

The Concussion Recognition Tool 5th Edition (CRT5)

Ruben J. Echemendia¹, Willem Meeuwisse², Paul McCrory³, Gavin A. Davis⁴, Margot Putukian⁵, John Leddy⁶, Michael Makdissi⁷, John Sullivan⁸, Steven P. Broglio⁹, Martin Raftery¹⁰, Kathryn Schneider¹¹, James Kissick¹², Michael McCrea¹³, Jiri Dvorak¹⁴, Allen K. Sills¹⁵, Mark Aubry¹⁶, Lars Engebretsen¹⁷, Mike Lossemore¹⁸, Gordon Fuller¹⁹, Jeffrey Kutcher²⁰, Richard Ellenbogen²¹, Kevin Guskiewicz²², Jon Patricios²³ and Stanley Herring²⁴

1. University Orthopaedic Center, Concussion Care Clinic, State College, PA, USA; University of Missouri-Kansas City, Kansas City, MO, USA.
2. Medical Director, National Hockey League
3. The Florey Institute of Neuroscience & Mental Health, University of Melbourne, Heidelberg, Australia
4. Murdoch Children's Research Institute & Florey Institute of Neuroscience and Mental Health, Melbourne, Victoria, Australia.
5. University Health Services, Princeton University, Princeton, NJ, USA, Rutgers-Robert Wood Johnson Medical School, New Brunswick, NJ USA
6. University at Buffalo Concussion Management Clinic, UBMD Orthopaedics and Sports Medicine; SUNY Buffalo Jacobs School of Medicine and Biomedical Sciences, Buffalo, New York, USA
7. The Florey Institute of Neuroscience and Mental Health, Melbourne, Australia
8. Centre for Health, Activity, and Rehabilitation Research, School of Physiotherapy, University of Otago, Dunedin, New Zealand
9. NeuroTrauma Research Laboratory, University of Michigan, Ann Arbor, MI, USA
10. Chief Medical Officer, World Rugby. Dublin Ireland
11. Sport Injury Prevention Research Centre, Faculty of Kinesiology; Alberta Children's Hospital Research Institute for Child & Maternal Health, Cumming School of Medicine; Hotchkiss Brain Institute, University of Calgary, Calgary, Alberta, Canada.
12. Carleton University Sport Medicine Clinic; University of Ottawa Dept of Family Medicine; International Paralympic Committee Medical Committee
13. Department of Neurosurgery, Medical College of Wisconsin, Milwaukee, Wisconsin, USA
14. Neurology Department, Schulthess Clinic Zurich, Switzerland.
15. Department of Neurosurgery, Vanderbilt University, Nashville, TN
16. Ottawa Sport Medicine Centre
17. Medical and Scientific Department, International Olympic Committee, Lausanne, Switzerland and Department of Orthopaedic Surgery, Oslo University Hospital, Oslo, Norway
18. Institute of Sport Exercise and Health. University College Hospital. London. UK
19. Centre for Urgent and Emergency Care Research, University of Sheffield, UK
20. The Sports Neurology Clinic, Brighton, Michigan, USA
21. Department of Neurological Surgery, University of Washington, USA
22. [Matthew Gfeller Sport-Related TBI Research Center, University of North Carolina at](#)

Chapel Hill; Chapel Hill, NC, USA

23. Section Sports Medicine, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa; Department of Emergency Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

24. Departments of Rehabilitation Medicine, Orthopaedics and Sports Medicine and Neurological Surgery, University of Washington, Seattle, Washington, USA

Short title: CRT5

Corresponding Author: Ruben J. Echemendia
University Orthopedic Center Concussion Care Clinic
101 Regent Ct.
State College, PA 16801

Phone: (814) 235-5588

FAX: (814) 472-0034

Email: rechemendia@comcast.net

Statistics:

word count (excluding abstract, tables, and references):

Author Note: To the editor-in-chief of BJSM, Dr. Karim Khan, the present paper has been commissioned by Professor Lars Engebretsen and is intended to be part of the BJSM IPHP theme issue on concussion in March 2017. This paper is internally reviewed by the expert group represented at the Berlin Consensus meeting on Concussion in Sport in October 2016. The SCAT5 assessment tool will be uploaded once artwork is complete.

