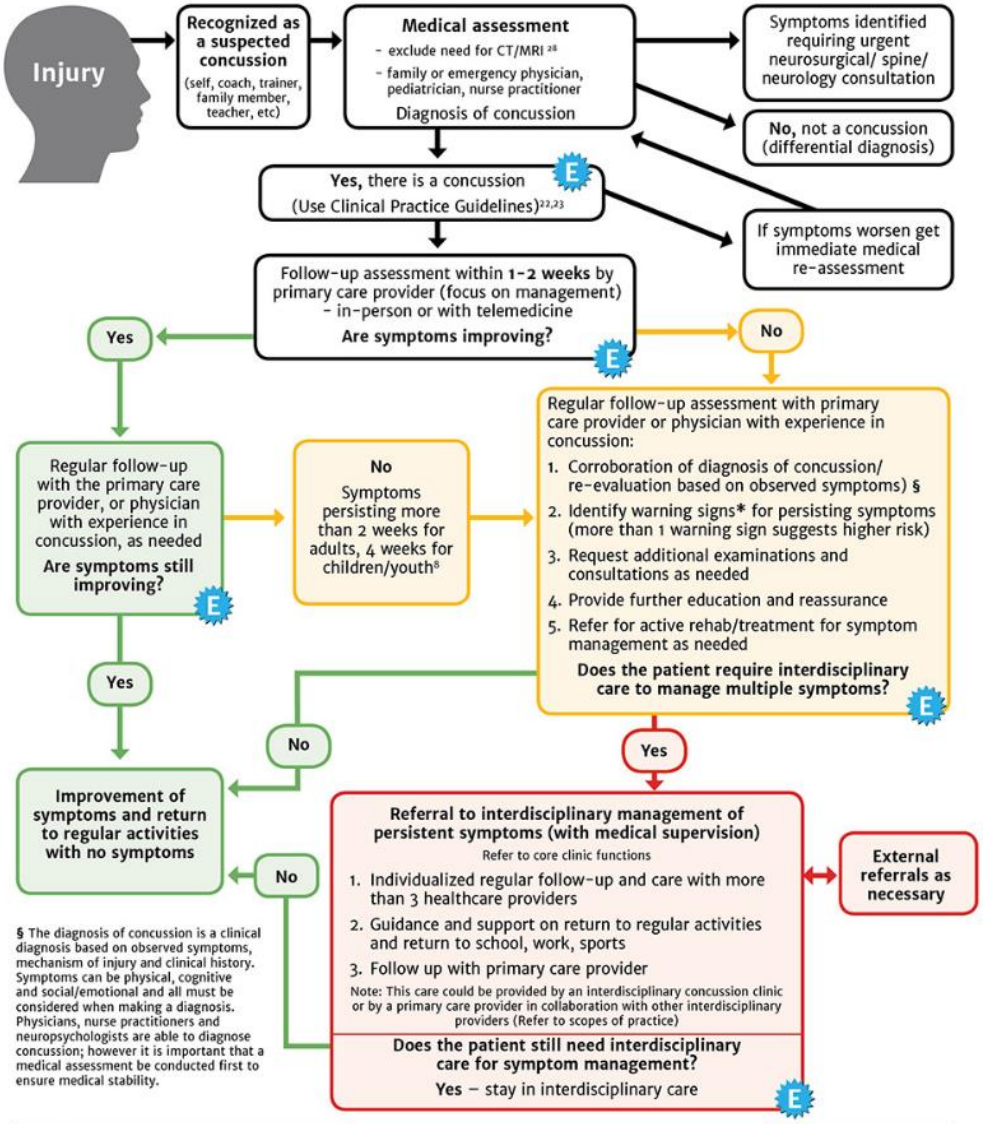
About ImPACT

Developed by clinical experts who pioneered the field, ImPACT (Immediate Post-Concussion Assessment and Cognitive Testing) is the most-widely used and most scientifically validated computerized concussion evaluation system. ImPACT provides trained clinicians with neurocognitive assessment tools and services that have been medically accepted as state-of-the-art best practices -- as part of determining safe return to play decisions.

