



## BOTTOM LINE RECOMMENDATIONS:

# Concussion

Concussion is “a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces”<sup>1</sup>. Concussion results from acceleration and deceleration forces which 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. Loss of consciousness and amnesia are **not required** for a diagnosis of concussion. **Pediatric concussion is considered a silent epidemic. Up to 3.8 million concussions occur annually, with over 700,000 Emergency Department (ED) visits in the USA for pediatric concussion**<sup>1</sup>.

**Note:** All tools mentioned in this document can be found in the [Guidelines for Diagnosing & Managing Pediatric Concussion: Recommendations for Health Care Professionals \(GDMPC-HCP\)](#) available on the [Ontario Neurotrauma Foundation](#) website. For each tool, the corresponding page number in the GDMPC-HCP is listed.

### SYMPTOMS

- » Somatic symptoms include headache, nausea, loss of balance & dizziness
- » Cognitive symptoms include feeling in a 'fog', difficulty concentrating/remembering & confusion
- » There can also be emotional and/or behavioural changes and sleep disturbances

### ASSESSMENT OF CHILDREN PRESENTING WITH MILD TRAUMATIC BRAIN INJURY<sup>2</sup>

#### » HISTORY

- » The acute event
- » Interval history
- » Medications
- » Symptom inventories: [ACE-ED](#), PCSI, [SCAT3](#) (also available on pages 49, 91 & 32 of the [GDMPC-HCP](#))
- » Symptoms
- » Social history
- » Medical history (concussions, migraine, ADHD/learning disorders)

#### » PHYSICAL EXAMINATION

- » General inspection (mood, pallor, demeanor)
- » Social history
- » Fundoscopy
- » HEENT and neck examination
- » Gait & Romberg's testing
- » Balance examination using [Balance Error Scoring System](#)
- » Neurological examination

#### » DETERMINE THE NEED FOR CT IMAGING

- » Head CT when a clinically important intracranial injury (epidural or subdural hematoma) is suspected
- » CT can routinely be eliminated based on the PECARN rule<sup>4</sup> (available on page 53 of the [GDMPC-HCP](#))
- » Head CT **cannot be used to diagnose concussions** since acute concussion symptoms are caused by functional disturbances rather than gross structural injury

### CRITERIA FOR SAFE DISCHARGE HOME

- » Patients and parents/caregivers should monitor symptoms every **24 hours**
- » Combined with clinical judgment, it is safe for the child or adolescent to be observed at home on the following conditions:
  - » Normal mental status with improving symptoms
  - » No risk factors indicating need for CT scan or normal CT scan if already done
  - » No indications for prolonged hospital observation including worsening symptoms, persistent clinical symptoms (nausea, headaches, etc.), bleeding disorders, multisystem injuries or comorbid symptoms

### CRITERIA FOR HOSPITAL ADMISSION OR PROLONGED OBSERVATION

- » Consider admission or prolonged observation if the child or adolescent shows '**red flag**' symptoms such as:
  - » Worsening headaches
  - » Drowsiness/ cannot be awakened
  - » Change in state of consciousness
  - » Seizures
  - » Repeated vomiting
  - » Focal neurologic symptoms
  - » Slurred speech
  - » Cannot recognize people or places
  - » Unusual behavioural change
  - » Increasing confusion or irritation
  - » Neck pain
  - » Weakness or numbness in arms or legs

## TREATMENT OF PEDIATRIC CONCUSSION

- » The mainstay of concussion treatment is **physical and cognitive rest** (including an initial 24 - 48 hour rest period)
- » Most children recover within 2 weeks although post-concussive symptoms persist after 1 month in up to 30%
- » Along with rest recommendations below, it is important to manage sleep hygiene and hydration

### » COGNITIVE REST<sup>2</sup>

- » Most children require a 48 hour break from school
- » Follow a **stepwise plan**. The ACE Post-Concussion Gradual Return to School Tool reflects a standard approach while the [CanChild Return to School Guidelines for Children and Youth](#) is conservative (available on pages 40 & 41 of the [GDMPC-HCP](#))

### » STANDARD APPROACH

- » **Step 1:** Stay at home; no school, schoolwork, reading, TV, smartphone or tablet use
- » **Step 2:** Return to school, partial day (1-3 hours)
- » **Step 3:** Full day, maximal supports (required throughout day)
- » **Step 4:** Full day, moderate supports (provided in response to symptoms during day)
- » **Step 5:** Full day, minimal supports (monitor final recovery)
- » **Step 6:** Full return, no supports needed

### » PHYSICAL REST<sup>2</sup>

- » A return to play program should be developed **after** the child has started the return to school program
- » Follow a **stepwise plan**. The [Parachute After a Concussion Guidelines for Return to Play Tool](#) reflects a standard approach while the [CanChild Return to Activity Guidelines for Children and Youth](#) is conservative (available at on pages 36 & 38 of the [GDMPC-HCP](#))

### » STANDARD APPROACH

- » **Step 1:** No activity, complete rest
- » **Step 2:** Light aerobic exercise
- » **Step 3:** Sport specific activities
- » **Step 4:** Begin drills without body contact
- » **Step 5:** Begin drills with body contact
- » **Step 6:** Game play

### » SYMPTOMATIC TREATMENT

- » Including analgesia for headache (NSAIDS) and appropriate wear of sunglasses, ear plugs or noise-cancelling headphones

**The purpose of this document is to provide health care professionals with key facts and recommendations for the diagnosis and treatment of concussion in children.** This summary was produced by the concussion content advisor for the TREKK Network, Dr. Roger Zemek of the Children's Hospital of Eastern Ontario, and uses the best available knowledge at the time of publication. However, healthcare professionals should continue to use their own judgment and take into consideration context, resources and other relevant factors.

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This summary is based on:

- 1) McCrory P, Meeuwisse WH, Aubrey M et al. Consensus statement on concussion in sport: the 4<sup>th</sup> International Conference on Concussion in Sport held in Zurich, November 2012. *Br J Sports Med.* 47 (5): 250-258 (2013).
- 2) Zemek R, Duval S, DeMatteo C et al. *Guidelines for Diagnosing and Managing Pediatric Concussion* [Internet]. Toronto, ON: Ontario neurotrauma Foundation; 2014 June [accessed 2014 Nov 28]. Available from: [http://onf.org/system/attachments/265/original/GUIDELINES\\_for\\_Diagnosing\\_and\\_Managing\\_Pediatric\\_Concussion\\_Full\\_v1.1.pdf](http://onf.org/system/attachments/265/original/GUIDELINES_for_Diagnosing_and_Managing_Pediatric_Concussion_Full_v1.1.pdf)
- 3) Guskiewicz KM. *Assessment of postural stability following sport-related concussion.* *Current Sports Medicine Reports.* 2003; 2: 24 – 30
- 4) Kuppermann N, Holmes JF, Dayan PS et al. *Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study.* *Lancet.* 374 (9696): 1160-1170 (2009).

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