



## Consensus

## Harrogate consensus agreement: Cycling-specific sport-related concussion

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## ARTICLE INFO

## Keywords:

Sport-related concussion  
Cycling

## ABSTRACT

Sport-related concussion (SRC) is a common and increasingly recognised sport-related injury and accounts for between 1% and 9% of all cycling-specific injuries. Attention has been drawn to the difficulty in managing suspected SRC in a fast-paced sport such as road cycling, particularly the lack of an effective and time-efficient assessment protocol. A meeting on cycling SRC was convened in Harrogate, United Kingdom, in an attempt to resolve this problem. The aim was to agree on standard terminology, definitions, diagnostic protocols and return to play protocols for the various differing codes of cycle sport. Seven experts in the field of cycling medicine were invited to participate by the International Cycling Union and are the authors of this report. The panel recognised that the sport of cycling consists of varied disciplines, some of which provide a setting in which a sideline assessment is possible which is in line with the Berlin Consensus statement. However, other disciplines provide challenging circumstances where health care providers have limited access to participants and where participants are unable to discontinue participation and participate in sideline assessment. Consensus-based discipline-specific protocols and guidelines which recognise the limitations posed by these circumstances, but nevertheless, improve on the current situation specific to the sport of cycling are presented as a potential solution to the unique challenges posed by these cycling disciplines.

## Introduction

Sport-related concussion (SRC) is a common and increasingly recognised sport-related injury.<sup>1</sup> SRC account for approximately 1% and 9% of all cycling-specific injuries.<sup>2–4</sup> Most studies regarding the effects of multiple concussions have shown neurocognitive impairments in the areas of memory and processing speed.<sup>5</sup> Moreover, the number of concussions and the time interval between concussions increase the severity of subsequent concussions. Global increased awareness has been achieved in the diagnosis and management of SRC in contact and team sports using the 2017 Berlin concussion consensus statement that provides a guiding reference<sup>6</sup>. Fundamental to making a confident diagnosis of

concussions is to memorize the personal history of concussion.

Attention has been drawn to the difficulty in managing suspected SRC in a fast-paced sport such as road cycling, and a recent review has evidenced the lack of published consensus for SRC management in cycling.<sup>7</sup> This attention has highlighted the lack of an effective and time-efficient assessment protocol for the discipline of road cycling. A first cycling-specific protocol for the assessment of SRC in the field was recently suggested.<sup>8</sup> Cycling disciplines such as cross country and marathon mountain biking, and the omnium event in track cycling, pose similar difficulties in managing suspected SRC cases.

A consensus meeting on cycling SRC was convened to attempt to resolve this problem and establish an SRC protocol for cycling. The aim of

**Abbreviations:** SRC, Sport related concussion; RTP, Return to play; BMX, Bicycle Motor Cross; UCI, International Cycling Union; SCAT, Sports Concussion Assessment Tool; VOMS, Vestibular Ocular Motor Screening.

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<https://doi.org/10.1016/j.smhs.2021.05.002>

Received 19 May 2021; Accepted 20 May 2021

Available online 2 June 2021

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**Table 1**  
Immediate and permanent removal features.

Seizure or convulsion
Tonic posturing
Loss of consciousness
Clearly dazed or confused
Ataxia/Balance impairment
Oculomotor signs
Disorientation (fails modified Madox questions)
Definite behaviour change (restlessness, agitation, combativeness)
Significant head or neck trauma
Weakness or tingling/burning in arms or legs
Double vision
Severe or increasing headache
Vomiting
Inability to speak or swallow

**Table 2**  
Summary of Road-side or Track-side assessment features.

Modified Maddocks questions (See Fig. 1)
Rapid symptom screen (headache, nausea, dizziness)
Immediate 10 word recall
Reverse digits
Balance assessment (feet together, head back)
Assessment of spine and neck
Delayed 10 word recall

this meeting was to agree on standard terminology, definitions, diagnostic protocols, and return to play (RTP) protocols for the various cycling disciplines. The intent of this work is to increase the recognition of and sensitivity of diagnosis SRC within elite road cycling and other disciplines, and as a consequence, improve rider welfare.

## Background to the meeting

The consensus meeting concerning cycling-specific SRC was held in Harrogate, the United Kingdom in September 2019. In the lead-up to this conference, eight experts in the field of cycling medicine were invited to participate in the conference and agreement meeting and are the authors of this report.

Prior to the meeting, the experts were asked to perform a review of the existing evidence and prepare presentations of their practical experience and views relating to SRC in cycling. These experts presented their reviews at the conference followed by a discussion of the relevant points. These points are discussed in this commentary. This statement presents the results of the consensus meeting and provides suggestions for the diagnosis and management of SRC in cycling.