Through tools such as the ImPACT Concussion Management Model ImPACT addresses the need for an accurate, medically accepted assessment system that is used as part of an overall concussion management protocol. This Model builds partnerships with healthcare professionals and athletic trainers to offer training and resources for affordable concussion management. ImPACT benefits athletes at all levels of play, from professional sports teams to students and their parents.

ImPACT has the largest database of clinical research (more than 215 peer reviewed and 145 independent studies) on concussion management, validating ImPACT's model. Further, ImPACT's comprehensive

Post-Concussion Care Pathway†



RETURN TO SCHOOL/SPORT (RTS)

There are many RTS guidelines but the main premise is that a player should never return to play while symptomatic. “If in doubt, sit them out”.

Return to play after mTBI should follow a stepwise process, proceeding to the next level only if asymptomatic. If any symptoms occur after mTBI, the person should revert to the previous asymptomatic level and try to progress again after 24 hour

Rest & Rehabilitation After a concussion, the athlete should have physical rest and relative cognitive rest for **~1-2 days** to allow their symptoms to improve. In most cases, after no more 1-2 days of rest, the athlete should gradually increase their daily activity level as long as their symptoms do not worsen. Once the athlete is able to complete their usual daily activities without concussion-related symptoms, the second step of the return to play/sport progression can be started. The athlete should not return to full play/sport until their concussion-related symptoms have resolved and the athlete has successfully returned to full school/learning activities.

Return-to-School Strategy[1]

Stage	Aim	Activity	Goal of each step
1	Daily activities at home that do not give the student-athlete symptoms	Typical activities during the day as long as they do not increase symptoms (i.e. reading, texting, screen time). Start at 5-15 minutes at a time and gradually build up.	Gradual return to typical activities.
2	School activities	Homework, reading or other cognitive activities outside of the classroom.	Increase tolerance to cognitive work.
3	Return to school part-time	Gradual introduction of schoolwork. May need to start with a partial school day or with increased breaks during the day.	Increase academic activities.
4	Return to school full-time	Gradually progress.	Return to full academic activities and catch up on missed school work.

Sport-Specific Return-to-Sport Strategy[1]

Stage	Aim	Activity	Goal of each step
1	Symptom-limiting activity	Daily activities that do not provoke symptoms.	Gradual re-introduction of work/school activities.
2	Light aerobic activity	Walking or stationary cycling at slow to medium pace. No resistance training.	Increase heart rate.
3	Sport-specific exercise	Running or skating drills. No head impact activities.	Add movement.
4	Non-contact training drills	Harder training drills, e.g. passing drills. May start progressive resistance training.	Exercise, coordination and increased thinking.
5	Full contact practice	Following medical clearance and complete return to school.	Restore confidence and assess functional skills by coaching staff.
6	Return to sport	Normal game play.	

Return to School

This tool is a guideline for managing a student's return to school following a concussion and does not replace medical advice. Timelines and activities may vary by direction of a health care professional.

AT HOME

STAGE 1:

Physical & cognitive rest

- Basic board games, crafts, talk on phone
- Activities that do not increase heart rate or break a sweat

Limit/Avoid:

- Computer, TV, texting, video games, reading

No:

- School work
- Sports
- Work
- Driving until cleared by a health care professional

Rest

When symptoms start to improve OR after resting for 2 days max, **BEGIN STAGE 2**

STAGE 2:

Start with light cognitive activity:

Gradually increase cognitive activity up to 30 min. Take frequent breaks.

Prior activities plus:

- Reading, TV, drawing
- Limited peer contact and social networking

Contact school to create *Return to School* plan.

When light cognitive activity is tolerated:

Introduce school work.

Prior activities plus:

- School work as per *Return to School* plan

Communicate with school on student's progression.

No:

- School attendance
- Sports
- Work

Gradually add cognitive activity including school work at home

Tolerates 30 min. of cognitive activity, introduce school work at home

Tolerates 60 min. of school work in two 30 min. intervals, **BEGIN STAGE 3**

AT SCHOOL

STAGE 3:

Back to school part-time

Part-time school with maximum accommodations.

