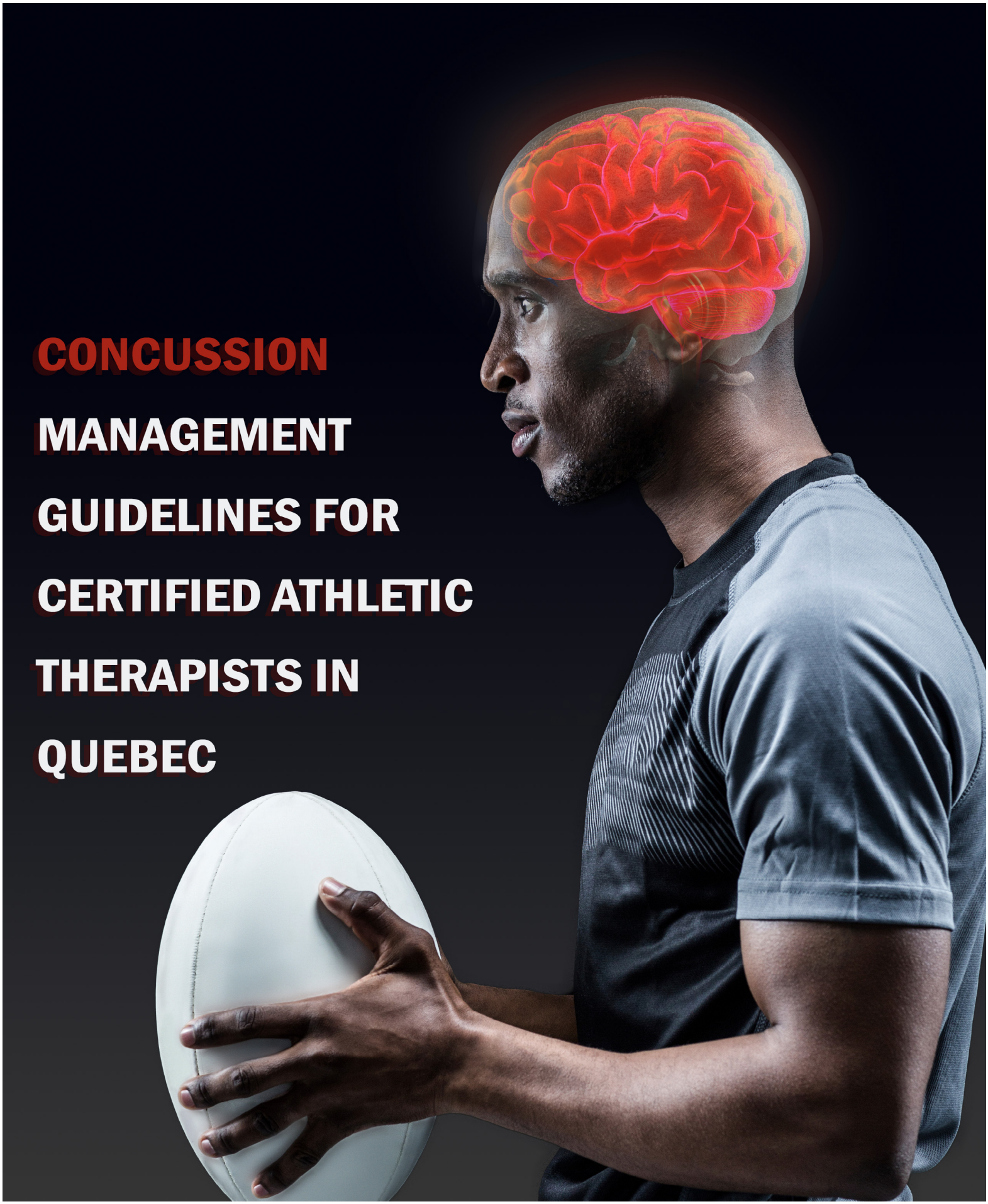
CONCUSSION MANAGEMENT GUIDELINES FOR CERTIFIED ATHLETIC THERAPISTS IN QUEBEC



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The *Corporation des thérapeutes du sport du Québec* (CTSQ) would like to express its utmost gratitude to the Concussion Committee, who upon being established in 2013, dedicated themselves to creating this document and thereby emphasizing the importance of appropriate clinical and field management of concussions. Extensive research and revision of current internationally recognized concussion management literature was required to achieve this goal. This enabled the committee to develop guidelines for the safe and effective assessment and treatment of concussions by certified athletic therapists in Quebec.

The CTSQ would like to acknowledge and thank the authors who worked tirelessly to create and deliver this document. In alphabetical order, the authors are:

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The authors created this document with help from the athletic therapy community by means of inspiration, guidance and support. The authors, as well as the CTSQ wish to express appreciation to everyone who contributed throughout the creation and editing of these guidelines.

This document will be reviewed and revised on a regular basis in order for its contents to remain up-to-date with current scientific literature on concussions. All of the appendices within this document will be available for download on the CTSQ's website, www.ctsq.qc.ca.

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INTRODUCTION

CTSQ Concussion Committee Mission Statement

Devoted to the health and well-being of all by ensuring the highest standard for the prevention and care of activity-related head trauma through research, education and knowledge transfer.

Background

In the fall of 2013 the *Corporation des Thérapeutes du Sport du Québec* (CTSQ) mandated an Adhoc Concussion Committee to provide a document outlining the current management guidelines for head trauma. The goal was to ensure that certified athletic therapists (CAT(C)s) continue to provide the highest standard of care for their patients and athletes. That committee has since changed to a full committee status and holds the name CTSQ Concussion Committee.

The overreaching desire of the CTSQ and this committee is to prevent possible patient mismanagement, unnecessary suffering and possible long-term neurological disorders and to inspire a positive effect on both the injured individual and their support networks.

The committee conducted thorough research, and also reviewed and clarified current internationally recognized concussion management standards and guidelines. These guidelines were found in peer-reviewed scientific literature. The resulting document is a thorough representation of concussion management standards as they currently exist, and should serve as the standard of care for all CAT(C)s practising in the province of Quebec. The document may also serve as a guideline for other health care professionals or persons who provide care to individuals who have sustained a head trauma. The document will be reviewed and revised on an ongoing and regular basis in order for its contents to remain up to date with current scientific literature.

Athletic Therapist Scope of Practice

Certified athletic therapists (CAT(C)s) are front-line health care professionals, as per the Quebec authorization regulation [1]. CAT(C)s are trained and prepared in accordance with the highest standard of care, to provide the emergency assessment, treatment, ongoing monitoring, and *Return to Learn* and *Return to Play* decision-making associated with a concussion or mild traumatic brain injury (mTBI) while following age appropriate guidelines. As such, CAT(C)s are well suited to provide post-concussive care to athletes at the recreational, elite and professional levels. They can also provide acute care services and facilitate active rehabilitation for an athlete's safe return to learn and return to play. As part of their education and certification, CAT(C)s are trained to manage an athlete with a suspected concussion/mTBI, both on-site at sports venues or in a clinical setting or training room. It is essential that these first encounters be dealt with expeditiously using the highest standard of health care.

The CTSQ advocates adopting a more conservative approach for concussion management due to the complexity of these injuries, the current literature and various other factors revolving around this particular condition such as age, maturation and medical history. Each case must therefore be evaluated on an individual basis and the management strategy should take all of these factors into account.

Concussion Interpretation and Definition

It should be understood that the terms concussion and mTBI are interchangeable. In sports and everyday life, the term concussion is widely used and perceived as being a minor injury relative to a Traumatic Brain Injury (TBI). Whereas, a concussion is in fact a mild traumatic brain injury, it is important that it be understood as such [2]. It is important that CAT(C)s, athletes, parents, and their support network understand the significance of the word "concussion" and that it is synonymous with mTBI. This understanding should raise awareness and promote caution and increase compliancy during the assessment, treatment and rehabilitation process required during the initial evaluation and after injury.

While the long-term effects and consequences of concussion mismanagement are unknown, it is clear that short-term mismanagement following a concussion leads to an increase in symptoms and delays in recovery [3]. A medical history of previous concussions has been associated with a greater risk of repeated mTBIs, and recent evidence suggests that chronic traumatic encephalopathy is a long-term neurological complication attributable to repeated concussions, as reported in high-contact sport athletes post-mortem in sports such as American football and boxing [4-6].

TBIs can be characterized as diffuse or focal. The diffuse injury type refers to an injury where there has been a widespread disruption of neurological function caused by shearing of neuronal connections. Depending on the area of the brain that is affected, the injury can result in a wide range of deficits, which can include, but are not limited to, changes in personality, loss of speech, inability to comprehend speech, motor impairment, and attention and/or memory deficits. The focal type injury, favoured by linear accelerations of the head and brain, [7-10] refers to injuries that are more localized and potentially life threatening such as with intracranial bleeding [9, 11, 12].

It is important to note that any direct or indirect impact to the head can result in a head injury and can also be associated with a traumatic brain injury of varying severity. Therefore, a proper brain injury assessment as per these guidelines should be performed.

Consensus Model for Concussion Management

Every four years, international experts meet to discuss advances in sports concussion management and provide recommendations regarding the assessment, treatment and rehabilitation of mild traumatic brain injuries in sport. Their latest consensus statement on concussion in sport, *4th International Conference on Concussion in Sport,* was held in Zurich November 2012. It was published in multiple journals in March 2013 [4].

This consensus statement provides details on emergency care and procedures for dealing with concussions. Although various groups provide guidelines on concussions, the CTSQ recommends following the guidelines outlined at the International Conference on Concussion in Sport, which reflect up-to-date research and findings [4].

Canadian Concussion Collaborative

The CTSQ supports the initiatives of the Canadian Concussion Collaborative (CCC). This collection of health-related organizations, including the Canadian Athletic Therapists Association (CATA), acknowledges that concussion in sport is recognized as a public health problem. The mission of the CCC is to help improve education and implementation of best practices for the prevention and management of concussions [13-15]. Barriers which prevent implementation of optimal care exist and as a result, the CCC has developed a consensus statement [4]. Sports organizing bodies need to develop prevention and management programs based on current literature and available resources. In situations where sufficient management resources are not available in a timely manner, multidisciplinary collaborative approaches should be employed.

Groupe de travail sur les commotions cérébrales

In 2013, the Quebec government created the *Groupe de travail sur les commotions cérébrales*, (GTCC), a work group designed to study the ongoing problem of head injuries in sport in the province. A certified athletic therapist was selected as a member of the group.

In March 2014, the CTSQ was invited to a round table discussion as an expert sports medicine group. The CTSQ was also requested to provide a written report on their recommendations which consisted of a 30-page report given to the GTCC.

The GTCC released its final report in March 2015 [14], outlining its strategies and timelines to help address the challenges associated with managing head injuries in sport in the province of Quebec.

GLOSSARY

Active rehabilitation
A personalized program for individuals experiencing chronic concussion symptoms, aimed at mitigating symptoms and improving mood. The program "consists of gradual, closely monitored physical conditioning, general coordination exercises, visualization, as well as education and motivation activities". [16]

Active rest
A term used in the return-to-play (RTP) guidelines where the individual is still not allowed to participate in the return-to-learn (R2L) and/or RTP protocol. The individual, however, is allowed to participate in everyday activities that do not produce or exacerbate any concussion symptoms.

Acute
In a field setting, an injury is considered to be in the acute phase from the moment of injury until 72-hour post-injury. In a clinical setting, during treatment and recovery, the acute phase can persist up to 7 to 10 days post-injury.

Age category
With respect to the currently available tools in these guidelines:

- **Child**: as per Quebec law, any person under the age of 18.
- **Adolescent & Young adult**: any person between the ages of 13 and 25, inclusively, as per brain maturation for current standards and management procedures in the province of Quebec.
- **Adult**: any person over the age of 25 years old [17, 18].

Child SCAT3
An evaluation tool for concussions specifically designed for children under 12 years of age [19].

Complete rest
The absence of any and all cognitive or physical activity or stimulation.

Concussion
See definition for Mild Traumatic Brain Injury (mTBI) [20].

Coup-Contrecoup, Whiplash

A term used to describe a direct or indirect injury to the head/neck caused by a sudden, forceful head/neck movement followed by subsequent forceful head/neck movements in the opposite direction. These movements can occur due to flexion/extension, side-bending and rotation. The coup usually produces injury on the same side of the impact. The contrecoup injury is a result of the head continuing to move after a sudden stop in the body's motion, usually producing an injury on the opposite side.

Diagnosis

An act reserved for physicians to identify an injury or disease, based on testing, and identifying signs and symptoms.

Diffuse axonal injury

Type of concussion where there is widespread disruption of neurological function caused by the shearing of neuronal connections [9, 11, 12].

Focal

Injury in which the resulting tissue damage is more localized and potentially life threatening [9, 11, 12].

Glasgow Coma Scale (GCS)

A tool used to assess and quantify a person's level of consciousness/responsiveness (Eyes + Verbal + Motor 4+5+6=15) [21].

Mechanism of Injury (MOI)

The events leading up to the injury, which caused the injury to occur.

Mild traumatic brain injury (mTBI)

An mTBI is an acute brain injury resulting from direct or indirect mechanical energy to the head from external physical forces. Operational criteria for clinical identification include:

- One or more of the following: confusion or disorientation, loss of consciousness for 30 minutes or less, post-traumatic amnesia for less than 24 hours and/or other transient neurological abnormalities such as focal signs, seizures, and intracranial lesions not requiring surgery [22].
- Glasgow Coma Scale score of 13–15 after 30 minutes post-injury or later upon presentation for healthcare. These manifestations of mTBI must not be due to drugs, alcohol, medications, other injuries or treatment for other injuries (e.g. systemic injuries, facial injuries or intubation), caused by other problems (e.g. psychological trauma, language barrier or coexisting medical conditions) or caused by a penetrating craniocerebral injury [22].

Post-Concussion Symptom Referral
A referral to a physician experienced in concussion managment (if available) if symptoms last longer than 10 days [13, 15].

Rehabilitation
The process of healing from an injury or disease through various forms of therapy.

Return-to-Learn (R2L)
Stepwise guidelines for a gradual return to participating in academic or work-related cognitive activities following a concussion [23].

Return-to-Play (RTP)
Stepwise guidelines for a gradual return to participating in a particular activity following a concussion [24].

Sport Concussion Assessment Tool 3 (SCAT3)
A concussion evaluation tool for individuals 13 years of age and older [20, 22].

Signs
Any objective evidence of disease or injury that is observed by the health practitioner that may or may not have been noticed by the patient.

Slow-to-recover
Any individual who has sustained a concussion and is still symptomatic for a minimum of four weeks (28 days) following the injury [25].

Symptoms
A characteristic of a disease or injury that is experienced and described by the patient to the health practitioner and is not visible to the health practitioner [20].

Traumatic brain injury (TBI)
A TBI is a non-degenerative non-congenital insult to the brain, resulting from direct or indirect mechanical energy to the head from external physical forces causing trauma and possibly leading to temporary or permanent impairment of cognitive, physical and psychosocial functions, with an associated altered state of consciousness. It includes the overall spectrum of all severities, from mild traumatic brain injury (concussion) to severe brain trauma [13, 15, 20, 22].

1. CONCUSSION ASSESSMENT GUIDELINES

1.1. ON-FIELD ASSESSMENT

1.1.1. Suggested Evaluation Tools

- SCAT3: 13 years old and up [20] – Appendix 1
- Child SCAT3: 5-12 years old [19] – Appendix 2
- Cranial Nerve Assessment [26, 27] – Appendix 4
- Glasgow Coma Scale (GCS) [21] – Appendix 5

1.1.2. Assessment Procedure

Use the SCAT3 as part of the screening tools to help determine "Recognize & Remove" concussion signs. Parts 1 and 2 of SCAT 3 are performed on-field.