Abstract

The Concussion Recognition Tool 5 (CRT5) is the most recent revision of the Pocket SCAT2 that was initially introduced by the Concussion In Sport Group in 2005. [1] The CRT5 is designed to assist non-medically trained individuals to recognize the signs and symptoms of possible sport-related concussion (SRC) and provides guidance for removing an athlete from play/sport and to seek medical attention . This paper presents the development of the CRT5 and highlights the differences between the CRT5 and prior versions of the instrument.

Key Words: Sports, Concussion, Brain Injury, Assessment

Introduction

The Concussion In Sport Group (CISG) first developed the Sport Concussion Assessment Tool (SCAT)[1] during the 2nd International Consensus Conference on Concussion in Sport, held in Prague, 2004, to serve as an educational tool for the public and to assist medical providers in evaluating sport-related concussion (SRC). The SCAT has been revised several times with the most recent in 2016, as the SCAT5 for adults [2] and the Child SCAT5 for children under 13. [3] All versions of the SCAT were designed for use by healthcare professionals. However, the CISG was acutely aware that healthcare professionals are not present at most athletic events, particularly in youth or recreational leagues. The Pocket SCAT2 was published in 2009 following the 3rd International Consensus Conference in Zurich. [4] The purpose of the Pocket SCAT2 was to provide a tool for the lay person to help recognize the signs and symptoms of sport-related concussion (SRC) in all age groups and to provide guidance for removing an athlete from play/sport and to seek medical attention. The Pocket SCAT2 was comprised of concussion symptoms, a brief assessment of basic memory, and balance testing. The Pocket SCAT2 was revised by the CISG in 2012 following the 4th International Consensus Conference[5] and renamed the Pocket Concussion Recognition Tool (Pocket CRT). The Pocket CRT maintained the focus on use by lay persons and expanded the tool to include more complete suggestions for identifying possible concussions through the use of visible or observable signs (e.g. loss of consciousness [LOC] or lack of responsiveness, balance problems or motor incoordination, confusion)

and symptoms (e.g. headache, dizziness, visual disturbances). The basic memory function questions were retained from the Pocket SCAT2. New to the Pocket CRT was the inclusion of “red flags” (e.g. increasing confusion, repeated vomiting, seizures or convulsions) that may signal the need for emergency transport to a medical facility. Explicit instructions were also provided for what to do for athletes with suspected concussion (e.g. basic first aid principles, do not move athlete, do not remove helmet, etc.).

Methods

The CISG met in Berlin in 2016 at the 5th International Consensus Conference on Concussion in Sport. The consensus process followed the approach previously employed by the CISG.[6] A subset of the expert panel met on a separate day and were tasked with reviewing the Pocket CRT and asked to provide recommendations for improving the tool, which was to be named the Concussion Recognition Tool 5 (CRT5). The version number (5) was chosen to align the version number with the consensus meeting number. To be explicit, there are no CRTs 2, 3 or 4. The number of the instrument refers to the number of the Concussion in Sport Group meeting – in this case 5 – Berlin (2016). Although the CRT was not the subject of a dedicated systematic review, an extensive series of related reviews were performed to inform the CRT revision process.

Results

The CRT5 expert panel underscored the importance of continuing to provide a “recognition and removal” tool for the layperson. Two key concepts guided the development of the CRT5: (1) maintain continuity with its predecessor, the Pocket CRT; and (2) improve consistency between the SCAT5 and the CRT5, while recognizing the different needs/experience of the users. With these objectives in mind, the following we included the following modifications in the CRT5.

Table 1. CRT5 Modifications

- A greater emphasis on the goals of the CRT5: Recognize and Remove.
- An expressed statement that the CRT5 is not to be used to diagnose concussion.
- An expansion of the Red Flags section including emphasis on calling an ambulance.
- Instruction that the presence of any red flag requires immediate medical attention.
- Clarification that if no red flags are present continued use of the tool is warranted.
- A list of visible signs of concussion and symptoms that is consistent with the SCAT5.
- A symptom list that is divided by type of symptom (e.g. somatic, cognitive, emotional) to facilitate identification of possible concussion, and language appropriate for both adults and children.
- Change from Memory Function to “Awareness” questions with instructions that the questions should only be used in athletes older than 12 years.
- Emphasis added on explicit instruction that any athlete suspected of concussion should be immediately removed from play and not returned to activity until assessed medically.
- Cautions issued regarding acute management and restrictions on behaviors (e.g. drinking alcohol, driving, use of drugs).

