CADTH

Scoping Summary

Non-Pharmacological Interventions for the Management of Concussion

Purpose of This Document

CADTH initiated scoping for a potential review of the evidence on non-pharmacological interventions for the management of concussion. As part of the scoping exercise, CADTH consulted with jurisdictions across Canada and experts and stakeholders involved in the field of concussion. Although the topic was of interest to the jurisdictions, a full review was not conducted due to competing priorities.

This document summarizes the scoping that was conducted. It outlines the context that led to this subject being identified and prioritized for a CADTH evidence review and presents overall findings of the scoping exercise. The document is not an evidence report or a scoping review. CADTH is making this information available to provide an overview of the completed scoping work.

Background

Concussion — also referred to as mild traumatic brain injury (mTBI) — is by far the most common type of brain injury. In Canada, data published by the Canadian Institute for Health Information indicate that 94% of sports-related brain injuries seen in Ontario and Alberta emergency departments in 2016–2017 were concussion related.[1] The diagnosis of concussion involves clinical assessment by a medical professional with the purpose of ruling out more severe form of injuries, such as intracranial hemorrhage, that can be confounded with a concussion.[2,3] The clinical assessment is commonly supported by the use of diagnostic tests that evaluate potential markers of a concussion following a head impact, such as abnormalities in physical and neurocognitive functions. Several of these tests are currently available but there is debate about their effectiveness in assessment and identification of concussion and informing related care strategies.

A number of non-pharmacological interventions are currently used for the management and treatment of concussion during the acute injury stage or when persistent symptoms occur. Available evidence reviews on management and treatment of mTBI focus mostly on assessing the effectiveness of a specific intervention or a limited number of interventions. At the time of scoping, there appeared to be no recent or planned health technology assessment on this topic.

Evidence-based guidelines on concussion have been developed in Canada and at the international level. The Concussion in Sport Group (CISG), an international panel of experts, released its latest consensus statement on sport-related concussion in 2017.[4] A number of systematic reviews were conducted, including on treatment and rehabilitation of sport-related concussion,[5] to support the development of the different recommendations put forward by the CISG. A planned update of the consensus document is expected.[4] Of note, the *Canadian Guideline on Concussion in Sport*, which was published in 2017 by the Parachute initiative, draws from the CISG consensus statement.[6] In 2018, the Ontario Neurotrauma Foundation published the third edition of its *Guideline for Concussion/Mild Traumatic Brain Injury and Persistent Symptoms*.[3] This guideline covers the adult population and provides recommendations on a range of concussion care aspects, such as diagnosis and management. It is scheduled to be updated in 2021.[3] In 2018, the Centers for Disease Control and Prevention (CDC) in the US published a guideline and related systematic review on the diagnosis and management of pediatric mTBI.[7,8] Although there is no identified

timeline for future review of the CDC guideline, the document states that the recommendations may be updated as new evidence emerges.[7]

Policy and Practice Issues

Feedback from the jurisdictions, experts, and organizations consulted; reviews of the literature; and Rapid Response Service requests submitted to CADTH provided indications of key issues and challenges that the health care system is facing in addressing concussion. Questions and issues that emerged include:

- Early assessment and detection of concussion in the immediate post-injury period including
  - How to assess individuals suspected of having sustained a concussion in the immediate post-injury period (e.g., sideline evaluation)
  - The effectiveness of tools and methods that are being used or promoted to evaluate individuals suspected of having sustained a concussion
- Early detection of concussion for referral to appropriate care (i.e., clinical diagnosis; testing to distinguish and monitor severe injuries)
- Effectiveness of interventions for the management and treatment of concussion in the acute injury phase
- Effectiveness of interventions for the management and treatment of persistent concussion symptoms
- Clearing patients who have experienced a concussion for return to normal activity (i.e., what methods are reliable?)
- Lack of resources for care, support, management, and rehabilitation of patients who have experienced a concussion
- Difficulties and gaps in educating care providers on how to manage and treat concussion.

The different issues and questions of interest are summarized as decision problems that a review of the evidence on concussion could help inform the following.