1. Mechanism of injury (MOI)

   Determining the MOI is important for establishing what potential structures may be involved. The two most common types of MOI are caused by a direct hit to anywhere, or a whiplash-type motion. Either type of MOI can cause injury as well as a concussion, and there is no evidence indicating which MOI leads to different or more severe symptoms.

2. Spinal precautions in effect

   Manually stabilize head and neck

3. Perform Primary Survey to identify red flags for possible ambulance transportation

   Primary Survey

   a) Determine level of consciousness, airway, breathing and circulation
   b) Assess: UABCd / Treat: UCABd [28] (U includes non-scored GCS)

4. Non-scored GCS is performed during determination of level of consciousness in the primary survey: (GCS - Appendix 5)

a) Evaluate level of consciousness:

i) ASK: "What happened?"
Do they open their eyes (E) if they were closed?
Do they respond verbally (V) or show a motor response (M)?

ii) ASK: "Open your eyes!"
Do they open their eyes (E) or show a motor response (M)?

iii) ASK: "Where does it hurt?"
Do they respond verbally (V)?

iv) ASK: "Squeeze my finger!" (in a 2-step task of reach and squeeze)
Do they reach for the finger and squeeze (M)?

Note: If no response to questions i and ii above, go directly to pain stimulation.

b) Invoke pain:

PINCH TRICEPS and/or NAIL BED (lunula)
Do they open their eyes (E)?
Do they moan (V)?
Do they localize pain (M)?
Do they withdraw from pain (M)?
Do they display decorticate/decerebrate posturing (M)?

Note: Do not induce pain above clavicles in cases of suspected spinal. If no response at all: Glasgow = 3/15

5. Initiate Emergency Response Plan (ERP) as required [29]
6. Deal with any first aid and emergency care issues
7. Determine chief complaint and MOI
8. Perform Secondary Survey to rule out life/limb threatening injuries as per MOI if known.

Secondary Survey includes:

i) SAMPLE, full-body scan, vitals, GCS baseline score

ii) Determine if concussion signs are present:
Somatic, cognitive or emotional changes/impairment?
Example: behavioural changes, cognitive impairment, motor impairment, loss of consciousness (LOC), balance/motor coordination issues, disorientation, confusion, memory loss, blank vacant stare, visible facial injury

iii) On-field cranial nerves assessment: [26, 27] – Appendix 4

II. Optic - visual acuity

III. Oculomotor - pupil reaction

IV. Trochlear - eye movements

VII. Facial - smile, grimace

NOTE: *If red flags are present during primary/secondary survey, the individual should undergo Spinal Motion Restriction (SMR) and be transported immediately to the hospital via ambulance [30]. The International Liaison Committee on Resuscitation (2015) [28] advocates the use of SMR over spinal immobilization. If serious injuries are present without red flags during the primary/secondary survey, activate the ERP [28, 29].*

RED FLAGS INCLUDE:

- Loss of consciousness
- Deterioration of neurological function
- Decreasing level of consciousness
- Decrease or irregularity of ventilation rate
- Decrease or irregularity of pulse
- Unequal, dilated or non reactive pupils
- Signs and symptoms associated with spine and/or skull fracture or bleeding
- Mental status changes; lethargy, difficulty staying awake, confusion, agitation, etc.
- Seizure activity, initial lucid (asymptomatic) interval, then presentation of rapidly progressing symptoms

NOTE: *If the athlete is conscious, alert, and has no red flags indicating serious head injury or the need for spinal motion restriction, the athlete can make his or her own way off the field, and the concussion assessment may continue on the sideline.*

1.2. SIDELINE ASSESSMENT

For field care situations, the evaluation may be continued on the sideline, where the athlete is constantly monitored and reassessed (serial assessment) for changes every 5 minutes. Quiet rooms are ideal, but not always realistic.

IMPORTANT
The athlete should not be left alone during the initial 4 hours post injury.

The initial sideline assessment always focuses on trying to rule out a more serious injury in a timely manner, in the midst of competition. Once the GCS is scored, signs and symptoms of the concussion should be recorded. After monitoring and a rest period of at least 10-15 minutes has passed, further SCAT3 testing is carried out, including an analysis of symptom severity and neurocognitive and physical evaluations.

IMPORTANT
The rest period is necessary to avoid influence of exertion or fatigue [19, 20].

Thereafter, sideline assessments are similar to clinic visits, in that it is safe to move athletes in order to complete a more thorough evaluation or for treatment from a CAT(C) during or after a game to seek help for a head injury.

1.2.1. Evaluation Tools for Sideline Assessment

- SCAT3: 13 years old and over [20] – Appendix 1
- Child SCAT3: 5-12 years old [19] – Appendix 2
- Graded Symptom Checklist (GSC) [20] – Appendix 3
- Cranial Nerve Assessment [26, 27] – Appendix 4
- Glasgow Coma Scale (GCS) [21] – Appendix 5

Note: repeat GCS every 5 minutes for the first 15 minutes post-trauma if the score is 13-14/15.

- Maddocks Score (if not performed on-field)
- Background and concussion history

Note: The following are to be done at resting state (at least 10-15 minutes post exercise):

- Symptom evaluation
- Cognitive & physical evaluation
- Neck examination
- Balance examination
- Coordination examination
- Standardized Assessment of Concussion (SAC) - Delayed Recall

Note: Regardless of the assessment tool chosen, the following criteria should be included:

- History and observation (note MOI)
- Orientation (time – space) and memory
- Level of consciousness
- Signs and symptoms (see Table 1)
- Cognitive function
- Cranial nerve function (see Appendix 4)
- Balance
- Coordination

1.2.2. Evaluation Procedure

Document SCAT3 findings at the time of injury and compare with baseline if available. Complete GSC at time of injury, 2-3 hours, 24-hour, 48-hour, and 72-hour post-injury.

IMPORTANT

Provide copies of both SCAT3 and GSC to the responsible adult doing the home monitoring and for referral visits.

If EMS is called, transfer of care should involve giving the paramedics the original copy of any intervention notes to document the athlete's condition. Having a means to copy the notes for

later reference is useful and may be done by taking a picture with a smart phone.
In all cases, it is highly recommended that athletes with suspected head injury seek medical attention. **An athlete with a suspected concussion can never RTP same day and must follow currently accepted age-specific RTP guidelines.**

1.2.3. Signs and Symptoms of a Concussion

NOTE: *A concussion should be suspected in the presence of any one, or more, of the following symptoms after any form of head injury [31].*

Table 1 - Most common symptoms of mTBI according to category*

References	Cognitive	Somatic	Emotional	Sleep disturbances
Marshall, 2012 [32] Hanson et al., 2014 [33] Hynes, 2006 [34] Scorza et al., 2012 [35] McCrory et al., 2013 [4]	• Confusion • Retrograde amnesia • Anterograde amnesia • Loss of consciousness • Disorientation • Feeling foggy (in a fog) • Vacant stare • Inability to focus • Delayed verbal responses • Incoherent speech (slurred) • Excessive drowsiness	• Headache • Dizziness • Balance disruption • Nausea • Vomiting • Visual disturbances • Photophobia	• Emotional lability • Irritablity • Fatigue • Anxiety • Sadness	• Trouble falling asleep • Decreased sleep • Increased sleep

Hanson et al., 2014 [33]	• Feeling slowed down • Difficulty concentrating • Difficulty remembering • Forgetful of recent information • Confused about recent events • Answers questions slowly • Repeats questions	• Balance problems • Visual problems • Fatigue • Sensitivity to light • Sensitivity to noise • Dazed • Stunned	• Nervousness	• Drowsiness
Hynes, 2006 [34]	• Dysphagia • Seeing Stars	• Deafness • Ringing in the ears • Temporomandibular dysfunction		
Scorza et al., 2012 [35]	• Disorientation • Stunned • Vacant stare	• Blurred vision • Convulsions • Light-Headedness • Numbness • Tingling • Tinnitus	• Clinginess • Depression • Personality changes	

* *Michael Morin, Pierre Langevin and Philippe Fait, "Cervical Spine Involvement in Mild Traumatic Brain Injury: A Review," Journal of Sports Medicine, vol. 2016, Article ID 1590161, 20 pages, 2016. doi:10.1155/2016/1590161.*

1.3. CLINICAL ASSESSMENT

Regardless of the nature and complexity of the signs and symptoms associated with the head injury, CAT(C)s should always approach this condition in the same clinical manner that they would to address any other musculoskeletal injury.

Clinical concussion assessments should include secondary, complimentary, subjective and objective history taking questions. The physical examination should include concussion specific tests to recognize certain consequences of concussions and provide appropriate decision-making guidelines for the treatment and/or referral of the concussed individual to the appropriate health care professional.

1.3.1. Components of a Complete Clinical Assessment

1.3.1.1. Balance and Posture Assessment

NOTE: *The clinical assessment of balance and postural control is considered a reliable and valid assessment tool for concussed individuals [4, 36, 37].*

a) Balance Error Scoring System (BESS Balance Test)

- Procedure: Use the modified BESS Balance Test
  - Double leg stance (for 20 seconds)
  - Single leg stance (for 20 seconds)
  - Tandem stance (for 20 seconds)

Note: always use the same surface when testing and retesting

b) Time Tandem Gait

- Procedure: Walk in heel-to-toe gait on a 3m long line (along a 38mm-wide tape) then turn 180° and return to the starting position using the same gait.
  - Four trials are completed and the best time is retained (athletes should complete the test in under 14 seconds)

1.3.1.2. Vestibular/Vision Assessment

a) Smooth Pursuits Test:

- Tests the ability to follow objects smoothly without effort/strain or nystagmus

b) Convergence Test:

- Tests the ability to follow converging objects without effort/strain or double vision [38, 39]

1.3.1.3. Post-Concussion Symptoms Assessment:

Note: Specific age-appropriate post-concussion symptom questionnaires are to be used for children and adults.

Adults over 18 years old

a) Graded Symptom Checklist (GSC) [20] – Appendix 3
b) Rivermead – [40] – Appendix 6

Children aged 5-18 years old

a) Post-Concussion Symptom Inventory (PCSI)
    - o PCSI Child (PCSI-C) Ages 5-12 [41] – Appendix 7
    - o PCSI Ages 13-18 (PCSI) [41] - Appendix 7
    - o PCSI Parent of child ages 5-18 (PCSI-P) [41] - Appendix 7

1.3.1.4. Physical Evaluation of the Cervical Spine:

Assessment of the cervical spine should be performed as per the CATA scope of practice guidelines for cervical spine evaluations [26].

1.3.1.5. SCAT3 / Child SCAT3

SCAT3 – For individuals 13 and older [20]– Appendix 1
or
Child SCAT3 – For children 5-12 years old [19]– Appendix 2

IMPORTANT

With individuals aged 5-12 years old, cognitive rest has been identified as an important factor in the concussion recovery process [19].

1.3.2. Adjunct Testing

1.3.2.1. Physician Directed Tests

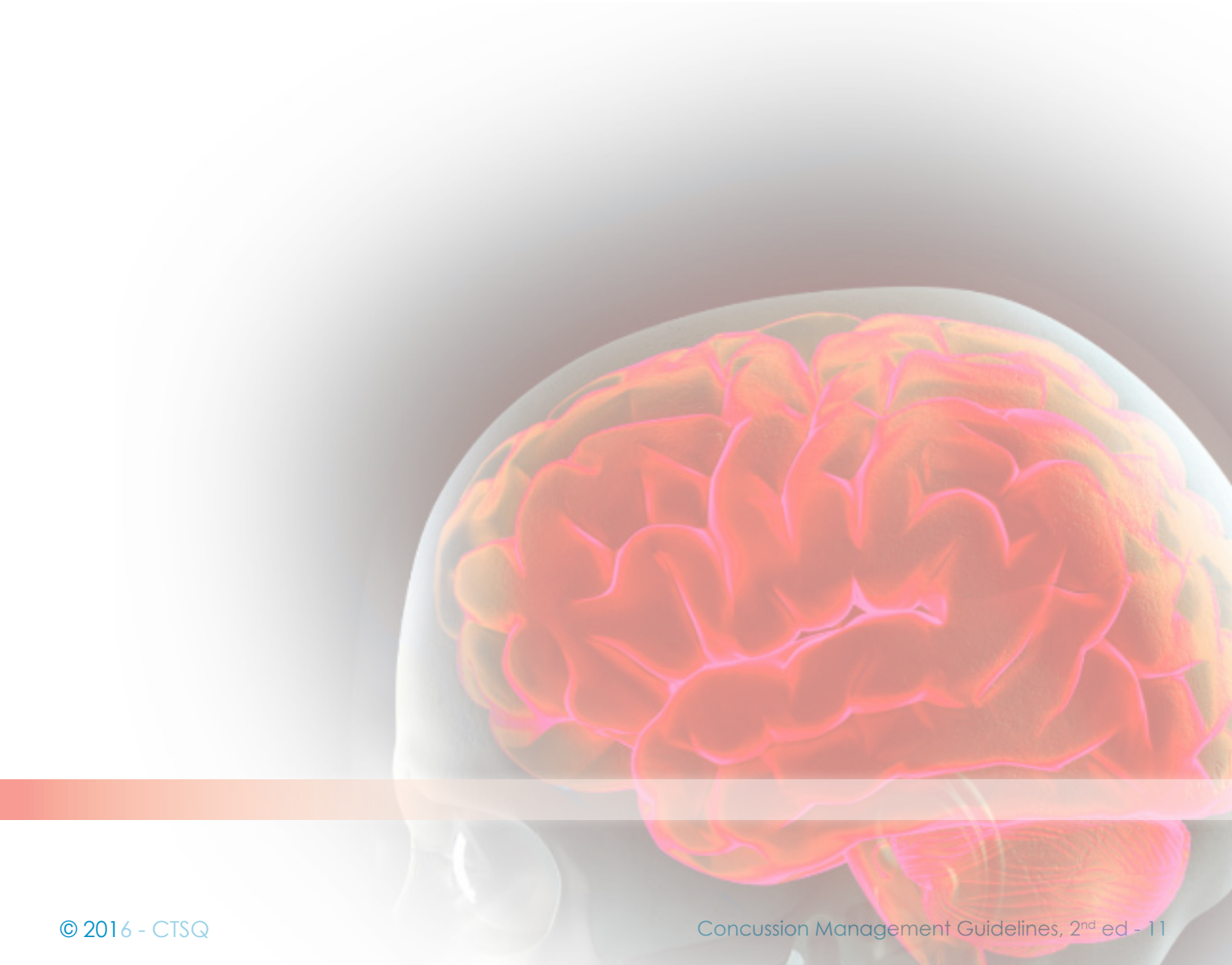
The following tests are physicians directed. However it is still important that the CAT(C)s consider them as part of, or in addition to, their assessment:

NOTE: *Computed Axial Tomography (CAT) and conventional Magnetic Resonance Imaging (MRI) usually fail to detect evidence of structural brain abnormalities in concussions. However, reviews of research in the biomechanical modelling of mTBI conclude that mTBI leads to functional neuronal disruption, and at times, structural damage [42-44].*