## Medical legal considerations

The consensus statement is not intended as a clinical practice guideline or legal standard of care and should not be interpreted as such. This document is only a proposal, and is of a general nature, consistent with the reasonable practice of a healthcare professional. The proposed protocol will evolve as epidemiological evidence on SRC in road cycling develops and feedback is received from interested parties.

## Evaluation of SRC in the field

The panel recognised that the sport of cycling consists of varied disciplines. Some of these (most race events in track cycling, BMX) provide a setting in which a sideline assessment is possible and provide opportunities for management of suspected cases of SRC in line with the Berlin Consensus statement.<sup>6</sup> However, other disciplines (road cycling, marathon mountain biking, cross country mountain biking, and omnium in track cycling) provide challenging circumstances where health care

providers have limited access to participants and in which participants are unable to temporarily discontinue race participation in order to undergo a sideline assessment. These situations require discipline-specific protocols and guidelines which recognise the limitations posed by these circumstances, but nevertheless, improve on the current situation in which SRC may go undiagnosed and lead to continued participation by athletes who may pose a risk to other participants and themselves.

## SRC recognition

A standardised initial screening assessment is needed to determine whether an athlete should be definitively removed from competition or when the athlete can return to play following a suspected head injury event. This first initial screening is based on the principles adopted by the International Rugby Board and have transformed and improved the management of concussion in elite Rugby.<sup>9</sup>

In order to account for the often transient, evolving, or delayed onset of SRC symptoms, serial clinical evaluations are used to optimise the diagnosis of SRC.<sup>10</sup>

The three-stage diagnostic process involves:

1. Initial assessment immediately following potential concussive event,
2. Re-assessment immediately following completion of the race on the same day of the injury, and
3. Re-assessment the day following the initial injury.

Riders are evaluated more regularly if any suspected concussion symptoms are displayed that warrant further evaluation. This protocol stipulates that any presentation of abnormal signs or symptoms confirms SRC diagnosis and can occur at any stage in the protocol, including at either of the two SRC re-evaluation time points.

## Initial assessment immediately following head impact event

The expert panel recognised that in road cycling and mountain biking disciplines, participants may sustain injuries, and SRC in the field when medical personal are not immediately present or not able to readily access the participants.

Riders sustaining traumatic events resulting in a potential SRC need not solely be identified by medical personnel. In situations where the race doctor, the team medical doctor; other team medical doctors, or allied health professionals are not in the immediate proximity of such an event, it is considered acceptable that key team staff may recognise the potential for SRC and take appropriate actions.

## Immediate withdrawal

Medical staff, allied medical staff, key team staff and other participants should alert the participant and/or race officials of the presence of one or more of the Immediate and Permanent Removal features (Table 1) that, if present, warrant immediate and permanent withdrawal from the competition. Education policies are to be implemented by the international federation (i.e., The international Cycling Union, UCI) and national federations to ensure that all race officials, participants, and team staff are aware of these features.

## Roadside or trackside assessment

In the absence of any of the Immediate and Permanent Removal features and where the nature of the incident provides the potential for SRC (broken helmet, significant impact, rider not responding to radio, etc.) but without clear evidence of observable signs or symptoms, race officials, marshals, team staff or other appropriate persons involved in the race should alert the race officials of the potential for SRC. Depending on the context of the race, the participant and the team doctor or race doctor should undergo a standardised assessment at the side of the road or the side of the course. In road cycling, where either the official race doctor or the participant's own team doctor is not available or can not be