Prior activities plus:

- School work at school as per *Return to School* plan

No:

- P.E., physical activity at lunch/recess, homework, testing, sports, assemblies, field trips

Communicate with school on student's progression.

School work only at school

Tolerates 120 min. of cognitive activity in 30-45 min. intervals, **BEGIN STAGE 4**

STAGE 4:

Part-time school

Increase school time with moderate accommodations.

Prior activities plus:

- Increase time at school
- Decrease accommodations
- Homework – up to 30 min./day
- Classroom testing with adaptations

No:

- P.E., physical activity at lunch/recess, sports, standardized testing

Communicate with school on student's progression.

Increase school work, introduce homework, decrease learning accommodations

Tolerates 240 min. of cognitive activity in 45-60 min. intervals, **BEGIN STAGE 5**

STAGE 5:

Full-time school

Full days at school, minimal accommodations.

Prior activities plus:

- Start to eliminate accommodations
- Increase homework to 60 min./day
- Limit routine testing to one test per day with adaptations

No:

- P.E., physical activity at lunch/recess, sports, standardized testing

Work up to full days at school, minimal learning accommodations

Tolerates school full-time with no learning accommodations **BEGIN STAGE 6**

STAGE 6:

Full-time school

Full days at school, no learning accommodations.

Prior activities plus:

- Attend all classes
- All homework
- Full extracurricular involvement
- All testing

No:

- full participation in P.E. or sports until *Return to Sport* protocol completed and written medical clearance provided

Full academic load

Return to School protocol completed, focus on **RETURN TO SPORT**

Note: A student is tolerating an activity if symptoms are not exacerbated.

Adapted from the Return to Learn protocol by G.F. Strong School Program (Vancouver School Board), Adolescent and Young Adult Program, G.F. Strong Rehabilitation Centre.

www.cattonline.com

CATT CONCUSSION AWARENESS TRAINING TOOL

BC INJURY research and prevention unit
www.injuryresearch.bc.ca

Return to Sport

This tool is a guideline for managing an individual's return to sport following a concussion and does not replace medical advice. Timelines and activities may vary by direction of a health care professional.

STAGE 1:	STAGE 2:	STAGE 3:	STAGE 4:	STAGE 5:	STAGE 6:
No sporting activity Physical and cognitive rest until symptoms start to improve OR after resting for 2 days max.	**Light aerobic exercise** Walking, swimming, stationary cycling. No resistance training. The pace of these activities should be at the point where you are still able to have a conversation.	**Sport-specific exercise** Skating drills (ice hockey), running drills (soccer). No head-impact activities.	**Non-contact drills** Progress to complex training drills (e.g. passing drills). May start resistance training.	**Full-contact practice** Following medical clearance participate in normal training activities.	**Back in the game** Normal game play
Recovery	**Increase heart rate**	**Add movement**	**Exercise, coordination, cognitive load**	**Restore confidence; assess functional skills**	
Symptoms improve or 2 days rest max? **Yes:** Move to stage 2 **No:** Continue resting Time & Date completed:	**No new or worsening symptoms for 24 hours?** **Yes:** Move to stage 3 **No:** Return to stage 1 Time & Date completed:	**No new or worsening symptoms for 24 hours?** **Yes:** Move to stage 4 **No:** Return to stage 2 Time & Date completed:	**Symptom-free for 24 hours?** **Yes:** Move to stage 5 **No:** Return to stage 3 Time & Date completed:	**Symptom-free for 24 hours?** **Yes:** Move to stage 6 **No:** Return to stage 4 Time & Date completed:	**Note: Premature return to contact sports (full practice and game play) may cause a significant setback in recovery.**

If new or worsening symptoms are experienced at any stage, go back to the previous stage for at least 24 hours. You many need to move back a stage more than once during the recovery process.