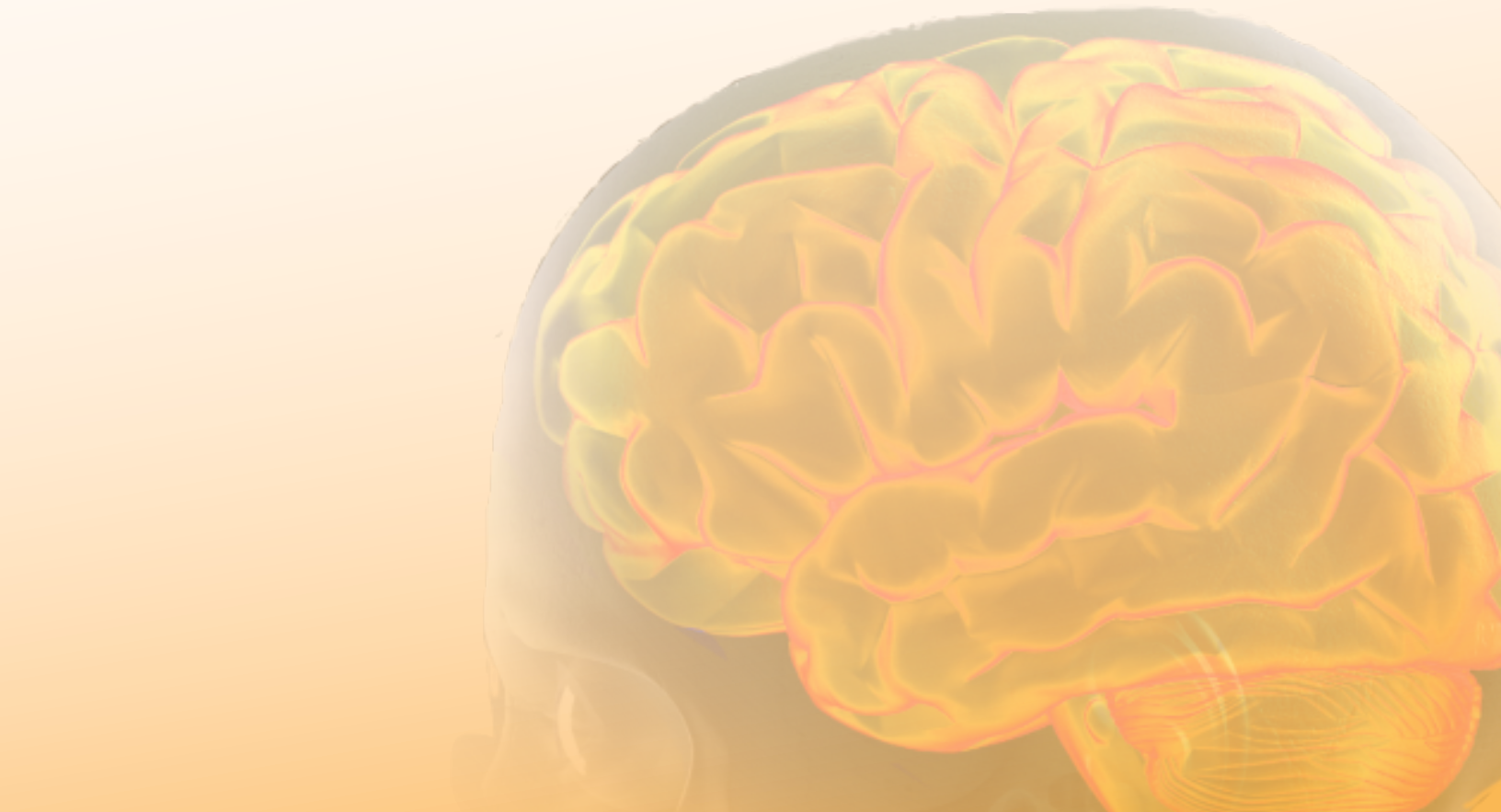
1.3.2.2. Neuropsychologist Directed Assessment

A Neuropsychological Assessment (NP) by a neuropsychologist allows the CAT(C) to assist in the clinical decision-making process for the overall management of the concussed individual, in addition to other management tools. Some NP testing tools can be used for both child and adult age populations.

NOTE: *Due to the continual cognitive development of children during the maturation period, NP testing has been shown not to be effective as a baseline test or comparison model.*



2. CONCUSSION TREATMENT GUIDELINES



2.1. ON-FIELD AND SIDELINE TREATMENT

Concussions are one of the most difficult injuries to treat on-field or on the sidelines. Each individual may respond differently to head trauma and it is difficult to find one protocol that applies to every case. Certified athletic therapists CAT(C)s must make informed decisions regarding concussion management using the tools available to them, and treat concussions with the utmost care.

Sometimes the presence of concussion signs makes it difficult to determine whether a more serious injury exists or will develop. The range of potential differentials may include, but not limited to, an epidural bleed, subdural hematoma, intracranial contusion, and the rare condition Second Impact Syndrome (SIS).

Recent studies are giving more credence to a more conservative approach with concussion [45, 46]. There is some emerging research evidence that vascular injuries can occur even in mild traumatic brain injuries [47, 48].

2.1.1. Evaluation Tools

a. SCAT3: 13 years old and up [20] – Appendix 1
b. Graded Symptom Checklist (GSC) [20] – Age over 18 – Appendix 3
c. Child SCAT3: 5-12 years old [19] – Appendix 2
d. Post-Concussion Symptom Inventory
    - PCSI Child (PCSI-C) Ages 5-12 [41] – Appendix 7
    - PCSI Ages 13-18 (PCSI) [41] – Appendix 7
    - PCSI Parent of child ages 5-18 (PCSI-P) [41] – Appendix 7

2.1.2. On-Field Management

• If a concussion is suspected, the athlete should be removed from play.
• Determine if there are indications for emergency management protocols (c-spine, seizures, etc.). If there are any doubts about urgency of symptoms, Emergency Response Plan (ERP) [29, 49] should be initiated, the athlete should be provided necessary care,

closely monitored, and urgently referred to an emergency room (ER) physician and medical centre by ambulance.

• Use the age-appropriate SCAT3 [20] or Child-SCAT3 (5-12 years old) [19] tool to determine the possible presence of a concussion [50].

• If the athlete is not deemed to have a medical emergency or contraindications to transport off the field, the athlete may be moved to the sideline for further assessment [50].

2.2. SIDELINE MANAGEMENT

A detailed assessment may be carried out on the sideline to determine the extent of concussion.

• Appropriate care is provided as per presentation of signs and symptoms.

• The athlete is continuously monitored, especially during the first 30 minutes, until a plan of action is made.

• A referral plan is made [51]. (see Referrals Following a Concussion - section 2.4)

• If on the sideline there is a presentation of urgent / evolving red flags, the athlete should be immediately referred to an emergency room for urgent care.

IMPORTANT

The athlete should not be left alone during the initial 4 hours post injury.

NOTE: *Documentation of acute concussion signs and any progressions will help with the return to play (RTP), especially if there is no baseline available. Comparison to a baseline may be used when available to detect subtle signs, which may be missed, as well as consulting with a close member of the individual's support team in order to detect subtle changes in personality or behaviour.*

2.3. GLOBAL MANAGEMENT

Every individual who has received a direct or indirect head trauma should be monitored from the time of injury to the point where signs and symptoms have completely resolved.

All individuals with any signs or symptoms of an acute concussion are removed from play for a minimum of 1 week for an adult [4] or 2 weeks for a child, and must follow acceptable age-appropriate RTP guidelines [24].

IMPORTANT

Generally, a graduated return to play (RTP) protocol should only proceed once an adult has been asymptomatic for at least 24 hours. A child and young adult will need a longer period of rest, which ranges between 2 to 7 days before the graduated RTP protocol commences [52]. Every case is different and is affected by co-morbidities and history.

***NOTE**: The determination of the safest initial rest period duration for individuals ≤ 25 years of age remains one of the biggest challenges due to the lack of consensus. Thus, the recommendation from the CTSQ is to err on the side of caution and encourage a longer rest period for this age group.*

Note: The availability of baseline values is an important tool in the assessment and treatment of concussions. Every CAT(C) should strive, whenever possible, to have a database of baselines available for individuals under their care. Some symptoms can be present pre-morbidly or at baseline, thus it would be valuable to note changes from their usual presentation.

IMPORTANT

The parent or legal guardian should fill out the Post-Concussion Symptom Inventory (PCSI) form for parents and help the athlete fill out the age appropriate PCSI form for children to allow for proper monitoring of the signs and symptoms of the concussion. This will also allow for adequate documentation of the athlete's progress throughout the rehabilitation and RTP. See Appendix 7 for instructions on how to fill out and use the PCSI [41].

2.4. REFERRALS FOLLOWING A CONCUSSION

All concussions should ideally be referred to a physician, who has experience managing sport-related head injuries [15]. As this is not presently the reality in most sports environments, a multi-disciplinary approach should be implemented [13, 15].

In some cases of concussions, symptoms may take up to 5 days to develop [15] and/or evolve. Therefore, CAT(C)s should remain in touch with the injured athlete and/or individual monitoring the athlete, especially during the first 48-72 hours. It is essential to watch for any possible red flags to ensure that appropriate follow-up is made. See section 2.4.1. for red flags [15].

A referral to a physician (versed in concussion management) is required for all concussions with symptoms lasting more than 10 days [14, 15]. Further examination may be required such as possible diagnostic testing, medication, etc. As per the CCC, physician visits just for medical forms / letters that must be completed for school should not be necessary in an organized system [13].

Certified athletic therapists are health care professionals ideally situated and trained to make critical referral decisions in the field of play and sidelines in the province of Quebec [14].

There are generally three categories of referrals needed following a concussion:

- **Urgent Care** (red flags present/symptom evolution)
  Emergency room visit
- **Follow-Up Care** (symptomatic, but clinically stable)
  CAT(C)/Concussion clinic
- **Post-Concussion Symptoms** (symptoms > 10 days)
  Physician with training in concussion management

2.4.1. Urgent Care Referral

Urgent cases with red flags present require immediate referral to an ER physician by ambulance. The individual would be transported urgently to the nearest appropriate hospital.

It is prudent to be over-cautious, but there are realities of the pre-hospital care system that should be considered. The current protocols for the Services Préhospitaliers d'Urgences du Québec (Quebec Emergency Medical Services) [51] indicate the use of a cervical collar and full spinal motion restriction [28] (including vacuum mattress) for ANY head injury. The use of urgent referral should be validated before use. However, if there is any doubt, initiate ERP including EMS/911 ambulance dispatch sooner than later.

RED FLAGS

The following are typical red flags indicating the need for a referral to urgent care:

- Unconsciousness / prolonged loss of consciousness
- Altered or decreasing level of consciousness
- Decreased neurological function
- Decreased or irregularity in pulse
- Unequal/dilated/non reactive pupils
- Mental status changes such as lethargy, non-arousal, confusion, agitation
- Seizure activity, lucid interval
- Convulsions
- Repeated vomiting
- Severe or increasing headache
- Visual changes
- Slurred speech
- Any signs/symptoms of associated injuries such as suspected spinal, skull fracture or cranial bleeding.

IMPORTANT

When Emergency Medical Services (EMS) is called, transfer of care should involve giving the paramedics a copy of any intervention notes to document the individual's condition. Having a means to copy the notes for later reference is useful and may be done by taking a picture with a smart phone.

2.4.2. Follow-up Care Referral

Health care professional with training in concussion assessment and management can make a referral for follow-up care when an individual who is clinically stable presents with symptoms (no red flags).

The CAT(C) would not leave the individual for at least 30 minutes (ideally 4-6 hours) to allow adequate time for assessment and observation. The clinically stable individual should be monitored by either a CAT(C) or delegated to a responsible adult/guardian who would be given an instructional "head sheet". The person would then be closely watched over the next 4-6 hours (up to 48 hours) for any deterioration/red flags. A follow-up appointment with the CAT(C) or a concussion clinic should be made in the next few days. If there is a deterioration in symptoms before the follow-up, it is recommended that the individual be taken to the ER, either by ambulance or car depending on urgency of the situation.

IMPORTANT

The individual should ideally be monitored for the next 4 hours before a referral decision is made. The presence or absence of a progression of symptoms will warrant urgent care referral or follow-up care referral.

It is important to provide the individual monitoring the injured athlete a completed copy of the SCAT3, including concussion injury advice. A copy of the GSC form (with initial findings) for home monitoring should be provided.

2.4.3. Post-Concussion Symptom Referral

A referral to a physician experienced in concussion management (if available) is required when post-concussion symptoms last more than 10 days [15].

Although 80-90% of concussion symptoms in adults recede within 7-10 days [4], others may have underlying circumstances that affect their recovery. A physician experienced in concussion management is best suited to address and identify possible issues and complications [13].

Multiple concussions, co-morbidities, and important symptoms are some of the factors that need further investigation and possible specialist referrals.

Concussion management is best provided by an interdisciplinary team using evidence-based methods.

2.5. ADDITIONAL INFORMATION

2.5.1. Return to Hospital/Worsening Symptoms

It should be understood that during an initial hospital ER visit, a CT scan may not always be done. If symptoms worsen or if any red flags appear (usually within first 24-48 hours), the individual should return to the same hospital [30]. Physician discretion would dictate whether imaging would be of benefit in this situation. CT scans are used sparingly and only in urgent situations, especially in the pediatric population.

Although the injury may initially seem mild and involve no need for transportation to the hospital, evolving symptoms should be monitored closely, as they may worsen with time.

Specific neurological indicators that show need for referral to emergency room include: [53]

- Loss of consciousness
- New, worsening or changing headache [30, 53]
- Severe headache
- Persistent or worsening neck pain
- Repeated vomiting (adult >1 time, under 13 years old >3 times) [53, 54]
- Dizziness
- Double vision
- Difficulty recognizing people/ places
- Weakness/numbness in limbs
- Increased confusion or irritability
- Slurred speech
- Seizure
- Difficulty walking, difficulty with balance
- Excessive drowsiness
- Personality changes
- Any symptom that concerns the individual or person caring for the individual

2.5.2. Home Care and Monitoring

Careful monitoring during the first 24-72 hours is critical to identify any evolving issues.

If the person does not require an urgent care referral (see section 2.4.1.) the CAT(C) should provide a structured plan for home care and monitoring until seen for follow-up care. This includes providing a copy of initial GSC and instructions. To ensure adequate home monitoring, GSC

should be completed at the time of injury, 2-3 hours, 24 hours, 48 hours, and 72 hours post injury. The age-appropriate post concussion symptom scale forms, provided by the CAT(C) should be completed by the individual and / or the responsible monitoring adult during the home care and monitoring time frames.

Any change or deterioration in cognitive or physical state or an increase in symptom severity requires an urgent care physician evaluation.

The following is a list of criteria for **urgent care** physician evaluation [55].