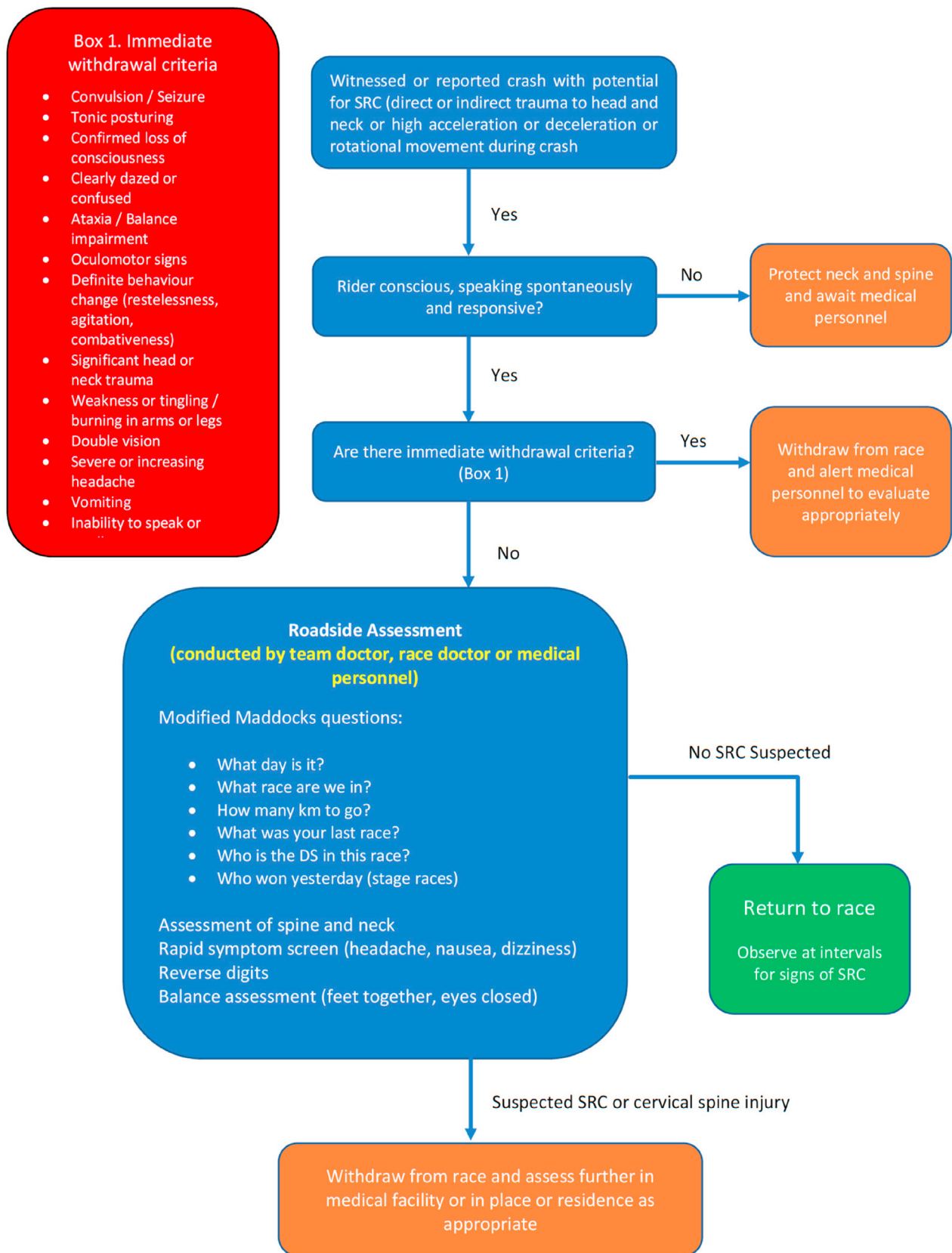


Fig. 1. Sports Related Concussion (SRC) assessment in the field, including immediate recognition and road-side assessment.

**Table 3**  
Progressive return to play activities and progression criteria.

Stage	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Activity	Complete rest	Symptom limited light activity (indoor trainer or non cycling activities) with added rehabilitation	Up to 70% of MHR or 50% of FTP power for up to 30min. Performed on indoor trainer.	Up to 90% of MHR or FTP power for up to 30 min. Performed on indoor trainer. Can follow with 30 min ride in the field with one rider as supervision or 30 min roller session with no errors.	No restriction of intensity or intensity	Return to normal training
Duration	24–48 h	Min 1 day	Min. 1 day	Min. 1 day	Min. 1 day	Min. 1 day
Progression to next stage	24–48 h	When symptom free and preferably only after repeat medical assessment	If no symptoms provoked by exercise (headache, dizziness, nausea)	If no symptoms provoked by exercise (headache, dizziness, nausea) and no roller error or technical error in the field	If no symptoms provoked by exercise (headache, dizziness, nausea) and no technical error in the field	If no symptoms provoked by exercise (headache, dizziness, nausea) and no technical error in the field

contacted within a reasonable duration, the doctor of another team may be requested to perform the roadside assessment.

The expert panel recognised that in both road cycling (and other mountain bike cross country and marathon racing) no opportunity for a “time-out” or substitution exists such as in the field sports such as rugby, football, or other field sport. Any road-side assessment needs to observe a balance between accurate and appropriate assessment, and the need for the participant who has not sustained an SRC to return to competition in a timely fashion and not impact their right to compete.

As such the expert panel recognised that the assessment needs to incorporate a modified version of which considered the current standard for field sports.<sup>11</sup> This assessment should include the features listed in Table 2. The principles of SRC field assessment including immediate recognition and road-side assessment are illustrated in Fig. 1. Any participant who is assessed as having an SRC should immediately be withdrawn from the competition, and as soon as possible, undergo further evaluation in a medical facility (when appropriately indicated) or in the confines of the team's medical support by a suitably trained and qualified medical doctor. The expert panel also recommended that all SRC events are referred to the UCI medical director ([medical@uci.ch](mailto:medical@uci.ch)) to ensure adequate surveillance for injury management and the long term on rider SRC follow-up. Such a provision implies a specific procedure will be put in place by the international federation (i.e., UCI).