Discussion

The CRT5 is modeled after its predecessor, the pocket CRT and is a tool for individuals who do not have medical training to recognize possible SRC and to take appropriate steps if a SRC is suspected. Although complementary to the SCAT5, the CRT5 serves a different purpose and is not to be used in the medical diagnosis of concussion. Rather, it is for use by lay people to guide the recognition of symptoms and signs of possible concussion and to assist with transferring such athletes to an appropriate health professional. Very little research has been conducted on the utility or efficacy of these tools in improving the detection and management of SRC. It is our goal to widely disseminate the CRT5 in multiple languages and we hope that research groups embrace the task of assessing the utility of this tool.

References

1. McCrory, P., K. Johnston, W. Meeuwisse, M. Aubry, R. Cantu, J. Dvorak, T. Graf-Baumann, J. Kelly, M. Lovell, and P. Schamasch, *Summary and Agreement Statement of the Second International Conference on Concussion in Sport, Prague 2004*. *Physician & Sportsmedicine*, 2005. **33**(4): p. 29-36;41-44.
2. Echemendia, R., G. Davis, M. Putukian, J. Leddy, M. Makdissi, J. Sullivan, S.P. Broglio, M. Rafferty, K. Schneider, J. Kissick, W. Meeuwisse, P. McCrory, M. McCrea, J. Dvorak, A. Sills, M. Aubry, L. Engebretsen, M. Lossemore, G.W. Fuller, J. Kutcher, R. Ellenbogen, and S. Herring, *The Sport Concussion Assessment Tool 5th Edition (SCAT5)*. *British Journal of Sports Medicine*, 2017.
3. Davis, G.A., L. Purcell, K. Schneider, K.O. Yeates, G. Gioia, V. Anderson, R. Ellenbogen, R.J. Echemendia, M. Makdissi, A. Sills, G.L. Iverson, J. Dvorak, P. McCrory, and W. Meeuwisse, *The Child Sport Concussion Assessment Tool 5th Edition (Child-SCAT5)*. *British Journal of Sports Medicine*, 2017.
4. McCrory, P.M., Willem; Johnston, Karen; Dvorak, Jiri; Aubry, Mark; Molloy, Mick; Cantu, Robert, *Consensus statement on concussion in sport - the Third International Conference on Concussion in Sport held in Zurich, November 2008*. *The Physician and sportsmedicine*, 2009. **37**(2): p. 141-59.
5. McCrory, P., W. Meeuwisse, M. Aubry, B. Cantu, J. Dvorak, R. Echemendia, L. Engebretsen, K. Johnston, J. Kutcher, M. Raftery, A. Sills, B. Benson, G. Davis, R. Ellenbogen, K. Guskiewicz, S.A. Herring, G. Iverson, B. Jordan, J. Kissick, M. McCrea, A. McIntosh, D. Maddocks, M. Makdissi, L. Purcell, M. Putukian, K. Schneider, C. Tator, and M. Turner, *Consensus statement on Concussion in Sport--the 4th International Conference on Concussion in Sport held in Zurich, November 2012*. *J Sci Med Sport*, 2013. **16**(3): p. 178-89.
6. McCrory, P., W. Meeuwisse, M. Aubry, B. Cantu, J. Dvorak, R. Echemendia, L. Engebretsen, K. Johnston, J. Kutcher, M. Raftery, A. Sills, B. Benson, G. Davis, R. Ellenbogen, K. Guskiewicz, S.A. Herring, G. Iverson, B. Jordan, J. Kissick, M. McCrea, A. McIntosh, D. Maddocks, M. Makdissi, L. Purcell, M. Putukian, K. Schneider, C. Tator, and M. Turner, *Consensus statement on Concussion in Sport - The 4th International Conference on Concussion in Sport held in Zurich, November 2012*. *Phys Ther Sport*, 2013. **14**(2): p. e1-e13.

Insert CRT5 to be uploaded as a separate file once artwork is complete.