- Loss of consciousness
- New, worsening or changing headache [30, 53]
- Severe headache
- Persistent or worsening neck pain
- Repeated vomiting (adult >1 time, less than 13 years old >3 times) [53, 54]
- Dizziness
- Double vision
- Difficulty recognizing people/ places
- Weakness/numbness in limbs
- Increased confusion or irritability
- Slurred speech
- Seizure
- Difficulty walking, difficulty with balance
- Excessive drowsiness
- Personality changes
- Any symptom that concerns the individual or person caring for the individual

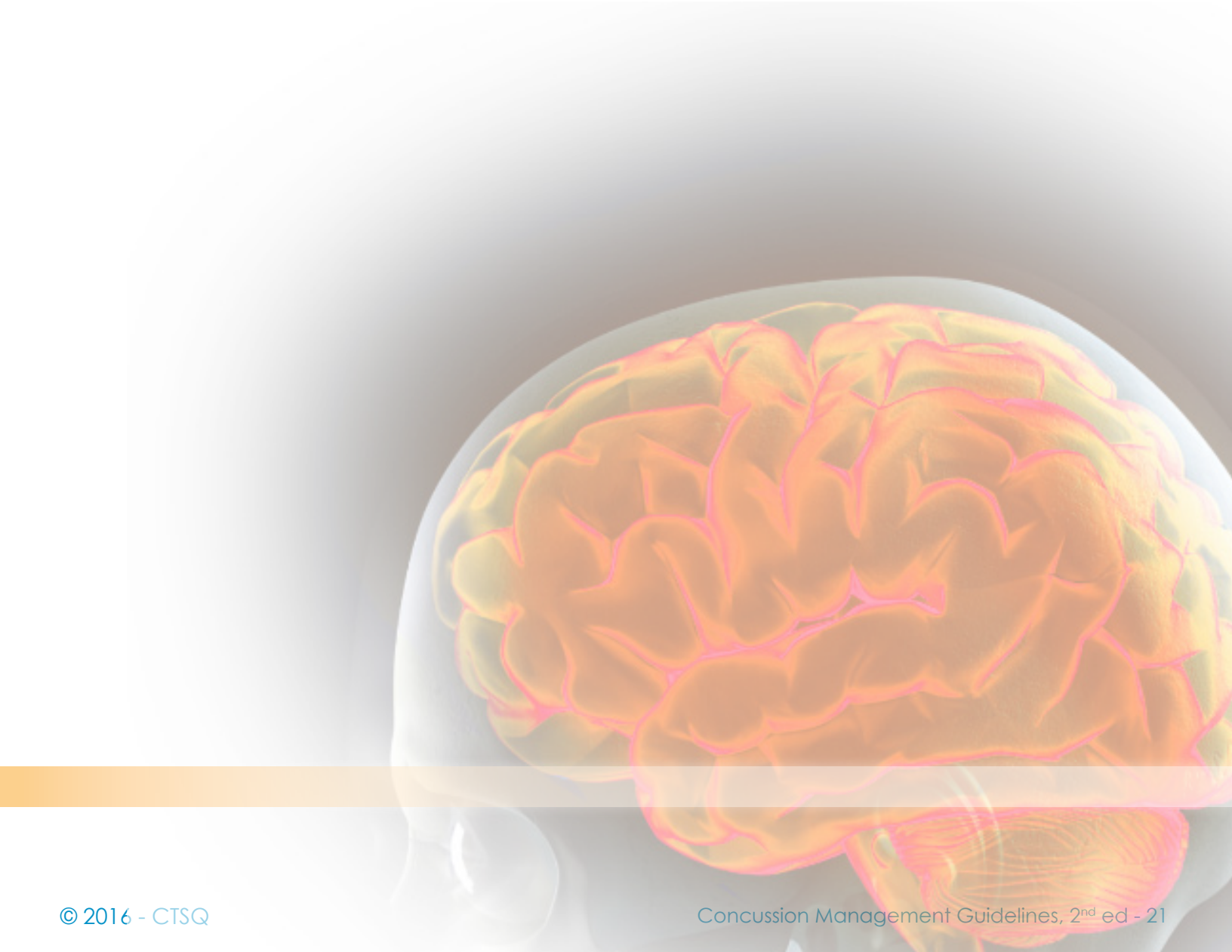
IMPORTANT

As cognitive rest is important, the practice of keeping awake or waking up the individual the first night is no longer advised [46, 56-58]. This practice may in fact disrupt sleep patterns and increase symptoms the next day due to combined effects of injury and sleep deprivation. Sleep is restorative and the individual should be allowed to sleep to rest [6].

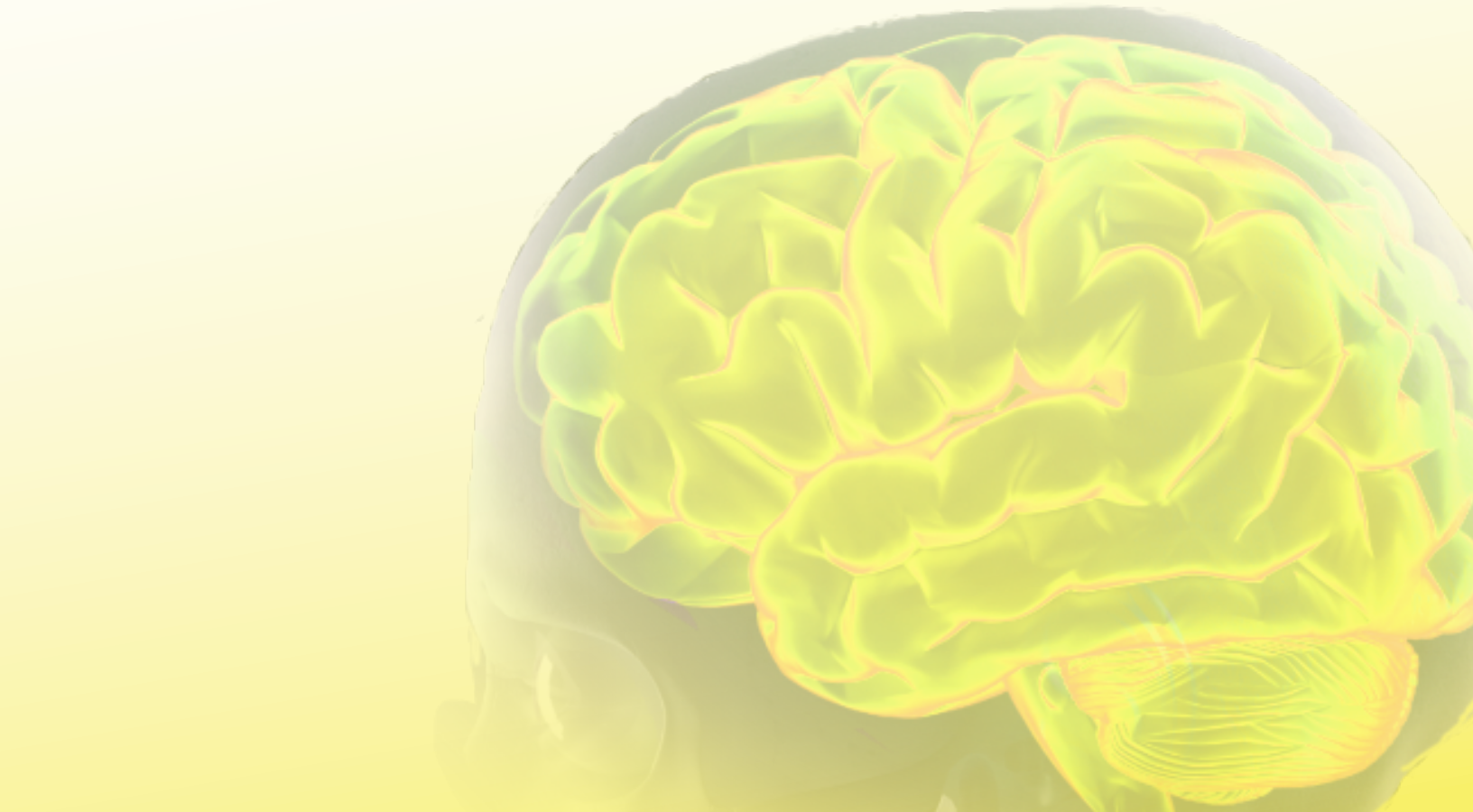
However, the parent or the designated guardian should check in on the individual after they are asleep. Monitoring the first night may involve quickly observing the person while they are sleeping

to take note of abnormal breathing patterns, excessive snoring, posturing, or distress. This can be done 2 and 4 hours after the individual has gone to bed. At this point the parent/guardian can also note if the individual is not sleeping. If there is any doubt regarding their condition, he/she should be woken up to ensure that they can be awakened, that there is no amnesia or any increase in symptoms requiring an urgent intervention.

General rules in management usually involve waking the individual up only if they had experienced a LOC, prolonged period of amnesia, or if they are still experiencing significant symptoms [11].



3. CLINICAL TREATMENT



3.1. PROTOCOLS

Clinical assessment should reveal treatment goals, and treatments should include the following components of rehabilitation programs and remain interdisciplinary wherever possible [59]:

- Soft tissue mobilization/Manual therapy:
    - To reduce tension in the musculoskeletal system that may be contributing to prolonged concussion symptoms (cervicogenic headache, dizziness, tinnitus, nausea, poor balance, auditory complaints, ear/eye pain) [4, 38, 60-62].
- Cervical spine stability exercises [63]
- Deep cervical flexor activation exercises [4, 60, 61]
- Muscle flexibility exercises [4, 60, 61]
- Postural balance exercises [38, 60, 61, 64]
- Core stability exercises [4, 60, 61]
- Vestibular/Vision exercises [38, 60, 62]
- Active rehabilitation protocols [16, 60, 65-69]

Furthermore, when providing concussion rehabilitation guidelines, the following should be included:

- Return to Learn guidelines [70]
- Return to Play guidelines [4, 19, 20, 60, 61, 71]
- Sleep-hygiene education [60, 61]
- Pharmacological management (physician directed) [4, 60, 61]
- Psychological management (physician or neuropsychologist directed) [4, 38, 60, 61]

IMPORTANT

As stated earlier, any individual who is still symptomatic and considered slow to recover (refer to glossary), should be referred and re-evaluated by a physician. The person should also consult a health care professional who is an expert in the management of concussions. An interdisciplinary approach is recommended [59].

3.1.1. Importance of Awareness and Education

Note: Awareness of concussions and its effects are a critical component of clinical concussion rehabilitation.

Adult Population:

- Occupational concussion management education [38, 61]
- Sport/coach concussion management education [61]

Child Population:

- Parent/family concussion management education [19, 61]
- School/teacher concussion management education [19, 61]
- Sport/coach concussion management education [19, 61]

3.2. Special Considerations

3.2.1. Post-Traumatic Headache

A post-traumatic headache is the most common symptom of sport-related concussion. This is one of the symptoms that make it difficult to determine urgency of referral. The International Headache Society has a classification category for secondary headaches associated with head and neck trauma.

The four most common classifications of post-traumatic headaches are: [72]

I. Tension type (including the cervicogenic component)
II. Migraine (including classic, concussion, vestibular, etc.)
III. Combined migraine and tension-type
IV. Cognitive fatigue

3.2.2. Medications

It is recommended that only physicians with experience in concussion management prescribe

medications to the patient. As long as the individual is on medication, any RTP should be considered with caution, since medications may mask signs of evolving issues.

3.2.3. Second Impact Syndrome (SIS)

Second Impact Syndrome (SIS) is a rare occurrence [73], but can lead to catastrophic results or a further delay in recovery. While there is no doubt that brain swelling may occur in response to a head injury, the issue of whether recurrent concussive injury is a risk factor for this condition is disputed. In the SIS literature, McCrory and Berkovic [74] found 12 reports that clearly describe sport-related catastrophic brain injury associated with cerebral swelling. SIS can occur when an individual is subjected to a second direct or indirect head injury while still experiencing symptoms from a prior injury. This seems to occur until the late teens to early twenties and within 7 days of the initial injury [75]. Care should be taken not to receive another insult to the brain while still experiencing signs of a concussion [75-78].

3.2.4. Vomiting

Vomiting after a head injury may have different implications depending on the specific situation. For children (<13 years old), persistent vomiting (>3 times) is a more reliable indicator of a head trauma [79]. For adults, more than one episode of vomiting would be cause for urgent referral in the absence of migraine / motion sickness history. Some people with familial and / or personal history of migraines or motion sickness may be more prone to vomiting after a head injury. In these cases, vomiting may not be indicative of head injury severity. Persistent vomiting may be more of an indicator than a single occurrence of vomiting. Approximately 10-15% of children vomit after a mild traumatic brain injury [54, 79].

3.2.5. Summary Statement Regarding Physician Referrals

An individual with a suspected concussion can never RTP the same day and must follow currently accepted age-specific RTP guidelines.

Any individual who is still symptomatic and considered slow-to-recover (refer to the glossary) should be referred and re-evaluated by a physician. The individual should also consult a health care professional who is an expert in the management of concussions. An interdisciplinary approach is recommended [59, 80, 81]. Refer to Clinical Treatment, section 3.1. Protocols.

4. COMMENTS REGARDING PRE-SEASON SCREENING AND POST-INJURY EVALUATION

To date there is no agreement on the best head injury screening tool due to the many factors that are involved such as; means of administration, cost, type of sport and population. The following is a list of widely used, accepted and scientifically validated assessment tools to be used as reference.

4.1. COMPUTERIZED NEUROPSYCHOLOGICAL ASSESSMENT (NP) TESTING

- Currently demonstrates variable test-retest reliability;
- Greater reliability when testing visual motor speed and reaction times;
- Online version had fewer invalid baseline results compared to the desktop version [82]

4.2. SCAT3

- There is no current scientific validation research underway on the SCAT3 and Child-SCAT3. However, it was still recommended in the Zurich 2012 Consensus Statement [4].

4.3. REVISED RIVERMEAD POST-CONCUSSION SYMPTOMS SCALE

- Only scale that is empirically driven
- Developed prior to clinical use
- A modified version of the original RPQ6 that separates the scoring into two parts – RPQ-3 and RPQ-13. This modification demonstrates that the RPQ can be used clinically as a subjective test-retest assessment tool for concussion symptoms [71].

4.4. McGILL ACE POST-CONCUSSION SYMPTOMS SCALE

- Used clinically to provide evidence-based clinical protocol at the initial evaluation [83].

5. RETURN TO PLAY GUIDELINES

Return to Play (RTP) procedures after suffering a concussion follow a stepwise progressive approach, based on the symptoms experienced by athletes. RTP should be individualized, progressive, sport- and age-specific, and based on critical clinical judgment.

IMPORTANT

An athlete should never return to play or activities on the day of the injury, even if signs and symptoms have cleared.

In order to diminish, and eventually eliminate symptoms related to the concussion, physical and cognitive rest for a period varying between 24 hours for adults and up to 7 days for children and young adults is necessary [41, 52, 65, 84]. If symptoms persist, complete rest for more than 7 days should be approached with caution [54]. However, gradual exposure to physical and cognitive activities (if and only if tolerated) for short periods can help reduce symptoms before a stepwise RTP approach is adopted [4, 85]. In case of prolonged symptom duration (more than 10 days), individuals should be referred to a concussion specialist, to undergo appropriate diagnostic measures and/or adopt an appropriate rehabilitation regime [15].

IMPORTANT

It is crucial, however, that the stepwise approach to return to activities be attempted only once symptoms have fully cleared [4, 6].

RTP should be monitored on a daily basis by the CAT(C) to note the presence/absence of symptoms and suggest proper sport-specific exercises as well as the appropriate exercise intensity.

5.1. AGE CONSIDERATIONS

Advances in the field of brain development and maturation suggest that a child's brain continues to develop until early adulthood [17, 18]. Although total brain size reaches 95% of its maximum size

by the age of six, cortical and subcortical components change dramatically during childhood and adolescence [86]. Full brain maturation is said to be attained between 20 and 30 years of age, and the prefrontal cortex is one of the last regions to mature [18, 87]. For these reasons, RTP procedures have been separated according to two age groups; children and young adults under 25 years of age, and adults over 25 years of age.

> ***NOTE**: The Quebec health care system considers any individual under 18 years of age to be a child. RTP procedures for children include a rest period of several days [84]. The Montreal Children's Hospital recommends a 5-7 day rest period before undergoing RTP procedures [24]. Due to age considerations for brain maturation between the ages of 18 and 25, we urge caution when making clinical judgments on the number of days of rest to be prescribed. We strongly recommend prescribing longer rest periods as opposed to a shorter one.*

5.2. CHILDREN & YOUNG ADULTS (≤25 YEARS OLD)

5.2.1. Return to Learn (R2L)

To help with the RTP process and to allow proper cognitive rest, it is highly encouraged that children and young adults modify their school attendance and extracurricular activities in order to decrease symptoms [4, 88]. However, light physical activity such as walking is now recommended throughout the return to learn protocol [70], thus integrating both stepwise approaches. However, completion of the *R2L* protocol (meaning the child can tolerate a full day at school with a normal course load) is essential before children can progress through more advanced steps of *RTP* protocol [58, 70].