#### Re-assessments and further evaluations

The expert panel recognised that the Berlin consensus statement on concussion<sup>6</sup> provides appropriate guidelines regarding the post race assessment of confirmed or suspected SRC. In brief this list includes:

- A medical assessment which includes a comprehensive history,
- A detailed neurological examination including evaluation of mental status/cognition, oculomotor function, gross sensorimotor, coordination, gait, vestibular function and balance, and
- A determination on whether a need exists for emergent neuro-imaging to exclude a more severe brain injury.

This assessment should be repeated the day after the SRC to evaluate the progression of the injury and subsequently at appropriate intervals during the return-to-play (RTP) process.

Assessment of cognitive function is an important component of the post-race SRC management. The expert panel recognised that computerised neurocognitive assessments are commonly used and can aid in the diagnosis and evaluation of SRC, although these components are not essential. These tools are readily available, take little time, but their routine use and validity remain questionable.<sup>12</sup> In addition, post-injury computerised cognitive assessment can assist in RTP decisions, especially when an athlete is clinically asymptomatic in the early stage of the RTP evaluation process.

The expert panel's opinion is that baseline or pre-season assessment

using the Sports Concussion Assessment Tool 5 (SCAT 5)<sup>11</sup> and computerised cognitive assessments are helpful for adding useful information to the overall interpretation of clinical SRC assessment and should be recommended or made mandatory at the elite/professional participation level.

The panel also recognised that newer modalities such as ocular testing using mobile are promising and when available can provide rapid, accurate SRC diagnostic tools. Impairments of vestibular/ocular motor function are commonly associated with concussions. Specific tools such as the Vestibular Ocular Motor Screening (VOMS) could be useful in detecting vestibulo-ocular dysfunction on roadsides, although this test relies on self-reported symptoms and is susceptible to unreliable self-reported subject results.<sup>13</sup> Head impact sensors provide linear and rotational acceleration data that is automatically available for real-time view. However, a large range of linear and rotational forces are recorded at the origin of concussions, suggesting significant variations in thresholds forces at the origin of the injuries.<sup>14</sup> The use of these devices in diagnosing SRC is still being evaluated, and their use should be guided by more global SRV guidelines such as any pending update of the Berlin consensus statement.<sup>13</sup>

#### Return to play

In line with the Berlin consensus statement,<sup>6</sup> this expert panel agreed that after a brief period of rest during the acute phase (24–48 h) of SRC, patients are encouraged to become gradually and progressively more physically active while staying below their cognitive and physical symptom-exacerbation thresholds (the exercise or cognitive load which exacerbates or brings on symptoms). The duration of this period of recovery is dependent on the severity of the initial injury and individual athlete characteristics.

Interventions such as psychological, cervical, and vestibular rehabilitation may be performed during this recovery process and may benefit brain function recovery.

Following the resolution of symptoms, the athlete can return to play following a graduated step wise rehabilitation process. In the sport of cycling, this rehabilitation process necessitates sport specific modalities. The progressive RTP protocol is outlined in Table 3, as documented by Heron et al.<sup>6</sup> The minimum duration from sustaining a SRC and returning to competition is 1 week. This expert panel agreed that junior athletes should undergo a minimum of a 2-week recovery prior to RTP.

#### Conclusions

We hope this paper will allow the formulation and introduction of a cycling-specific SRC assessment and management protocol within the different cycling disciplines. Debate is encouraged with individuals involved in cycling to allow revisions of SRC protocol and to optimise the rider health. These protocols should regularly be reviewed to ensure that protocols offer an evidence-based approach in line with the evolving

evidence-based for SRC assessment and management.

### Submission statement

A version of this document has been published online by the International Cycling Union who initiated this meeting and the subsequent consensus agreement. The purpose of this publication is to alert stakeholders to the implementation of the consensus findings in terms of the management of SRC. The submission to Sports Medicine and Health Science is aimed at peer review prior to publication of these consensus findings.

<https://www.uci.org/docs/default-source/medical/2020-uci-cycling-specific-sport-related-concussion-protocol.pdf>.

### Authors' contributions

All authors participated in the meeting, during which the consensus statements were discussed, debated and agreed upon. All authors contributed to the writing and editing of this manuscript.

### Conflict of interest

The authors declare that there are no conflicts of interest or competing interests.

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