Medical clearance required before moving to stage 5

BOTH TOOLS CAN BE USED IN PARALLEL; HOWEVER, *RETURN TO SCHOOL* SHOULD BE COMPLETED ***BEFORE*** *RETURN TO SPORT* IS COMPLETED

www.cattonline.com

CATT
CONCUSSION AWARENESS TRAINING TOOL

BC INJURY research and prevention unit
www.injuryresearch.bc.ca

Be careful of even well intentioned websites/ resources!! This is out of date as based off old Zurich guidelines

CONCUSSION MANAGEMENT

Return to Activity Guidelines for Children & Youth

These guidelines should be followed in discussion with a physician or brain injury clinician.

STEP 1: No Activity and Complete Rest

- NO physical activity if symptomatic

Which symptom group are you in: BLUE, PURPLE, or GREEN?

SYMPTOM FREE WITHIN 1 WEEK	SYMPTOM FREE WITHIN 1 - 4 WEEKS	SYMPTOMATIC FOR MORE THAN 4 WEEKS
Rest for 1 more week after symptom free	**Rest** for 1 more week after symptom free	Begin **STEP 2** (4 weeks after injury)
↓ Begin **STEP 2** ↓	↓ Begin **STEP 2** ↓	↓ **DO NOT** progress to **STEP 3** until symptom free and cleared by a physician or brain injury clinician ↓
Take at least **24 hours** for each step as you complete the rest of the guidelines	Take at least **1 week** for each step as you complete the rest of the guidelines	Take at least **1 week** for each step as you complete the rest of the guidelines

**Get clearance from a physician or brain injury clinician before beginning STEP 2*

STEP 2: Light Exercise

STOP If symptoms return, rest for at least 24 hours and then go back to the previous step

- NO resistance training or weight lifting
- **10-15 minutes** light exercise, maximum twice a day
  e.g., walking, stationary cycling, light jogging, freestyle swimming

STEP 3: Individual Sport-Specific Activity

- NO body/head contact, spins, dives, jumps, high speed stops, hitting a baseball with a bat, or other jarring motions
- **20-30 minutes** general conditioning, maximum twice a day.
  e.g., skating, running, throwing

STEP 4: Sport-Specific Practice with Team, NO CONTACT

- NO checking, heading the ball, tackling, live scrimmages
- Begin activities with one other teammate and then by the end of this step progress to full team practice, with NO contact.
  e.g., ball drills, shooting/passing drills, or other non-contact activities
- Begin resistance training and 'beginner level' sport-specific skills. Increase skill level over time.

**Get clearance from a physician or brain injury clinician before beginning STEPS 5 and 6*

STEP 5: Sport-Specific Practice with Team and CONTACT

- Participate in normal training activities. If no symptoms, you are ready to return to competition!

STEP 6: Return to Activity, Sport or Game Play

Reference: McCrory P, Meeuwisse W, Johnston K et al. Consensus Statement on Concussion in Sport: The 3rd International Conference on concussion in Sport Held in Zurich, Nov 2008. Journal of Athletic Training 2009; 44(4):434-448.

CONCUSSION MANAGEMENT

Return to School Guidelines for Children & Youth

These stages are designed to strike a balance between the importance of returning to school and brain recovery. Work with your school to put these recommendations into place.

STAGE 1: Brain Rest - NO SCHOOL

- No school for at least one week
- Lots of cognitive rest (**NO** TV, video games, texting, reading)
- When symptom free, move to **STAGE 2**

**If symptoms persist past 2 weeks, move to STAGE 2*

STAGE 2: Getting Ready to Go Back

- Begin gentle activity guided by symptoms (walking, 15 minutes of screen time twice daily, begin reading). If symptoms worsen, reduce activity.
- When symptom free, move to **STAGE 3**

**If symptoms persist, stay in this stage for a maximum of 2 weeks and discuss moving to STAGE 3 with your physician or brain injury clinician*

STAGE 3: Back to School/Modified Academics

- This stage may last for days or months depending on rate of recovery
- Go to bed early and get lots of sleep. Have a quiet retreat space in school
- Academic Modifications:
- Timetable/attendance: Start by going for one hour, half days or every other day
- Curriculum: Attend less stressful classes, no tests, homework in 15 minute blocks up to a maximum of 45 minutes daily
- Environment: Preferential seating, **avoid** music class, gym class, cafeteria, taking the bus, carrying heavy books
- Activities: Limit screen/TV time into 15 minute blocks for up to 1 hour daily
- When symptom free, move to **STAGE 4**