Best practices suggest that:

- The concussed individual or guardian should communicate with the school (school nurse, teacher and/or school mental health professional) and sign a release of information for school staff to coordinate with the CAT(C).

- The interdisciplinary team, consisting of the CAT(C) and the school administrators, work together with the student and family to decide on the level of academic adjustment needed, depending on the type and severity of the symptoms present and the times of the day when the student feels better or worse [89].

- The success of this approach resides in the ability of performing activities that are below the individual's symptom threshold, hence, encouraging activities that do not exacerbate symptoms. Tolerance to these activities should improve over the course

of recovery; it is important to understand that recovery rate can greatly vary between individuals [4, 15, 70, 89].

• Return to Learn is as important as returning to sports in children and young adults, since the main occupation of this age demographic constitutes attending school. Hence, *R2L* and *RTP* protocols go hand in hand when it comes to concussion recovery [70, 90].

• In the event that the individual is not attending school (e.g. summer vacation, school break, work) or is attending post-secondary education, the CAT(C) will need to adapt the *R2L* protocol to activities that are relevant to the individual's daily life and gradually incorporate cognitive activities that require more focus.

• Non-school-based sports programs may have less control and consideration for the R2L component of recovery. In this situation the CAT(C) needs to manage the successful achievement of symptom resolution and R2L. A signed form (parents and therapist) must be provided to coach/organization before RTP may be commenced. This serves both as an educational and legal assurance of RTP readiness [13].

Return to Learn

Adapted from DeMatteo [70,90]

Step 1

- Cognitive rest, no school
  - Limited reading, homework, computer, video games and/or smartphone activities.
  - Recommend time off school for a couple of days.

Step 2

IMPORTANT

Moving to Step 2 is only recommended when:
The child is symptom free
or
The child is symptomatic for more than 14 days.

Note: If the child is symptomatic for more than 14 days, they should be referred to a concussion specialist [15].

- Reintegrating cognitive activities (at least 2 days before returning to school)
    - o Gradually integrate cognitive activities, such as reading or screen time for short periods (e.g. 2 periods of 15 minutes)
    - o Integrate light physical activity, such as walking (Step 2 of *RTP*)

Step 3

- Back to school with modified attendance and curriculum
    - o Gradually return to school, with attendance that caters the individual's needs (e.g. 1 hour per day, half-days, 2 full-days, etc.)
    - o Gradually reintegrate homework in blocks of 15 minutes, to a maximum of 45 minutes per day.
    - o Control environmental factors, by avoiding busy areas of the school, offering a quiet area, etc.
    - o Non-school-related activities allowed for blocks of 15 minutes, up to one hour daily.

Step 4

- Normal routines (with modifications if necessary)
    - o Full day of school (can do less than 5 days if required)
    - o Full amount of homework
    - o Maximum of 1 test per week

Step 5

- Full activation/Full return
    - o Normal routine, attendance, tests and homework, as well as extracurricular activities (corresponds to Step 3 of *RTP*)

IMPORTANT

The Return to Learn approach consists of 5 stages that should be undertaken based on the presence of symptoms or lack thereof. If symptoms worsen during a given step, activities should be reduced until symptoms resolve.

Furthermore, throughout this process, there should be only limited physical activity, with an emphasis on Return to Learn before returning to physical activities.

Note: This stepwise approach provided as a guideline. It is imperative that CAT(C)s adapt it based on the presence of symptoms and patient-specific requirements using their expertise and critical judgment.

5.2.2. Return to Play**

If a particular step during the graded RTP protocol, including step 7 – full return to game, leads to the development of symptoms, the athlete should rest (cognitive and physical) until symptom-free for a minimum of 24 hours before starting the previous step over.

Return to Play Protocol

Step 1

- No activity
  - Requires that children and young adults be symptom free for several days (preferably 7) before they can move on to Step 2 [4, 84]

Step 2

- Light aerobic exercise, keeping intensity between 50-70% of maximum heart rate for 20 minutes [91]
  - Walking, swimming, stationary cycling

Note: It has been suggested in the literature that a rest period of 7 days may help decrease the severity of concussion-related symptoms and increase cognitive performance upon recovery [92]. For steps 2 to 7, a minimum of 24 hours between steps is required.

Step 3

- Light aerobic exercise (50-70% max heart rate for 20 minutes) and the addition of individual sport-specific drills
  - Specific drills should be incorporated into the workout and should not include any plyometrics or rotation/change-of-direction exercises, such as spins and jumps

***Adapted from the Montreal Children's Hospital Concussion Kit [7, 19]*

Step 4

- Sport-specific exercises
    - Sport-specific exercises can be done individually or with a teammate. Increase the duration of the exercises, and incorporate resistance training if desired. This should not include activities that involve impacts to the head. It is possible to incorporate plyometrics and rotation/change-of-direction exercises such as light jumps and spins.

Step 5

- No-contact training drills
    - Practice more complex drills, increase resistance training, increase level of skills (jumps, spins)

Step 6

- Full practice with body contact

Step 7

- Return to play
    - Normal game-play with body contact

5.3. ADULTS (>25 YEARS OLD)***

5.3.1. Return to Work

Although there are no current consensus or guidelines on a stepwise approach to return to work for adults following an mTBI, procedures that are similar to return to learn in children and young adults should be applied to help adults return to normal cognitive function. In fact, before returning to physical activities, adults should be able to return to work without experiencing symptoms. Therefore, it is highly recommended that adults follow a return to work regime that resembles the return to learn protocol for children, adolescents and young adults.

5.3.2. Return to Play

If a particular step in the graded RTP protocol causes about symptoms, athletes should rest (cognitive and physical) until symptom-free for a minimum of 24 hours before starting over at the previous step.

****Adapted from the Zurich Consensus Statement on Concussion in Sport. [7, 66]*

Return to Play Protocol

Step 1

- No activity
  - Physical and cognitive rest to mitigate symptoms

Note: Adults should be symptom free for at least 24 hours before they can move on to Step 2.

Step 2

- Light aerobic exercise, keeping intensity between 50-70% of maximum heart rate for 20 minutes [16, 91].
  - Walking, swimming, stationary cycling

Note: For steps 2 to 6, a minimum of 24 hours between steps is necessary.

Step 3

- Light aerobic exercise (50-70% maximum heart rate for 20 minutes) and integrate individual sport-specific drills
  - Specific drills should be incorporated into the workout and should not include any plyometrics and rotation/change-of-direction exercises such as spins and jumps

Step 4

- Sport-specific exercise
  - Sport-specific exercises can be done individually or with a teammate. Increase the duration of the exercises, and incorporate resistance training if desired. This should not include activities that involve impacts to the head. It is possible to incorporate plyometrics and rotation/change-of-direction exercises such as light jumps and spins.

Step 5

- Non-contact training drills
  - Practice more complex drills, increase resistance training, increase level of skills (jumps, spins)

Step 6

- Full practice with body contact

Step 7

- Return to play
    - Normal game-play with body contact

IMPORTANT

This stepwise approach is provided as a guideline and it is imperative that CAT(C)s adapt it using their expertise and critical judgment, based on the symptoms exhibited and the specific needs of each patient.

APPENDIX

APPENDIX 1

SCAT3 [20] - For printing purposes, download document from CTSQ website

SCAT3 ™

Sport Concussion Assessment Tool – 3rd Edition

For use by medical professionals only

Name | Date / Time of Injury: | Date of Assessment: | Examiner:

What is the SCAT3? [1]

The SCAT3 is a standardized tool for evaluating injured athletes for concussion and can be used in athletes aged from 13 years and older. It supersedes the original SCAT and the SCAT2 published in 2005 and 2009, respectively [2]. For younger persons, ages 12 and under, please use the Child SCAT3. The SCAT3 is designed for use by medical professionals. If you are not qualified, please use the Sport Concussion Recognition Tool [1]. Preseason baseline testing with the SCAT3 can be helpful for interpreting post-injury test scores.

Specific instructions for use of the SCAT3 are provided on page 3. If you are not familiar with the SCAT3, please read through these instructions carefully. This tool may be freely copied in its current form for distribution to individuals, teams, groups and organizations. Any revision or any reproduction in a digital form requires approval by the Concussion in Sport Group.

NOTE: The diagnosis of a concussion is a clinical judgment, ideally made by a medical professional. The SCAT3 should not be used solely to make, or exclude, the diagnosis of concussion in the absence of clinical judgement. An athlete may have a concussion even if their SCAT3 is "normal".

What is a concussion?

A concussion is a disturbance in brain function caused by a direct or indirect force to the head. It results in a variety of non-specific signs and/or symptoms (some examples listed below) and most often does not involve loss of consciousness. Concussion should be suspected in the presence of any one or more of the following:

- Symptoms (e.g., headache), or
- Physical signs (e.g., unsteadiness), or
- Impaired brain function (e.g. confusion) or
- Abnormal behaviour (e.g., change in personality).

SIDELINE ASSESSMENT

Indications for Emergency Management

NOTE: A hit to the head can sometimes be associated with a more serious brain injury. Any of the following warrants consideration of activating emergency procedures and urgent transportation to the nearest hospital:

- Glasgow Coma score less than 15
- Deteriorating mental status
- Potential spinal injury
- Progressive, worsening symptoms or new neurologic signs

Potential signs of concussion?

If any of the following signs are observed after a direct or indirect blow to the head, the athlete should stop participation, be evaluated by a medical professional and should not be permitted to return to sport the same day if a concussion is suspected.

Any loss of consciousness?	Y	N
"If so, how long?"		
Balance or motor incoordination (stumbles, slow/laboured movements, etc)	Y	N
Disorientation or confusion (inability to respond appropriately to questions)	Y	N
Loss of memory:	Y	N
"If so, how long?"		
"Before or after the injury?"		
Blank or vacant look:	Y	N
Visible facial injury in combination with any of the above:	Y	N

1 Glasgow coma scale (GCS)

Best eye response (E)	
No eye opening	1
Eye opening in response to pain	2
Eye opening to speech	3
Eyes opening spontaneously	4
Best verbal response (V)	
No verbal response	1
Incomprehensible sounds	2
Inappropriate words	3
Confused	4
Oriented	5
Best motor response (M)	
No motor response	1
Extension to pain	2
Abnormal flexion to pain	3
Flexion / Withdrawal to pain	4
Localizes to pain	5
Obeys commands	6
Glasgow Coma score (E + V + M)	of 15

GCS should be recorded for all athletes in case of subsequent deterioration.

2 Maddocks Score [3]

"I am going to ask you a few questions, please listen carefully and give your best effort."

Modified Maddocks questions (1 point for each correct answer)

What venue are we at today?	0	1
Which half is it now?	0	1
Who scored last in this match?	0	1
What team did you play last week / game?	0	1
Did your team win the last game?	0	1
Maddocks score		of 5

Maddocks score is validated for sideline diagnosis of concussion only and is not used for serial testing.

Notes: Mechanism of Injury ("tell me what happened??

Any athlete with a suspected concussion should be REMOVED FROM PLAY, medically assessed, monitored for deterioration (i.e., should not be left alone) and should not drive a motor vehicle until cleared to do so by a medical professional. No athlete diagnosed with concussion should be returned to sports participation on the day of Injury.

BACKGROUND

Name: _____ Date: _____

Examiner: _____

Sport / team / school: _____ Date / time of injury: _____

Age: _____ Gender: ☐ M ☐ F

Years of education completed: _____

Dominant hand: ☐ right ☐ left ☐ neither

How many concussions do you think you have had in the past? _____

When was the most recent concussion? _____

How long was your recovery from the most recent concussion? _____

Have you ever been hospitalized or had medical imaging done for a head injury? ☐ Y ☐ N

Have you ever been diagnosed with headaches or migraines? ☐ Y ☐ N

Do you have a learning disability, dyslexia, ADD / ADHD? ☐ Y ☐ N

Have you ever been diagnosed with depression, anxiety or other psychiatric disorder? ☐ Y ☐ N

Has anyone in your family ever been diagnosed with any of these problems? ☐ Y ☐ N

Are you on any medications? If yes, please list: ☐ Y ☐ N

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

SYMPTOM EVALUATION

3 How do you feel?

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

	none	mild		moderate		severe	
Headache	0	1	2	3	4	5	6
" Pressure in head"	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
Trouble falling asleep	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or Anxious	0	1	2	3	4	5	6

Total number of symptoms (Maximum possible 22) _____

Symptom severity score (Maximum possible 132) _____

Do the symptoms get worse with physical activity? ☐ Y ☐ N

Do the symptoms get worse with mental activity? ☐ Y ☐ N

☐ self rated ☐ self rated and clinician monitored

☐ clinician interview ☐ self rated with parent input

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

Please circle one response:

no different	very different	unsure	N/A

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

COGNITIVE & PHYSICAL EVALUATION

4 Cognitive assessment

Standardized Assessment of Concussion (SAC) [4]

Orientation (1 point for each correct answer)

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
What time is it right now? (within 1 hour)	0	1
Orientation score		of 5

Immediate memory

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

Immediate memory score total of 15

Concentration: Digits Backward

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

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

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

5 Neck Examination:

Range of motion Tenderness Upper and lower limb sensation & strength

Findings: _____

6 Balance examination

Do one or both of the following tests.

Footwear (shoes, barefoot, braces, tape, etc.) _____

Modified Balance Error Scoring System (BESS) testing [5]

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

Testing surface (hard floor, field, etc.) _____

Condition

Double leg stance:	Errors
Single leg stance (non-dominant foot):	Errors
Tandem stance (non-dominant foot at back):	Errors

And / Or

Tandem gait [6,7]

Time (best of 4 trials) _____ seconds

7 Coordination examination

Upper limb coordination

Which arm was tested: ☐ Left ☐ Right

Coordination score of 1

8 SAC Delayed Recall [4]

Delayed recall score of 5

INSTRUCTIONS

Words in Italics throughout the SCAT3 are the instructions given to the athlete by the tester.

Symptom Scale

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

To be completed by the athlete. In situations where the symptom scale is being completed after exercise, it should still be done in a resting state, at least 10 minutes post exercise.
For total number of symptoms, maximum possible is 22.
For Symptom severity score, add all scores in table, maximum possible is 132.

SAC [4]

Immediate Memory

"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."

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."

Complete all 3 trials regardless of score on trial 1. Read the words at a rate of one per second. Score 1 pt. for each correct response . Total score equals sum across all 3 trials. Do not inform the athlete that delayed recall will be tested.

Concentration

Digits backward

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

If correct, go to next string length. If incorrect, read trial 2. One point possible for each string length. Stop after incorrect on both trials. The digits should be read at the rate of one per second.

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"

1 pt. for entire sequence correct

Delayed Recall

The delayed recall should be performed after completion of the Balance and Coordination Examination.

"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."

Score 1 pt. for each correct response

Balance Examination

Modified Balance Error Scoring System (BESS) testing [5]

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)[5]. A stopwatch or watch with a second hand is required for this testing.

"I am now going to test your balance. Please take your shoes off, roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances."

(a) Double leg stance:

"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."

(b) Single leg stance:

"If you were to kick a ball, which foot would you use? [This will be the dominant foot] Now stand on your non-dominant foot. The dominant leg should be held in approximately 30 degrees of hip flexion and 45 degrees of knee flexion. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."

(c) Tandem stance:

"Now stand heel-to-toe with your non-dominant foot in back. Your weight should be evenly distributed across both feet. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."

Balance testing – types of errors

1. Hands lifted off iliac crest
2. Opening eyes
3. Step, stumble, or fall
4. Moving hip into > 30 degrees abduction
5. Lifting forefoot or heel
6. Remaining out of test position > 5 sec

Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the athlete. The examiner will begin counting errors only after the individual has assumed the proper start position. **The modified** BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum total number of errors for any single condition is 10. If a athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once subject is set. Subjects that are unable to maintain the testing procedure for a minimum of **five seconds** at the start are assigned the highest possible score, ten, for that testing condition.