Assessment and Identification

1. What tests and methods should be used to perform early assessment (e.g., sideline evaluation) of individuals for concussion?
2. What tests and methods should be used to screen and triage patients with suspected concussion for referral to appropriate care?

Treatment and Management – Acute Phase

1. What non-pharmacological interventions should be used for the management and treatment of concussion in the acute injury stage?
2. What tests and methods should be used to evaluate and clear patients for return to normal activity?

Treatment and Management – Persistent Symptoms

1. What non-pharmacological interventions should be used for the management and treatment of persistent concussion symptoms?
2. What tests and methods should be used to evaluate and clear patients for return to normal activity?

Funding and Access to Care

1. Should access to publicly funded care related to concussion be improved and what considerations should guide funding and implementation of this care?

Findings

A first phase of scoping identified a range of non-pharmacological interventions and approaches used in the management and treatment of concussion. This non-exhaustive list includes:

- **Physical and neurological rest** – Involves restricting physical and neurological activity following a concussion with the aim of relieving the symptoms, promoting timely recovery, and avoiding a second concussion after a recent one.[5,9] Current recommendations call for a brief period of rest (24 hours to 48 hours) during the acute phase followed by a gradual return to physical and neurological activities at levels that do not exacerbate symptoms.[4]
- **Behavioural therapies** – Includes psychological interventions, such as cognitive behavioural therapy, which can be used to identify and correct detrimental behaviours and psychological issues, such as depression and anxiety, that complicate the recovery process.[10]
- **Psychoeducational interventions** – Typically involves educating the patient about concussion symptoms, the expected recovery trajectory, and guidance and practices to follow to facilitate recovery. These interventions aim to address cognitive issues about symptoms and negative expectations about recovery that may prolong the recovery process.[11]
- **Cognitive rehabilitation** – Includes a various set of interventions (e.g., Attention Process Training; problem-solving training) that aim to address symptoms of cognitive impairment, such as attention and memory deficits, which are often present in concussed individuals with persistent symptoms.[11]
- **Aerobic exercise** – Involves aerobic exercise performed a few times a week at reduced intensity and sub-symptom threshold. This intervention may be used as part of a treatment approach to address persistent symptoms.[5]
- **Vestibular rehabilitation** – Vestibular-related symptoms induced by a concussion include issues such as impaired reflexes, visual motion sensitivity, imbalance, and dizziness. Different types of rehabilitation interventions, such as vision therapy, may be used to care for affected individuals.[9]
- **Hyperbaric oxygen therapy (HBOT)** – Involves the inhalation of pure oxygen while ambient air pressure (inside the hyperbaric chamber) is maintained at 3 times higher than normal air pressure. HBOT causes an increased level of oxygen in the blood circulating to body tissues, which helps injured tissues to recover.[12] This therapy is increasingly used to treat persistent symptoms resulting from a concussion.[13,14]

The second phase of scoping focused on the aspect of assessment and identification of concussion and identified a number of commonly used diagnostic tests and approaches as potential subjects for a comprehensive review of the evidence. Examples of such interventions include:

- **The Sport Concussion Assessment Tool** – The current version of this tool is designated as SCAT5. It is used for individuals aged 13 years or older. The tool is a composite of different tests that are designed to assess a range of clinical, physical, and cognitive indicators used to determine if an individual has sustained a concussion.[15]
- **The Child Sport Concussion Assessment Tool** – The current version of this tool is called the ChildSCAT5. It is aimed at children between the ages of 5 years and 12 years.
- **Immediate Post-Concussion and Cognitive Testing (ImPACT)** – A computer-based, neurocognitive test that evaluates verbal memory, reaction time, visual-motor speed, and visual memory. Deficits in these functions signal the presence of a concussion.[16] The results are determined by comparing baseline test scores with post-injury scores.
- **The King-Devick (K-D) test** – An eye movement screening test that was developed initially for assessment of dyslexia and other learning difficulties in children. It measures the speed at which the individual being tested reads a series of single-digit numbers presented on 3 cards. This test is often described as being easy to use and quick to administer, which has led to its frequent use in situations, such as sports, where rapid assessment of a suspected concussion needs to be performed. Baseline and post-injury results achieved in the test are compared to help determine whether an individual has sustained a concussion.[17,18]
- **The biomarker S100B** – This serum biomarker is used to identify potential intracerebral lesions in individuals who have sustained a head trauma. Following trauma, the presence of cerebral lesions will cause S100B to be immediately released into the circulatory system and measuring this biomarker is helpful in determining if an mTBI patient should be referred to CT scan. More than 90% of children who are suffering from mTBI have no intracerebral lesions.[19] It should be noted that CADTH published, in June 2020, a Horizon Scan bulletin on several biomarker-based point-of-care tests, including S100B, that are currently in development for assessment of mTBI.[20]
- **CT imaging** – Commonly used to determine whether intracerebral lesions are present in individuals who have sustained a head trauma. The results help in the diagnosis of concussion by enabling the ruling out of more serious brain injuries.

Summary

CADTH conducted scoping for a potential project on non-pharmacological interventions for the management of concussion. The scoping identified a number of issues and questions about the treatment, management, identification, and assessment of concussion. Ongoing work by CISG and the Ontario Neurotrauma Foundation may address some of the issues. Concussion is a significant public health issue, and there is an identified need for a comprehensive review of the evidence on the various interventions being used to address the diagnosis, management, and treatment of the condition. Determining optimal evidence-based interventions may result in decisions that ensure more equitable access to care for concussion. Outstanding questions, evidence gaps, and options that could be used to address them are presented in Table 1.

Table 1: Project Options

	Assessment and identification	Treatment and management – acute phase	Treatment and management – persistent symptoms
Decision problems and questions	• What tests and methods should be used to perform early assessment (e.g., sideline evaluation) of individuals for concussion? • What tests and methods should be used to screen and triage patients with suspected concussion for referral to appropriate care?	• What non-pharmacological interventions should be used for management and treatment of concussion in the acute injury stage? • What tests and methods should be used to evaluate and clear patients for return to normal activity? • Should access to publicly funded care for concussion be improved and what considerations should guide funding and implementation of this care?	• What non-pharmacological interventions should be used for management and treatment of persistent concussion symptoms? • What tests and methods should be used to evaluate and clear patients for return to normal activity? • Should access to publicly funded care for concussion be improved and what considerations should guide funding and implementation of this care?
Potential work	**Review of:** • Tests and methods commonly used in early assessment, such as ImPACT; the King-Devick test • Tests and methods used as aids in the diagnostic process, such as the SCAT5, Child SCAT5, and imaging modalities • Guidelines related to assessment and diagnosis • Perspectives, experiences, and expectations related to the assessment and identification of concussion • Novel and emerging tests and methods (e.g., biomarkers for detection of traumatic brain injury; helmet sensors)	**Review of:** • Interventions commonly used to treat and manage concussion in the acute phase, such as physical and neurological rest, and psychological therapies • Other interventions being offered by various providers • Tests and methods being used to help clear patients for return to normal activity • Guidelines related to care and management • Perspectives, experiences, and expectations related to treatment and management of concussion • Novel and emerging treatment and management interventions	**Review of:** • Interventions commonly used to address persistent symptoms, such as cognitive rehabilitation, behavioural therapies, and hyperbaric oxygen therapy • Other interventions being offered by various providers • Guidelines related to care and management • Perspectives, experiences, and expectations related to treatment and management of concussion • Novel and emerging treatment and management interventions

Child SCAT5 = Child Sport Concussion Assessment Tool; ImPACT = Immediate Post-Concussion and Cognitive Testing; SCAT5 = Sport Concussion Assessment Tool.