**If symptoms persist past 4 weeks → A recovery Individualized Education Plan (IEP) may be needed*

STAGE 4: Nearly Normal Routines

- Back to full days of school, but can do less than 5 days a week if needed
- Complete as much homework as possible and a maximum of 1 test per week
- When symptom free, move to **STAGE 5**

STAGE 5: Fully Back to School

- Gradually return to normal routines including attendance, homework, tests and extracurricular activities

McMaster University

CanChild Centre for Childhood Disability Research

www.canchild.ca

SYMPTOMS OF CONCUSSION

- Sleep disturbances or drowsiness
- Sensitivity to light or noise
- Headache
- Mentally foggy
- Nausea and vomiting
- Difficulty concentrating/ remembering
- Poor balance or coordination
- Irritability
- Dizziness
- Sadness
- Visual problems
- Nervousness

PREVENTION

- Do helmets or mouthguards prevent concussion?
- Specialized products? (ie. Bauer Neurosheild https://neuroshield.ca/)
- Monitoring – helmet sensors (ie. Shockbox – http://www.theshockbox.com)
- Non-contact sport <13yrs of age proven to prevent
- Neck strengthening/proprioception work

CONCERNS

- Will participation in sport go down – obesity epidemic
- Have to convince some people/kids that they DON'T have a concussion (there is over-reporting)

Case #1

CASE #1

1. Who would send this player back to play that game?

2. If he presented to your office in follow up, how would you go about diagnosing a concussion if you suspect it?

3. What are your instructions to him if you diagnose a concussion?

4. When would you allow him to return to play?

CASE #2

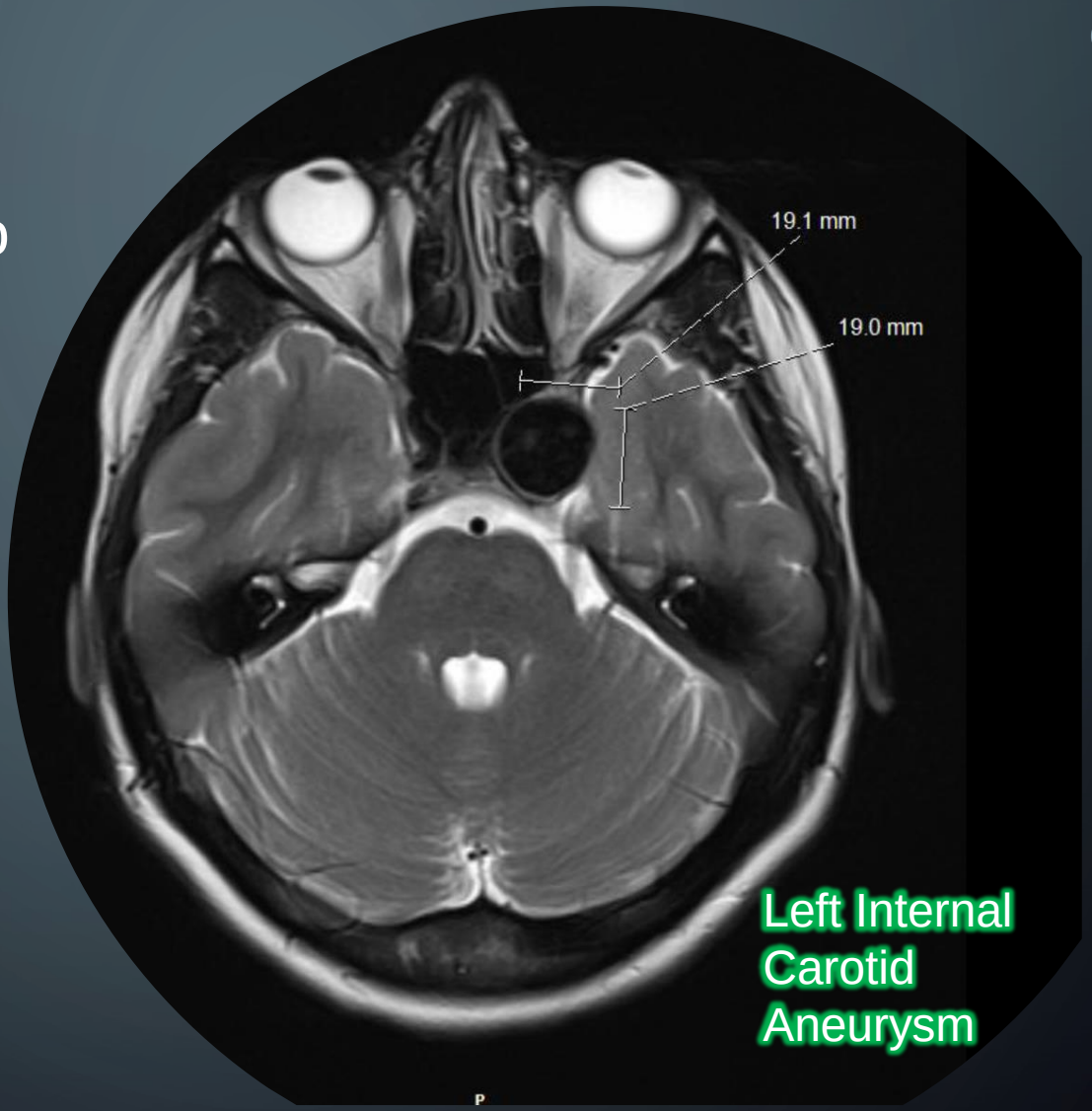
14 y/o F hockey player referred from ER for follow up ?concussion.
On history she reports spinning/vision issues. No one injury but was at a hockey tournament when symptoms became worse.
No risk factors.