OPTION : For further assessment, the same 3 stances can be performed on a surface of medium density foam (e.g., approximately 50 cm x 40 cm x 6 cm).

Tandem Gait [6,7]

Participants are instructed to stand with their feet together behind a starting line (the test is best done with footwear removed). Then, they walk in a forward direction as quickly and as accurately as possible along a 38mm wide (sports tape), 3 meter line with an alternate foot heel-to-toe gait ensuring that they approximate their heel and toe on each step. Once they cross the end of the 3m line, they turn 180 degrees and return to the starting point using the same gait. A total of 4 trials are done and the best time is retained. Athletes should complete the test in 14 seconds. Athletes fail the test if they step off the line, have a separation between their heel and toe, or if they touch or grab the examiner or an object. In this case, the time is not recorded and the trial repeated, if appropriate.

Coordination Examination

Upper limb coordination
Finger-to-nose (FTN) task:

"I am going to test your coordination now. Please sit comfortably on the chair with your eyes *open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended), pointing in front of you. When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of* the nose, and then return to the starting position, as quickly and as accurately as possible."

Scoring: 5 correct repetitions in < 4 seconds = 1
Note for testers: Athletes fail the test if they do not touch their nose, do not fully extend their elbow or do not perform five repetitions. Failure should be scored as 0.

References & Footnotes

1. This tool has been developed by a group of international experts at the 4th International Consensus meeting on Concussion in Sport held in Zurich, Switzerland in November 2012. The full details of the conference outcomes and the authors of the tool are published in The BJSM Injury Prevention and Health Protection, 2013, Volume 47, Issue 5. The outcome paper will also be simultaneously co-published in other leading biomedical journals with the copyright held by the Concussion in Sport Group, to allow unrestricted distribution, providing no alterations are made.

2. McCrory P et al., Consensus Statement on Concussion in Sport – the 3rd International Conference on Concussion in Sport held in Zurich, November 2008. British Journal of Sports Medicine 2009; 43: i76-89.

3. Maddocks, D L; Dicker, GD; Saling, MM. The assessment of orientation following concussion in athletes. Clinical Journal of Sport Medicine. 1995; 5(1): 32 – 3.

4. McCrea M. Standardized mental status testing of acute concussion. Clinical Journal of Sport Medicine. 2001; 11: 176 – 181.

5. Guskiewicz K M. Assessment of postural stability following sport-related concussion. Current Sports Medicine Reports. 2003; 2: 24 – 30.

6. Schneiders, A.G., Sullivan, S.J., Gray, A., Hammond-Tooke, G. &McCrory, P. Normative values for 16-37 year old subjects for three clinical measures of motor performance used in the assessment of sports concussions. Journal of Science and Medicine in Sport. 2010; 13(2): 196 – 201.

7. Schneiders, A.G., Sullivan, S.J., Kvarnstrom. J.K., Olsson, M., Yden. T. &Marshall, S.W. The effect of footwear and sports-surface on dynamic neurological screening in sport-related concussion. Journal of Science and Medicine in Sport. 2010; 13(4): 382 – 386

ATHLETE INFORMATION

Any athlete suspected of having a concussion should be removed from play, and then seek medical evaluation.

Signs to watch for

Problems could arise over the first 24 – 48 hours. The athlete should not be left alone and must go to a hospital at once if they:

- Have a headache that gets worse
- Are very drowsy or can't be awakened
- Can't recognize people or places
- Have repeated vomiting
- Behave unusually or seem confused; are very irritable
- Have seizures (arms and legs jerk uncontrollably)
- Have weak or numb arms or legs
- Are unsteady on their feet; have slurred speech

Remember, it is better to be safe.
Consult your doctor after a suspected concussion.

Return to play

Athletes should not be returned to play the same day of injury.
When returning athletes to play, they should be medically cleared and then follow a stepwise supervised program, with stages of progression.

For example:

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

There should be at least 24 hours (or longer) for each stage and if symptoms recur the athlete should rest until they resolve once again and then resume the program at the previous asymptomatic stage. Resistance training should only be added in the later stages.

If the athlete is symptomatic for more than 10 days, then consultation by a medical practitioner who is expert in the management of concussion, is recommended.

Medical clearance should be given before return to play.

Scoring Summary:

Test Domain	Score		
	Date:	Date:	Date:
Number of Symptoms of 22			
Symptom Severity Score of 132			
Orientation of 5			
Immediate Memory of 15			
Concentration of 5			
Delayed Recall of 5			
SAC Total			
BESS (total errors)			
Tandem Gait (seconds)			
Coordination of 1			

Notes:

CONCUSSION INJURY ADVICE

(To be given to the person monitoring the concussed athlete)

This patient has received an injury to the head. A careful medical examination has been carried out and no sign of any serious complications has been found. Recovery time is variable across individuals and the patient will need monitoring for a further period by a responsible adult. Your treating physician will provide guidance as to this timeframe.

If you notice any change in behaviour, vomiting, dizziness, worsening head ache, double vision or excessive drowsiness, please contact your doctor or the nearest hospital emergency department immediately.

Other important points:

- Rest (physically and mentally), including training or playing sports until symptoms resolve and you are medically cleared
- No alcohol
- No prescription or non-prescription drugs without medical supervision. Specifically:
  - No sleeping tablets
  - Do not use aspirin, anti-inflammatory medication or sedating pain killers
- Do not drive until medically cleared
- Do not train or play sport until medically cleared

Clinic phone number

Patient's name

Date / time of injury

Date / time of medical review

Treating physician

Contact details or stamp

APPENDIX 2

CHILD-SCAT3 [19] - For printing purposes, download document from CTSQ website

Child-SCAT3 ™

Sport Concussion Assessment Tool

for children ages 5 to12 years

For use by medical professionals only

What is childSCAT3? [1]

The ChildSCAT3 is a standardized tool for evaluating injured children for concussion and can be used in children aged from 5 to 12 years. It supersedes the original SCAT and the SCAT2 published in 2005 and 2009, respectively. For older persons, ages 13 years and over, please use the SCAT3. The ChildSCAT3 is designed for use by medical professionals. If you are not qualified, please use the Sport Concussion Recognition Test. Baseline testing with the ChildSCAT3 can be helpful for interpreting post-injury test scores.

Specific instructions for use of the ChildSCAT3 are provided on page 3. If you are not familiar with the ChildSCAT3, please read through these instructions carefully. This tool may be freely copied in its current form for distribution to individuals, teams, groups and organizations. Any revision and any reproduction in a digital form require approval by the Concussion in Sport Group.
NOTE: The diagnosis of a concussion is a clinical judgment, ideally made by a medical professional. The ChildSCAT3 should not be used solely to make, or exclude, the diagnosis of concussion in the absence of clinical judgement. An athlete may have a concussion even if their ChildSCAT3 is "normal".

What is a concussion?

A concussion is a disturbance in brain function caused by a direct or indirect force to the head. It results in a variety of non-specific signs and/or symptoms (like those listed below) and most often does not involve loss of consciousness. Concussion should be suspected in the presence of any one or more of the following:

- Symptoms (e.g., headache), or
- Physical signs (e.g., unsteadiness), or
- Impaired brain function (e.g. confusion) or
- Abnormal behaviour (e.g., change in personality).

SIDELINE ASSESSMENT

Indications for Emergency Management

NOTE: A hit to the head can sometimes be associated with a more severe brain injury. If the concussed child displays any of the following, then do not proceed with the ChildSCAT3; instead activate emergency procedures and urgent transportation to the nearest hospital:

- Glasgow Coma score less than 15
  Deteriorating mental status
  Potential spinal injury
- Progressive, worsening symptoms or new neurologic signs
  Persistent vomiting
- Evidence of skull fracture
  Post traumatic seizures
  Coagulopathy
- History of Neurosurgery (eg Shunt)
  Multiple injuries

1 Glasgow coma scale (GCS)

Best eye response (E)	
No eye opening	1
Eye opening in response to pain	2
Eye opening to speech	3
Eyes opening spontaneously	4
Best verbal response (V)	
No verbal response	1
Incomprehensible sounds	2
Inappropriate words	3
Confused	4
Oriented	5
Best motor response (M)	
No motor response	1
Extension to pain	2
Abnormal flexion to pain	3
Flexion/Withdrawal to pain	4
Localizes to pain	5
Obeys commands	6
Glasgow Coma score (E + V + M)	of 15

GCS should be recorded for all athletes in case of subsequent deterioration.

Potential signs of concussion?

If any of the following signs are observed after a direct or indirect blow to the head, the child should stop participation, be evaluated by a medical professional and should not be permitted to return to sport the same day if a concussion is suspected.

Any loss of consciousness?	☐ Y ☐ N
"If so, how long?"	
Balance or motor incoordination (stumbles, slow/laboured movements, etc)?	☐ Y ☐ N
Disorientation or confusion (inability to respond appropriately to questions)?	☐ Y ☐ N
Loss of memory:	☐ Y ☐ N
"If so, how long?"	
"Before or after the injury?"	
Blank or vacant look:	☐ Y ☐ N
Visible facial injury in combination with any of the above:	☐ Y ☐ N

2 Sideline Assessment – child-Maddocks Score [3]

"I am going to ask you a few questions, please listen carefully and give your best effort."

Modified Maddocks questions (1 point for each correct answer)

Where are we at now?	0	1
Is it before or after lunch?	0	1
What did you have last lesson/class?	0	1
What is your teacher's name?	0	1
child-Maddocks score		of 4

Child-Maddocks score is for sideline diagnosis of concussion only and is not used for serial testing.

Any child with a suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration (i.e., should not be left alone). No child diagnosed with concussion should be returned to sports participation on the day of Injury.

BACKGROUND

Name: _____ Date/Time of Injury: _____

Examiner: _____ Date of Assessment: _____

Sport/team/school: _____

Age: _____ Gender: ☐ M ☐ F

Current school year/grade: _____

Dominant hand: ☐ right ☐ left ☐ neither

Mechanism of Injury ("tell me what happened"?) _____

For Parent/carer to complete:

How many concussions has the child had in the past? _____

When was the most recent concussion? _____

How long was the recovery from the most recent concussion? _____

Has the child ever been hospitalized or had medical imaging done (CT or MRI) for a head injury?	☐ Y ☐ N
Has the child ever been diagnosed with headaches or migraines?	☐ Y ☐ N
Does the child have a learning disability, dyslexia, ADD/ADHD, seizure disorder?	☐ Y ☐ N
Has the child ever been diagnosed with depression, anxiety or other psychiatric disorder?	☐ Y ☐ N
Has anyone in the family ever been diagnosed with any of these problems?	☐ Y ☐ N
Is the child on any medications? If yes, please list:	☐ Y ☐ N

SYMPTOM EVALUATION

3 Child report

Name: _____

	never	rarely	sometimes	often
I have trouble paying attention	0	1	2	3
I get distracted easily	0	1	2	3
I have a hard time concentrating	0	1	2	3
I have problems remembering what people tell me	0	1	2	3
I have problems following directions	0	1	2	3
I daydream too much	0	1	2	3
I get confused	0	1	2	3
I forget things	0	1	2	3
I have problems finishing things	0	1	2	3
I have trouble figuring things out	0	1	2	3
It's hard for me to learn new things	0	1	2	3
I have headaches	0	1	2	3
I feel dizzy	0	1	2	3
I feel like the room is spinning	0	1	2	3
I feel like I'm going to faint	0	1	2	3
Things are blurry when I look at them	0	1	2	3
I see double	0	1	2	3
I feel sick to my stomach	0	1	2	3
I get tired a lot	0	1	2	3
I get tired easily	0	1	2	3

Total number of symptoms (Maximum possible 20) _____

Symptom severity score (Maximum possible 20 = 60) _____

☐ self rated ☐ clinician interview ☐ self rated and clinician monitored

4 Parent report

The child	never	rarely	sometimes	often
has trouble sustaining attention	0	1	2	3
Is easily distracted	0	1	2	3
has difficulty concentrating	0	1	2	3
has problems remembering what he /she is told	0	1	2	3
has difficulty following directions	0	1	2	3
tends to daydream	0	1	2	3
gets confused	0	1	2	3
is forgetful	0	1	2	3
has difficulty completeing tasks	0	1	2	3
has poor problem solving skills	0	1	2	3
has problems learning	0	1	2	3
has headaches	0	1	2	3
feels dizzy	0	1	2	3
has a feeling that the room is spinning	0	1	2	3
feels faint	0	1	2	3
has blurred vision	0	1	2	3
has double vision	0	1	2	3
experiences nausea	0	1	2	3
gets tired a lot	0	1	2	3
gets tired easily	0	1	2	3

Total number of symptoms (Maximum possible 20) _____

Symptom severity score (Maximum possible 20 = 60) _____

Do the symptoms get worse with physical activity? ☐ Y ☐ N

Do the symptoms get worse with mental activity? ☐ Y ☐ N

☐ parent self rated ☐ clinician interview ☐ parent self rated and clinician monitored

Overall rating for parent /teacher /coach /carer to answer.
How different is the child acting compared to his /her usual self?
Please circle one response:

no different	very different	unsure	N/A

Name of person completing Parent-report: _____

Relationship to child of person completing Parent-report: _____

Scoring on the ChildSCAT3 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.

COGNITIVE & PHYSICAL EVALUATION

5 Cognitive assessment

Standardized Assessment of Concussion – Child Version (SAC-C) [4]

Orientation (1 point for each correct answer)

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
Orientation score		of 4

Immediate memory

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

Immediate memory score total _____ of 15

Concentration: Digits Backward

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

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

Sunday-Saturday-Friday-Thursday-Wednesday-Tuesday-Monday	0	1
Concentration score		of 6

6 Neck Examination:

Range of motion ☐ Tenderness ☐ Upper and lower limb sensation & strength ☐

Findings: _____

7 Balance examination

Do one or both of the following tests.

Footwear (shoes, barefoot, braces, tape, etc.) _____

Modified Balance Error Scoring System (BESS) testing[5]

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

Testing surface (hard floor, field, etc.) _____

Condition

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

Tandem gait [6,7]

Time taken to complete (best of 4 trials): _____ seconds

If child attempted, but unable to complete tandem gait, mark here ☐

8 Coordination examination

Upper limb coordination

Which arm was tested: ☐ Left ☐ Right

Coordination score _____ of 1

9 SAC Delayed Recall [4]

Delayed recall score _____ of 5

Since signs and symptoms may evolve over time, it is important to consider repeat evaluation in the acute assessment of concussion.

INSTRUCTIONS

Words in Italics throughout the ChildSCAT3 are the instructions given to the child by the tester.

Sideline Assessment – child- Maddocks Score

To be completed on the sideline /in the playground, immediately following concussion. There is no requirement to repeat these questions at follow-up.

Symptom Scale [8]

In situations where the symptom scale is being completed after exercise, it should still be done in a resting state, at least 10 minutes post exercise.

On the day of injury
- the child is to complete the Child Report, according to how he /she feels now.

On all subsequent days
- the child is to complete the Child Report, according to how he /she feels today, and
- the parent/carer is to complete the Parent Report according to how the child has been over the previous 24 hours.

Standardized Assessment of Concussion – Child Version (SAC-C) [4]

Orientation
Ask each question on the score sheet. A correct answer for each question scores 1 point. If the child does not understand the question, gives an incorrect answer, or no answer, then the score for that question is 0 points.

Immediate memory

"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."

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."

Complete all 3 trials regardless of score on trial 1. Read the words at a rate of one per second. Score 1 pt. for each correct response. Total score equals sum across all 3 trials. Do not inform the child that delayed recall will be tested.