References

1. Canadian Institute for Health Information. Head's up on sport related brain injuries. 2018; https://www.cihi.ca/en/heads-up-on-sport-related-brain-injuries-0. Accessed 2019 Jan 24.
2. Master CL, Mayer AR, Quinn D, Grady MF. Concussion. *Ann Intern Med.* 2018;169(1):Itc1-itc16.
3. Guideline for concussion/mild traumatic brain injury & persistent symptoms, 3rd edition, for adults over 18 years of age. Toronto (ON): Ontario Neurotrauma Foundation; 2018: http://braininjuryguidelines.org/concussion/. Accessed 2019 Jan 24.
4. McCrory P, Meeuwisse W, Dvorak J, et al. Consensus statement on concussion in sport-the 5(th) international conference on concussion in sport held in Berlin, October 2016. *Br J Sports Med.* 2017;51(11):838-847.
5. Schneider KJ, Leddy JJ, Guskiewicz KM, et al. Rest and treatment/rehabilitation following sport-related concussion: a systematic review. *Br J Sports Med.* 2017;51(12):930.
6. Canadian guideline on concussion in sport. Toronto (ON): Parachute; 2017: https://www.parachutecanada.org/en/professional-resource/concussion-collection/canadian-guideline-on-concussion-in-sport/. Accessed 2019 Jan 23.
7. Lumba-Brown A, Yeates KO, Sarmiento K, et al. Centers for Disease Control and Prevention guideline on the diagnosis and management of mild traumatic brain injury among children. *JAMA Pediatr.* 2018;172(11):e182853.
8. Lumba-Brown A, Yeates KO, Sarmiento K, et al. Diagnosis and management of mild traumatic brain injury in children: a systematic review. *JAMA Pediatr.* 2018;172(11):e182847.
9. Broglio SP, Collins MW, Williams RM, Mucha A, Kontos AP. Current and emerging rehabilitation for concussion: a review of the evidence. *Clin Sports Med.* 2015;34(2):213-231.
10. Leddy JJ, Sandhu H, Sodhi V, Baker JG, Willer B. Rehabilitation of concussion and post-concussion syndrome. *Sports health.* 2012;4(2):147-154.
11. Prince C, Bruhns ME. Evaluation and treatment of mild traumatic brain injury: the role of neuropsychology. *Brain Sci.* 2017;7(8).
12. Mayo Clinic. Hyperbaric oxygen therapy. 2020; https://www.mayoclinic.org/tests-procedures/hyperbaric-oxygen-therapy/about/pac-20394380. Accessed 2019 Jan 31.
13. Davis MC, Shoja MM, Tubbs SR, Griessenauer CJ. Hyperbaric oxygen therapy for chronic post-concussive syndrome. *Med Gas Res.* 2014;4(1):8.
14. Dong Y, Hu XH, Wu T, Wang T. Effect of hyperbaric oxygenation therapy on post-concussion syndrome. *Exp Ther Med.* 2018;16(3):2193-2202.
15. Echemendia RJ, Meeuwisse W, McCrory P, et al. The Sport Concussion Assessment Tool 5th edition (SCAT5): background and rationale. *Br J Sports Med.* 2017;51(11):848-850.
16. Dessy AM, Yuk FJ, Maniya AY, et al. Review of assessment scales for diagnosing and monitoring sports-related concussion. *Cureus.* 2017;9(12):e1922.
17. Legarreta AD, Mummareddy N, Yengo-Kahn AM, Zuckerman SL. On-field assessment of concussion: clinical utility of the King-Devick test. *Open Access J Sports Med.* 2019;10:115-121.
18. Wang KK, Yang Z, Zhu T, et al. An update on diagnostic and prognostic biomarkers for traumatic brain injury. *Expert Rev Mol Diagn.* 2018;18(2):165-180.
19. Oris C, Pereira B, Durif J, et al. The biomarker S100B and mild traumatic brain injury: a meta-analysis. *Pediatrics.* 2018;141(6).
20. Biomarker-based point-of-care tests for the evaluation of mild traumatic brain injury. *(CADTH Issues in Emerging Health Technologies no. 188)*. Ottawa (ON): CADTH; 2020: https://cadth.ca/sites/default/files/hs-eh/eh0084-bti-concussion-final.pdf. Accessed 2021 Feb 9.