O/E: Neuro, cervical and VOR testing negative but Dix-Hallpike + for nystagmus and reproduction of symptoms.

What next?

She attended chiro for BPPV exercise with no improvement at f/u in 2 weeks and now slight proptosis of left eye.

MRI was ordered.



IT ISN'T ALWAYS A CONCUSSION

The top 5 key messages from the 5th International Consensus Statement on Concussion in Sport

These key messages were developed by the Canadian Concussion Collaborative (June 2017)

Important note: The selected key messages presented in this document are not an exhaustive list of the new information found in the 5th International Consensus Statement on Concussion in Sport (McCrory et al. 2017). These key messages are meant for physicians and other health care professionals already familiar with the 4th iteration of this consensus statement (Zurich, 2012). The key messages should be read in conjunction with the full version of the Berlin consensus statement.

1- **Prolonged rest until all symptoms resolve is no longer recommended**:

After an initial short rest period lasting 24-48 hours, the early introduction of light cognitive and physical activity can be initiated as long as the activity does not exacerbate symptoms (sub-threshold activities).

2- **A gradual return-to-school (cognitive activity) strategy has been detailed**:

A 4-step graduated return-to-school strategy has been proposed. It is recommended that children and adolescents return to full time school activities before they return to sports; however, initiation of physical activity can occur prior to a complete return to school.

3- **Progression through the recovery process should be guided by the symptom exacerbation threshold**:

Gradual return to sub-threshold cognitive activities and low risk individual physical activity can progress as long as they don't increase symptoms. However, complete symptom resolution should be achieved before participating in activities placing the individual at risk of concussion (ex: non-contact training drills). Also, the statement emphasises the importance of respecting a minimum of 24 hours between each step of the return to sport protocol, and obtaining medical clearance before resuming sport-specific activities that may place the individual at risk of concussion.

4- **The use of baseline testing is not necessary**:

The Sport Concussion Assessment Tool 5 (SCAT5) is considered useful to help health care professionals assess for the possible presence of a concussion immediately after an injury, but should not be used as a stand-alone method to diagnose a concussion. The utility of the SCAT5 as a screening tool appears to decrease significantly 3–5 days after injury. SCAT5 baseline testing is not necessary for interpreting post-injury scores.