Concentration

Digits Backward:

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

If correct, go to next string length. If incorrect, read trial 2. One point possible for each string length. Stop after incorrect on both trials. The digits should be read at the rate of one per second.

Days in Reverse Order:

"Now tell me the days of the week in reverse order. Start with Sunday and go backward. So you'll say Sunday, Saturday … Go ahead"

1 pt. for entire sequence correct

Delayed recall

The delayed recall should be performed after completion of the Balance and Coordination Examination.
"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."

Circle each word correctly recalled. Total score equals number of words recalled.

Balance examination

These instructions are to be read by the person administering the childSCAT3, and each balance task should be demonstrated to the child. The child should then be asked to copy what the examiner demonstrated.

Modified Balance Error Scoring System (BESS) testing [5]

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)[5]. A stopwatch or watch with a second hand is required for this testing.

"I am now going to test your balance. Please take your shoes off, roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of two different parts."

(a) Double leg stance:
The first stance is standing with the feet together with hands on hips and with eyes closed. The child should try to maintain stability in that position for 20 seconds. You should inform the child that you will be counting the number of times the child moves out of this position. You should start timing when the child is set and the eyes are closed.

(b) Tandem stance:
Instruct the child to stand heel-to-toe with the non-dominant foot in the back. Weight should be evenly distributed across both feet. Again, the child should try to maintain stability for 20 seconds with hands on hips and eyes closed. You should inform the child that you will be counting the number of times the child moves out of this position. If the child stumbles out of this position, instruct him/her to open the eyes and return to the start position and continue balancing. You should start timing when the child is set and the eyes are closed.

Balance testing – types of errors - Parts (a) and (b)

1. Hands lifted off iliac crest
2. Opening eyes
3. Step, stumble, or fall
4. Moving hip into > 30 degrees abduction
5. Lifting forefoot or heel
6. Remaining out of test position > 5 sec

Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the child. The examiner will begin counting errors only after the child has assumed the proper start position. The modified BESS is calculated by adding one error point for each error during the two 20-second tests. The maximum total number of errors for any single condition is 10. If a child commits multiple errors simultaneously, only one error is recorded but the child should quickly return to the testing position, and counting should resume once subject is set. Children who are unable to maintain the testing procedure for a minimum of **five seconds** at the start are assigned the highest possible score, ten, for that testing condition.

OPTION: For further assessment, the same 2 stances can be performed on a surface of medium density foam (e.g., approximately 50cm x 40cm x 6cm).

Tandem Gait [6,7]

Use a clock (with a second hand) or stopwatch to measure the time taken to complete this task.
Instruction for the examiner: Demonstrate the following to the child:

The child is instructed to stand with their feet together behind a starting line (the test is best done with footwear removed). Then, they walk in a forward direction as quickly and as accurately as possible along a 38mm wide (sports tape), 3 meter line with an alternate foot heel-to-toe gait ensuring that they approximate their heel and toe on each step. Once they cross the end of the 3m line, they turn 180 degrees and return to the starting point using the same gait. A total of 4 trials are done and the best time is retained. Children fail the test if they step off the line, have a separation between their heel and toe, or if they touch or grab the examiner or an object. In this case, the time is not recorded and the trial repeated, if appropriate.

Explain to the child that you will time how long it takes them to walk to the end of the line and back.

Coordination examination

Upper limb coordination
Finger-to-nose (FTN) task:

The tester should demonstrate it to the child.

"I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended). When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose as quickly and as accurately as possible."

Scoring: 5 correct repetitions in < 4 seconds = 1
Note for testers: Children fail the test if they do not touch their nose, do not fully extend their elbow or do not perform five repetitions. Failure should be scored as 0.

References & Footnotes

1. This tool has been developed by a group of international experts at the 4th International Consensus meeting on Concussion in Sport held in Zurich, Switzerland in November 2012. The full details of the conference outcomes and the authors of the tool are published in The BJSM Injury Prevention and Health Protection, 2013, Volume 47, Issue 5. The outcome paper will also be simultaneously co-published in other leading biomedical journals with the copyright held by the Concussion in Sport Group, to allow unrestricted distribution, providing no alterations are made.

2. McCrory P et al., Consensus Statement on Concussion in Sport – the 3rd International Conference on Concussion in Sport held in Zurich, November 2008. British Journal of Sports Medicine 2009; 43: i76-89.

3. Maddocks, D L; Dicker, GD; Saling, MM. The assessment of orientation following concussion in athletes. Clinical Journal of Sport Medicine. 1995; 5(1): 32 – 3.

4. McCrea M. Standardized mental status testing of acute concussion. Clinical Journal of Sport Medicine. 2001; 11: 176 – 181.

5. Guskiewicz K M. Assessment of postural stability following sport-related concussion. Current Sports Medicine Reports. 2003; 2: 24 – 30.

6. Schneiders, A.G., Sullivan, S.J., Gray, A., Hammond-Tooke, G. & McCrory, P. Normative values for 16-37 year old subjects for three clinical measures of motor performance used in the assessment of sports concussions. Journal of Science and Medicine in Sport. 2010; 13(2): 196 – 201.

7. Schneiders, A.G., Sullivan, S.J., Kvarnstrom. J.K., Olsson, M., Yden. T. & Marshall, S.W. The effect of footwear and sports-surface on dynamic neurological screening in sport-related concussion. Journal of Science and Medicine in Sport. 2010; 13(4): 382 – 386

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CHILD ATHLETE INFORMATION

Any child suspected of having a concussion should be removed from play, and then seek medical evaluation. The child must NOT return to play or sport on the same day as the suspected concussion.

Signs to watch for

Problems could arise over the first 24 – 48 hours. The child should not be left alone and must go to a hospital at once if they develop any of the following:

- New Headache, or Headache gets worse
- Persistent or increasing neck pain
- Becomes drowsy or can't be woken up
- Can not recognise people or places
- Has Nausea or Vomiting
- Behaves unusually, seems confused, or is irritable
- Has any seizures (arms and /or legs jerk uncontrollably)
- Has weakness, numbness or tingling (arms, legs or face)
- Is unsteady walking or standing
- Has slurred speech
- Has difficulty understanding speech or directions

Remember, it is better to be safe.
Always consult your doctor after a suspected concussion.

Return to school

Concussion may impact on the child's cognitive ability to learn at school. This must be considered, and medical clearance is required before the child may return to school. It is reasonable for a child to miss a day or two of school after concussion, but extended absence is uncommon. In some children, a graduated return to school program will need to be developed for the child. The child will progress through the return to school program provided that there is no worsening of symptoms. If any particular activity worsens symptoms, the child will abstain from that activity until it no longer causes symptom worsening. Use of computers and internet should follow a similar graduated program, provided that it does not worsen symptoms. This program should include communication between the parents, teachers, and health professionals and will vary from child to child. The return to school program should consider:

- Extra time to complete assignments /tests
- Quiet room to complete assignments /tests
- Avoidance of noisy areas such as cafeterias, assembly halls, sporting events, music class, shop class, etc
- Frequent breaks during class, homework, tests
- No more than one exam /day
- Shorter assignments
- Repetition/memory cues
- Use of peer helper /tutor
- Reassurance from teachers that student will be supported through recovery through accommodations, workload reduction, alternate forms of testing
- Later start times, half days, only certain classes

The child is not to return to play or sport until he /she has successfully returned to school /learning, without worsening of symptoms. Medical clearance should be given before return to play.

If there are any doubts, management should be referred to a qualified health practitioner, expert in the management of concussion in children.

Return to sport

There should be no return to play until the child has successfully returned to school/learning, without worsening of symptoms.
Children must not be returned to play the same day of injury.
When returning children to play, they should medically cleared and then follow a stepwise supervised program, with stages of progression.

For example:

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

There should be approximately 24 hours (or longer) for each stage and the child should drop back to the previous asymptomatic level if any post-concussive symptoms recur. Resistance training should only be added in the later stages.
If the child is symptomatic for more than 10 days, then review by a health practitioner, expert in the management of concussion, is recommended.
Medical clearance should be given before return to play.

Notes:

CONCUSSION INJURY ADVICE FOR THE CHILD AND PARENTS/CARERS

(To be given to the person monitoring the concussed child)

This child has received an injury to the head. A careful medical examination has been carried out and no sign of any serious complications has been found. It is expected that recovery will be rapid, but the child will need monitoring for the next 24 hours by a responsible adult.

If you notice any change in behavior, vomiting, dizziness, worsening headache, double vision or excessive drowsiness, please call an ambulance to transport the child to hospital immediately.

Other important points:

- Following concussion, the child should rest for at least 24 hours.
- The child should avoid any computer, internet or electronic gaming activity if these activities make symptoms worse.
- The child should not be given any medications, including pain killers, unless prescribed by a medical practitioner.
- The child must not return to school until medically cleared.
- The child must not return to sport or play until medically cleared.

Clinic phone number

Patient's name

Date/time of injury

Date/time of medical review

Treating physician

Contact details or stamp

APPENDIX 3

GRADED SYMPTOM CHECKLIST (GSC) [11] - For printing purposes, download document from CTSQ website

SYMPTOM	TIME OF INJURY	2-3 HOURS POST-INJURY	24-HOUR POST-INJURY	48-HOUR POST-INJURY	72-HOUR POST-INJURY
Blurred vision					
Dizziness					
Drowsiness					
Excess sleep					
Easily distracted					
Fatigue					
Feel “in a fog”					
Feel “slowed down”					
Headache					
Inappropriate emotions					
Irritability					
Loss of consciousness					
Loss of orientation					
Memory problems					
Nausea					
Nervousness					
Personality change					
Poor balance/ coordination					
Poor concentration					
Ringing in ears					
Sadness					
Seeing stars					
Sensitivity to light					
Sensitivity to noise					
Sleep disturbance					
Vacant stare/glassy eyes					
Vomiting					

***NOTE**: The GSC should be used not only for the initial evaluation, but also for each subsequent follow-up assessment until signs and symptoms have cleared at rest and during physical exertion. In lieu of simply checking each symptom present, the CAT(C) can ask the athlete to grade or score the severity of the symptom on a scale of 0-6 where 0 = not present. 1 = mild, 4 = moderate and 6 = most severe.*

APPENDIX 4

CRANIAL NERVE TESTS [26, 27] - For printing purposes, download document from CTSQ website

	Cranial Nerve	Function	Special Test
I	Olfactory	Smell	Ask athlete to identify familiar odor (e.g. fruit, purel, alcohol prep pad)
II	Optic	Visual acuity	Ask athlete to read score board, eye chart
III	Occulomotor	Pupillary reaction	Using penlight, determine if pupils are equal and reactive to light
IV	Trochlear	Eye movements	Using penlight, ask athlete to track light medial, laterally, inferiorly, superiorly
V	Trigeminal	Facial sensation	Perceive light facial touch, ask athlete to bite down on tongue depressor
VI	Abducens	Lateral eye movements	Using penlight, ask athlete to track lateral and medial
VII	Facial	Facial expression	Ask athlete to smile, frown, etc.
VIII	Acoustic	Hearing, Balance	Hearing: Snap finger beside each ear Balance: Tandem stance
IX	Glossopharyngeal	Swallow, Voice	Ask athlete to swallow, speak
X	Vagus	Swallow, Gag	Ask athlete to swallow, check gag with tongue depressor
XI	Spinal	Neck strength	Check isometric neck strength, shoulder shrug
XII	Hypoglossal	Tongue movement/ strength	Ask athlete to stick out tongue, move medial and lateral

Adapted from Magee, Orthopedic Assessment, 4th edition [26]

APPENDIX 5

GLASGOW COMA SCALE [21] - For printing purposes, download document from CTSQ website

IMPORTANT

No pain should be invoked above clavicle level in cases of suspected spinal.

The use of sternal rub is not advised in pre-hospital setting.

Pain is thus invoked with a triceps or nailbed pinch.

GLASGOW COMA SCALE : Do it this way

GCS at 40 | EYES VERBAL MOTOR

Institute of Neurological Sciences NHS Greater Glasgow and Clyde

CHECK	OBSERVE	STIMULATE	RATE
For factors Interfering with communication, ability to respond and other injuries	Eye opening , content of speech and movements of right and left sides	Sound: spoken or shouted request Physical: Pressure on finger tip, trapezius or supraorbital notch	Assign according to highest response observed

Eye opening

Criterion	Observed	Rating	Score
Open before stimulus	✔	Spontaneous	4
After spoken or shouted request	✔	To sound	3
After finger tip stimulus	✔	To pressure	2
No opening at any time, no interfering factor	✔	None	1
Closed by local factor	✔	Non testable	NT

Verbal response

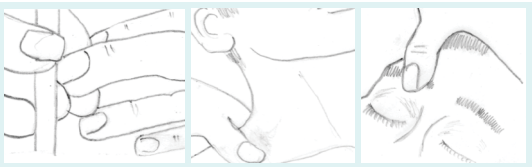
Criterion	Observed	Rating	Score
Correctly gives name, place and date	✔	Orientated	5
Not orientated but communication coherently	✔	Confused	4
Intelligible single words	✔	Words	3
Only moans / groans	✔	Sounds	2
No audible response, no interfering factor	✔	None	1
Factor interferring with communication	✔	Non testable	NT

Best motor response

Criterion	Observed	Rating	Score
Obey 2-part request	✔	Obeys commands	6
Brings hand above clavicle to stimulus on head neck	✔	Localising	5
Bends arm at elbow rapidly but features not predominantly abnormal	✔	Normal flexion	4
Bends arm at elbow, features clearly predominantly abnormal	✔	Abnormal flexion	3
Extends arm at elbow	✔	Extension	2
No movement in arms / legs, no interfering factor	✔	None	1
Paralysed or other limiting factor	✔	Non testable	NT

Sites For Physical Stimulation

Finger tip pressure | Trapezius Pinch | Supraorbital notch



Features of Flexion Responses

Modified with permission from Van Der Naalt 2004
Ned Tijdschr Geneeskd

Abnormal Flexion

Slow Sterotyped
Arm across chest
Forearm rotates
Thumb clenched
Leg extends

Normal flexion

Rapid
Variable
Arm away from body

For further information and video demonstration visit www.glasgowcomascale.org

APPENDIX 6

RIVERMEAD POST CONCUSSION SYMPTOMS QUESTIONNAIRE [40]

For printing purposes, download document from CTSQ website

Rivermead Post Concussion Symptoms Questionnaire

Modified (Rpq-3 And Rpq-13) [42] Printed With Permission: Modified Scoring System From Eyres 2005 [28]

Name: Date:

After a head injury or accident some people experience symptoms that can cause worry or nuisance. We would like to know if you now suffer any of the symptoms given below. Because many of these symptoms occur normally, we would like you to compare yourself now with before the accident. For each symptom listed below please circle the number that most closely represents 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:

	not experienced	no more of a problem	mild problem	moderate problem	severe problem
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? Please specify, and rate as above.					
1.	0	1	2	3	4
2.	0	1	2	3	4

Administration only:

RPQ-3 *(total for first three items)*	
RPQ-13 *(total for next 13 items)*	

http://www.maa.nsw.gov.au/default.aspx?MenuID=148

Rivermead Post Concussion Symptoms Questionnaire (cont.)

Modified (Rpq-3 And Rpq-13) [42] Printed With Permission: Modified Scoring System From Eyres 2005 [28]

Administration only

Individual item scores reflect the presence and severity of post concussive symptoms. Post concussive symptoms, as measured by the RPQ, may arise for different reasons subsequent to (although not necessarily directly because of) a traumatic brain injury. The symptoms overlap with broader conditions, such as pain, fatigue and mental health conditions such as depression [72].

