

# Sports-related concussion, mild traumatic brain injury or sport-originated brain injury (SOBI): A more useful term

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**T**raumatic brain injury (TBI) has been reported to be the one injury that will surpass many other diseases as the major cause of death and disability by 2020.<sup>1</sup> There has been a big focus within the sports medicine arena on the incidence and effects of concussions that occur from participation in sporting activities.<sup>2</sup> It has been reported that concussions affect reaction time,<sup>3</sup> memory,<sup>3-5</sup> balance<sup>6</sup> and planning skills.<sup>5</sup> Previous concussions also place the individual athlete at a 1.4-11.1 higher risk of sustaining a subsequent concussion.<sup>7-9</sup>

Sport-related concussion (SRC) or sport-related mild traumatic brain injury (mTBI) are terms often used interchangeably to describe those brain injuries that occur in sport, with concussion more commonly being a non-medical term.<sup>2</sup> Athletes and coaches have used other non-medical terms like “head knock” and “bell ringer” for concussion which minimise the significance of brain injury. Moving away from using the term concussion would be beneficial towards abandoning this entrenched stigma.

Concussion has been described as being a subset of mTBI.<sup>10,11</sup> This is due to the classification of the acute injury characteristics being at the less severe end of the brain injury spectrum reflecting no neurosurgical significance of a pathological injury.<sup>12,10,11</sup> However, although all concussions are

mTBIs, not all mTBIs are concussions. Describing an injury to the brain as mild may cause athletes, members of the general public, and policy makers to misinterpret the seriousness of these injuries, and falsely perceive them as inconsequential.

Attitudes have shifted in the last decade from considering SRC as an insignificant minor injury with no long-term repercussions to a more serious brain injury that requires active monitoring and treatment. These changes in perceptions have been driven mostly by the rapidly evolving evidence within the literature regarding the epidemiology of, underlying mechanisms, symptoms, assessment, rehabilitation/return to play, and potential long-term repercussions of a history of sport related concussion.

To improve the understanding of the seriousness of any brain injury that can result from sport, and to improve clarity surrounding the implications of mTBI and concussion resulting from sporting activities, we have coined the easily remembered abbreviation SOBI for sport-originated brain injury. The term SOBI can be used to describe the mechanical loading and deformation of brain tissue that occurs as a result of impacts to the head or body and transmitted to the head that can occur during sport participation. This loading can then trigger the secondary cascade of neurophysiological impairments resulting in the player presenting clinically with somatic, cognitive, and emotional symptoms.<sup>13,14</sup>

Traditional terminology for SRC had been based upon the grading of the severity of the injury. Although some of these grading scales are still utilised<sup>15,16</sup> it was recommended over several international conferences on concussion in sport<sup>17-19</sup> that the use of grading scales be removed.

Although in 2008<sup>19</sup> it was reported that the terms 'simple' and 'complex' were recommended, the following conference (2012)<sup>20</sup> rejected the terminology as it did not fully define the entities of concussion.<sup>19</sup> However, instead of reporting on the complexity of the injury, by utilising the SOBI terminology, the incorporation of terms such as expected and complicated resolution of SOBI are more appropriate than fast/slow or simple/complex given the terms expected and complicated can be adapted as new evidence emerges within the literature.

Similar to sports injury definitions, to fully understand the extent and nature of SOBI it is necessary to consider the various definitions that have been used for the collation and assessment of head injuries in sport. Studies reporting on the incidence of SOBI have varied in two main areas: (1) the definitions being utilised, and (2) the methodologies being undertaken.<sup>21-25</sup> As a consequence of these variations between studies, the results and conclusions that have been obtained and reported often have some important differences.<sup>21,23-29</sup> A fundamental process, and typically the first step behind the injury prevention process, is ongoing injury surveillance.<sup>21,24,30,31</sup> However, inter-study comparisons may prove to be difficult due to the inconsistencies in the definitions provided and the methodological approaches undertaken.

Van Mechelen et al<sup>21</sup> and Finch<sup>31</sup> have both identified that the use of ongoing injury surveillance is a fundamental process behind successful injury prevention. However, this has proven to be elusive in major sports partially because of the difficulties in forming consistent injury definitions, especially in terms of head injuries.<sup>24,32</sup> The lack of consensus between researchers in terms of methodological approaches, technologies utilised and the definition being utilised have severely limited the ability to compare injury rates between countries.<sup>30</sup> Although several team sports (cricket,<sup>30</sup> football/soccer<sup>33</sup> and rugby union<sup>34</sup>) have published injury

consensus statements in an attempt to obtain more consistent and comparable results from studies undertaken in these sporting activities, there has been no consensus statement for the methodological approaches towards the recording and reporting of SOBI.

The definition of a sports injury has been a frequently debated topic<sup>35,36</sup> and, to date, there has been no universally accepted injury definition for a sports injury<sup>22,37,38,36</sup> nor a sports related concussion.<sup>2</sup> Even though the Concussion In Sport Group (CISG) reports have been supported by several international sporting bodies, and have produced an SRC definition and assessment tool (Sports Concussion Assessment Tool [SCAT]),<sup>18,20,39,19</sup> there have been other definitions published.<sup>40,17,41,42,18,19,43-48,11</sup> Until a universally accepted definition is established, the epidemiological incidence of these injuries will be a challenge.

We recommended that sport-originated brain injury (SOBI) should be the term used to describe an injury to the brain resulting from mechanical loading and deformation of brain tissue as a result of impacts due to sporting activities. This recommendation is based on our experience in talking with patients and health professionals and from our review of terminology used in the literature.

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