In addition, based on current evidence, the widespread routine use of baseline computerized neuropsychological testing is not recommended in children and adolescents. When these tests are used in the post-injury setting they should optimally be performed and interpreted by an accredited neuropsychologist.

5- **Persistent post-concussive symptoms should be reassessed to identify associated conditions and define an individualised treatment plan**:

The strongest and most consistent predictor of slower recovery from concussion is symptom severity in the initial few days after injury. The symptom checklist demonstrates clinical utility in tracking recovery. Based on the evolution of most concussions, the notion of "persistent concussion symptoms" has been re-defined as greater than 2 weeks for adults and greater than 4 weeks for children. When symptoms persist beyond this expected timeframe, medical re-evaluation should be obtained to develop an individualised treatment plan. Attention should be given to recognising and managing of the following conditions: autonomic system dysfunction, physical deconditioning, cervical spine problems, vestibular dysfunction and mood problems. Care of patients with persistent post-concussive symptoms should optimally be managed in a multi-disciplinary setting by a team of healthcare providers including a physician with experience in sport related concussions.

4 Characteristics of a Good Concussion Clinic

A document of the Canadian Concussion Collaborative (CCC)
First edition, July 2017

Who Should Use This Guide

This guide is designed to help people who have persistent symptoms of a concussion (symptoms that are not clearly improving after a period of seven to 10 days) find a good concussion clinic. Many sport medicine clinics and concussion clinics offer concussion management and treatment. Before you choose one, be sure that care is provided by licensed health care practitioners and ask the questions described in this document.

The answers to these questions will tell you whether the clinic provides good concussion care:

- "Yes" to questions 1 to 3 means they are likely providing up-to-date concussion care.
- "No" to any question means that the clinic does not follow best practices. They should make it clear that their approach is not supported by current guidelines.

Quick Concussion Facts

A concussion is a brain injury. It can happen when a blow to the head, face, neck or body makes the brain suddenly shake or jerk inside the skull. You can have a concussion and not lose consciousness. Signs and symptoms of a concussion include:

- Headache
- Neck pain
- Dizziness
- Irritability
- Blurred vision
- Nausea or vomiting
- Sensitivity to light or noise

After a medical evaluation, most concussions will heal gradually with an initial period of mental and physical rest, followed by gradual return to mental and physical activity. If the symptoms of a concussion do not clearly improve within 7 to 10 days, a personalized concussion care plan should be developed.

Questions to Ask a Concussion Clinic

Does the clinic have a medical doctor?

The treatment of patients with persistent concussion symptoms may involve many health care professionals, but a physician should ideally do the initial assessment of patients and should direct patient care and provide final medical clearance to return to sport, school and work-related activities. Clinics offering concussion care should have timely access to physicians with training and experience in concussion. These physicians should be identified by name.

WARNING! Proceed to an emergency department if any of the RED FLAGS listed in the "Concussion Recognition Tool" (CRT5) are observed:

- 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
- Increasing restlessness, agitation or combativeness

Questions to Ask a Concussion Clinic

Does the clinic have a team of licensed health care professionals?

In addition to a medical doctor, a team approach is helpful to evaluate and manage concussions more effectively. A good clinic has access to licenced professionals from several health care disciplines, either on-site or by referral. If needed, these professionals help provide mental and physical evaluation, education, rehabilitation and advice about getting back to work, school and sport. They provide complementary expertise from their health care disciplines and should work with the medical doctor to design a personalised treatment plan. The professional teams present at these clinics may include: athletic therapists, chiropractors, neuropsychologists, nurses, occupational therapists and physiotherapists.

Does the clinic follow the most up-to-date standards of care for managing a concussion?

Recommended standards of care are updated every few years by groups of experts in documents like the "International Consensus Statement on Concussion in Sport." The clinic should follow the most up-to-date standards to ensure good concussion care.

What tools, tests and recommendations is the clinic using?