The questionnaire can be repeated to monitor a patient's progress over time. There may be changes in the severity of symptoms, or the range of symptoms. Typical recovery is reflected in a reduction of symptoms and their severity within three months.

Scoring

The scoring system has been modified from Eyres, 2005 [24].

The items are scored in two groups. The first group (RPQ-3) consists of the first three items (headaches, feelings of dizziness and nausea) and the second group (RPQ-13) comprises the next 13 items. The total score for RPQ-3 items is potentially 0–12 and is associated with early symptom clusters of post concussive symptoms. If there is a higher score on the RPQ-3, earlier reassessment and closer monitoring is recommended.

The RPQ-13 score is potentially 0–52, where higher scores reflect greater severity of post concussive symptoms. The RPQ-13 items are associated with a later cluster of symptoms, although the RPQ-3 symptoms of headaches, dizziness and nausea may also be present. The later cluster of symptoms is associated with having a greater impact on participation, psychosocial functioning and lifestyle. Symptoms are likely to resolve within three months. A gradual resumption of usual activities is recommended during this period, appropriate to symptoms. If the symptoms do not resolve within three months, consideration of referral for specialist assessment or treatment services is recommended.

References:

Eyres, S., Carey, A., Gilworth, G., Neumann, V., Tennant, A. (2005). Construct validity and reliability of the Rivermead Post Concussion Symptoms Questionnaire. Clinical Rehabilitation, 19, 878-887.

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http://www.maa.nsw.gov.au/default.aspx?MenuID=148

APPENDIX 7

POST-CONCUSSION SYMPTOM INVENTORY (PCSI) [41]

For printing purposes, download document from CTSQ website

PCSI Administration Manual

The Post-Concussion Symptom Inventory (PCSI) was developed to assess common post-concussion physical, cognitive, and behavioural/emotional symptoms directly via the child's self-report. Age-specific PCSI forms were created appropriate to age/developmental level of the child (i.e., ages 5-7 years, 8-12 years and 13-18 years). A companion parent symptom report was also developed which serves to augment symptom assessment in children by gathering parent-observed symptoms (Gioia et al., 2009).

Forms. The PCSI for the 5 to 7 years age group is comprised of 5 symptom rating items, removing items with complex vocabulary (e.g., fogginess, nausea, irritability), subtle internal states (e.g., fogginess), and other items not likely monitored by younger children (e.g., sleep). The PCSI for 5- to 7-year-olds includes five items that tap physical (three items), cognitive (one item), and emotional (one item) symptoms.

The PCSI form for 8- to 12-year-olds includes 17 items that assess physical (eight items), cognitive (four items), emotional (three items), and fatigue (two items) symptoms.

The PCSI for the 13- to 18-year-olds includes 21 items that assess physical (eight items), cognitive (six items), emotional (four items), and fatigue (three items) symptoms.

The Parent PCSI is composed of 20 items that assess physical (eight items), cognitive (five items), emotional (four items), and fatigue (three items) symptoms.

Each of the post-injury forms includes an additional item asking child/adolescent/parent to indicate if they are 'acting differently than before the injury'. This item is presented as a general summary judgment of their overall state.

Administration. One may use the PCSI to collect symptoms report data as a *pre-injury baseline, retrospective baseline* and a *post-injury* measurement. It is important to understand the different time frames of the symptom reporting and the corresponding differences administration. When administering the PCSI as a Pre-Injury Baseline of Post-Injury assessment; each symptom is preceded by the phrase 'Yesterday of Today' to give the child the time frame within which they should be making their decision about the symptom's presence and degree. The PCSI is intended to assess the child's *current* symptom state and not whether the child has ever experienced the symptom. This is a symptom very important point that examiners must emphasize to the child and parent – we want to know how the child is *currently* feeling. The same intent and emphasis applies whether the child is taking a baseline or post-injury exam.

When administering the PCSI post-injury, it is often useful to find out how the child normally feels, this is known as a Retrospective Baseline. In this case, the child is asked to report if they experienced any of the symptoms prior to the injury (and if so, to what degree).

Scores. The PCSI scales produce a *Total Symptom* score for the 5-7 year, 8-12 year, 13-18 year and Parent PCSI versions, as well as scores reflecting the specific *Physical, Cognitive, Emotional* and *Fatigue* symptom domains for the 8-12, 13-18 and Parent Versions. Scores for the PCSI are simple sums of the number and degree of symptoms.

Post-Concussion Symptom Inventory (PCSI-P)
Parent Report Form
Pre and Post-Injury

Student's Name:_____ **Today's date:** _____
Birthdate:_____ **Age/ Grade:**_____
Person Completing Form:_____ **Relation: Mother ___ Father___ Other___**

Instructions: We would like to know if your child had problems with these symptoms before their injury. Next, we would like to know if these symptoms have changed after the injury. Please rate the problem at two points in time- **Before the Injury/ Pre-Injury** and **Current Symptoms/ Yesterday and Today**.

Please answer all the items the best that you can. Do not skip any items. Circle the number to tell us how much of a problem this symptom has been for your child.

0 = Not a problem 3 = Moderate problem 6 = Severe problem

		Before the Injury/ Pre-Injury							Current Symptoms/ Yesterday and Today						
1	Complains of headaches	0	1	2	3	4	5	6	0	1	2	3	4	5	6
2	Complains of nausea	0	1	2	3	4	5	6	0	1	2	3	4	5	6
3	Has balance problems	0	1	2	3	4	5	6	0	1	2	3	4	5	6
4	Appears or complains of dizziness	0	1	2	3	4	5	6	0	1	2	3	4	5	6
5	Appears drowsy	0	1	2	3	4	5	6	0	1	2	3	4	5	6
6	Sleeping more than usual	0	1	2	3	4	5	6	0	1	2	3	4	5	6
7	Sensitivity to light	0	1	2	3	4	5	6	0	1	2	3	4	5	6
8	Sensitivity to noise	0	1	2	3	4	5	6	0	1	2	3	4	5	6
9	Acts irritable	0	1	2	3	4	5	6	0	1	2	3	4	5	6
10	Appears sad	0	1	2	3	4	5	6	0	1	2	3	4	5	6
11	Acts nervous	0	1	2	3	4	5	6	0	1	2	3	4	5	6
12	Acts more emotional	0	1	2	3	4	5	6	0	1	2	3	4	5	6
13	Acts or appears mentally "foggy"	0	1	2	3	4	5	6	0	1	2	3	4	5	6
14	Has difficulty concentrating	0	1	2	3	4	5	6	0	1	2	3	4	5	6
15	Has difficulty remembering	0	1	2	3	4	5	6	0	1	2	3	4	5	6
16	Has or complains of visual problems (blurry, double vision)	0	1	2	3	4	5	6	0	1	2	3	4	5	6
17	Appears more tired or fatigued	0	1	2	3	4	5	6	0	1	2	3	4	5	6
18	Becomes confused with directions or tasks	0	1	2	3	4	5	6	0	1	2	3	4	5	6
19	Appears to move in a clumsy manner	0	1	2	3	4	5	6	0	1	2	3	4	5	6
20	Answers questions more slowly than usual	0	1	2	3	4	5	6	0	1	2	3	4	5	6
	PCSI Total Symptom Score	**Pre-Injury** _____							**Post-Injury** _____						
In general, to what degree is your child acting "differently" than before the injury (not acting like himself or herself)?		**No Difference 0 1 2 3 4 Major Difference** *Circle your rating with "0" indicating "Normal" (No Difference) and "4" indicating "Very Different" (Major Difference)*													

Authored / Developed by: Gioia, Janusz, Sady, Vaughan, & Isquith. 2012.

Post-Concussion Symptom Inventory for Children (PCSI-C)

Pre/Post Version 5 to 12

Name:_____ **Today's date:**_____ **Birthdate:**_____ **Age**_____ **Grade:**_____

Instructions: We would like to know if you have had any of these symptoms before your injury. Next, we would like to know if these symptoms have changed after your injury.

I am going to ask you to tell me about your symptom at two points in time - Before the Injury and Yesterday / Today. Interviewer: Please circle only one answer.

	0 = No 1 = A little 2 = A lot	**Before the Injury /Pre-Injury**				**Current Symptoms/ Yesterday and Today**		
1	Have you had headaches? Has your head hurt?	0	1	2		0	1	2
2	Have you felt sick to your stomach or nauseous?	0	1	2		0	1	2
3	Have you felt dizzy? (like things around you were spinning or moving)	0	1	2		0	1	2
4	Have you felt grumpy or irritable? (like you were in a bad mood)	0	1	2		0	1	2
5	Has it been hard for you to pay attention to what you are doing? (like homework or chores, listening to someone, or playing a game)	0	1	2		0	1	2
	Continue if age 8 or older							
6	Have you felt more drowsy or sleepy than usual?	0	1	2		0	1	2
7	Have bright lights bothered you more than usual? (like when you were in the sunlight, when you looked at lights, or watched TV)	0	1	2		0	1	2
8	Have loud noises bothered you more than usual? (like when people were talking, when you heard sounds, watched TV, or listened to loud music)	0	1	2		0	1	2
9	Have you had any balance problems or have you felt like you might fall when you walk, run or stand?	0	1	2		0	1	2
10	Have you felt sad?	0	1	2		0	1	2
11	Have you felt nervous or worried?	0	1	2		0	1	2
12	Have you felt like you are moving more slowly?	0	1	2		0	1	2
13	Have you felt like you are thinking more slowly?	0	1	2		0	1	2
14	Has it been hard to think clearly?	0	1	2		0	1	2
15	Have you felt more tired than usual?	0	1	2		0	1	2
16	Has it been hard for you to remember things? (like things you heard or saw, or places you have gone)	0	1	2		0	1	2
17	Have things looked blurry?	0	1	2		0	1	2

All Ages- Do you feel "different" than usual? (Circle one) 0=No 1=A little 2=A lot

PCSI Total Symptom Score	**Pre=**	**Post=**

Subscale scores (Age 8-12) Pre/Post	**Physical**	**Cognitive**	**Emotional**	**Fatigue**
	/	/	/	/

Authored / Developed by: Gioia, Janusz, Sady, Vaughan, Schneider & Natale. 2012.

Post-Concussion Symptom Inventory (PCSI)
Self-Report Assessment Form
Pre and Post-Injury Report
Ages 13-18

Patient Name:_____ **Today's date:**_____
Birthdate:_____ **Age:**_____

Instructions: We would like to know if you have had any of these symptoms before your injury. Next, we would like to know if these symptoms have changed after your injury. Please rate the symptom at two points in time- Before the Injury/Pre-Injury and Currently.

Please answer all the items the best that you can. Do not skip any items. Circle the number to tell us how much of a problem this symptom has been for you.

0 = Not a problem 3 = Moderate problem 6 = Severe problem

		Before the Injury/ Pre-Injury	**Current Symptoms/ Yesterday and Today**
1	Headache	0 1 2 3 4 5 6	0 1 2 3 4 5 6
2	Nausea	0 1 2 3 4 5 6	0 1 2 3 4 5 6
3	Balance problems	0 1 2 3 4 5 6	0 1 2 3 4 5 6
4	Dizziness	0 1 2 3 4 5 6	0 1 2 3 4 5 6
5	Fatigue	0 1 2 3 4 5 6	0 1 2 3 4 5 6
6	Sleep more than usual	0 1 2 3 4 5 6	0 1 2 3 4 5 6
7	Drowsiness	0 1 2 3 4 5 6	0 1 2 3 4 5 6
8	Sensitivity to light	0 1 2 3 4 5 6	0 1 2 3 4 5 6
9	Sensitivity to noise	0 1 2 3 4 5 6	0 1 2 3 4 5 6
10	Irritability	0 1 2 3 4 5 6	0 1 2 3 4 5 6
11	Sadness	0 1 2 3 4 5 6	0 1 2 3 4 5 6
12	Nervousness	0 1 2 3 4 5 6	0 1 2 3 4 5 6
13	Feeling more emotional	0 1 2 3 4 5 6	0 1 2 3 4 5 6
14	Feeling slowed down	0 1 2 3 4 5 6	0 1 2 3 4 5 6
15	Feeling mentally "foggy"	0 1 2 3 4 5 6	0 1 2 3 4 5 6
16	Difficulty concentrating	0 1 2 3 4 5 6	0 1 2 3 4 5 6
17	Difficulty remembering	0 1 2 3 4 5 6	0 1 2 3 4 5 6
18	Visual problems (double vision, blurring)	0 1 2 3 4 5 6	0 1 2 3 4 5 6
19	Get confused with directions or tasks	0 1 2 3 4 5 6	0 1 2 3 4 5 6
20	Move in a clumsy manner	0 1 2 3 4 5 6	0 1 2 3 4 5 6
21	Answer questions more slowly than usual	0 1 2 3 4 5 6	0 1 2 3 4 5 6
22	In general, to what degree do you feel "differently" than before the injury (not feeling like yourself)?	**No Difference 0 1 2 3 4 Major Difference** *Circle your rating with "0" indicating "Normal" (No Difference) and "4" indicating "Very Different" (Major Difference)*	

APPENDIX 8

RETURN TO PLAY GUIDELINES FOR CHILD [24]

Reproduced with permission Montreal Children's Hospital, Trauma Center [24]

Hôpital de Montréal pour enfants
Centre universitaire de santé McGill

Montreal Children's Hospital
McGill University Health Centre

TRAUMATOLOGIE TRAUMA

RETURN TO SPORTS FOLLOWING A CONCUSSION

If you have sustained a concussion, this action plan is recommended before fully returning to physical activity.
You must complete your recommended period of rest and follow the activity restrictions.
You should be symptom-free at rest for 5-7 days before starting the following progressive steps.
There should be approximately 24 hours in between each step. If any symptoms return at any time during this action plan, stop working out. Rest until you are symptom-free for 24 hours.
Then return to the previous step. If symptoms do not resolve or get worse, seek medical attention.

STEP 1: LIGHT GENERAL CONDITIONING EXERCISES

- **NO CONTACT.**
- Begin with a warm up (stretching / flexibility) for 5-10 minutes.
- Start a cardio workout of 15-20 minutes which can include: stationary bicycle, elliptical, treadmill, fast paced walking, light jog, rowing or swimming.
- 50% intensity.

STEP 2: GENERAL CONDITIONING AND SPORT SPECIFIC SKILL WORK DONE INDIVIDUALLY

- **NO CONTACT.**
- Begin with a warm up (stretching / flexibility) for 5-10 minutes.
- Increase intensity and duration of cardio workout to 20-30 minutes.
- Begin sport specific skill work within the workout, but no spins, dives or jumps.
- 50-60% intensity.

STEP 3: GENERAL CONDITIONING, SKILL WORK DONE WITH A TEAM-MATE

- **NO CONTACT.**
- Increase duration of session to 60 minutes. Begin resistance training including neck and core strengthening exercises.
- Continue practicing sport specific individual skills.
- Begin general shooting, kicking or passing drills with a partner.
- Start beginner level spins, dives and jumps.
- 75% intensity.

STEP 4: GENERAL CONDITIONING, SKILL WORK AND TEAM DRILLS

- **NO CONTACT. NO SCRIMMAGES.**
- Resume pre-injury duration of practice and team drills.
- Increase resistance training and skill work as required.
- Gradually increase skill level of spins, dives and jumps.
- 75-90% intensity

STEP 5: FULL PRACTICE WITH BODY CONTACT

- **CONTACT. SCRIMMAGES.**
- Participate in a full practice. If completed with no symptoms, discuss with the coach about returning to activity.
- 90-100% intensity.

Do not progress until the following is achieved:

- Coaches must make sure that the athlete has regained his/her pre-injury skill-level.
- The child or teen is confident in his/her ability to return to activity.

STEP 6: RETURN TO COMPETITION.

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