The clinic should be using the tests recommended in the most current "International Consensus Statement on Concussion in Sport." The clinic should perform tests to evaluate many different components including patient symptoms, mental functions, balance, cervical spine, mood, response to exercise and neurological (brain) functions.

The use of pre-season (baseline) neuropsychological testing, including baseline computerized neurocognitive testing, is not recommended in children and adolescents.

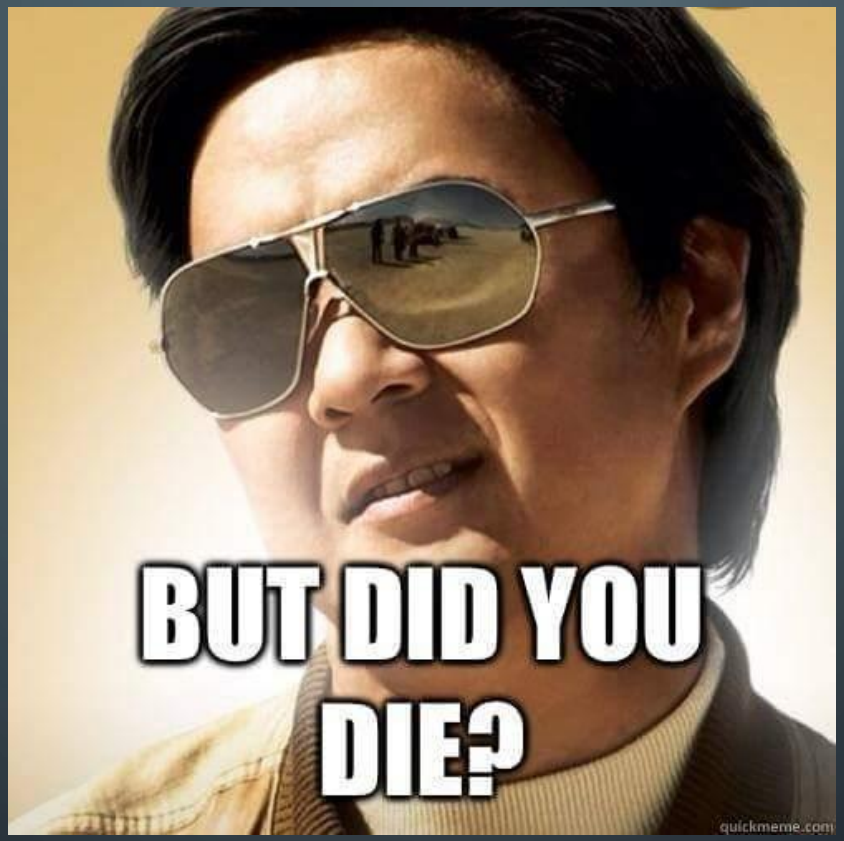
Concussion clinics and health care providers that are advertising "certification" for concussion management isn't a guarantee of proper concussion care. Private certification is an unregulated practice and is not endorsed by the Canadian Concussion Collaborative. To identify a good concussion clinic, ask the four questions described in this document!

BEWARE IF:

- **The clinic charges access fees or more for concussion treatments:** Clinics should have standardized time-based fee schedules regardless of the injury being treated.
- **The clinic's website or publicity offers testimonials:** This is an unethical practice for most health care professions.
- **The clinic claims to use a treatment that is proven to improve recovery from concussions:** No single treatment has been shown to improve recovery from all concussions.

Canadian Concussion Collaborative

Visit the CASEM website for additional concussion tools and resources.


BUT DID YOU DIE?
quickmeme.com

CASEM IS A GREAT RESOURCE WITH LOTS OF FREE INFORMATION
HTTP://CASEM-ACMSE.ORG/CONCUSSION-RELATED-POSITION-STATEMENTS-TOOLS/

MY HANDOUTS COME FROM BC AS THEY HAVE GREAT RESOURCES AS WELL (SEE SHEETS ON TABLES)…

IF INTERESTED ONTARIO NEURTRAUMA FOUNDATION IS ALSO HAS GREAT MANAGEMENT STRATEGIES AND GUIDELINES BASED ON BERLIN 2016 CONSENSUS GUIDELINES

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