

Fifty Shades of Grey Matter: Concussion Complexities and Constructive Conclusions

Drs Jon Patricios¹ and Michael Makdissi²

Corresponding author: Dr Jonathan Speridon Patricios; PO Box 1267, Parklands 2121, Johannesburg, South Africa; jpat@mweb.co.za; fax +27 11 2825165

¹ Sports Concussion South Africa, Johannesburg, South Africa; The Section of Sports Medicine, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa; The Department of Emergency Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa.

² The Florey Institute of Neuroscience and Mental Health, Austin Campus, Melbourne Brain Centre, University of Melbourne, Australia; The Centre for Health, Exercise and Sports Medicine, University of Melbourne, Australia

Neither of the authors have any competing interests to declare.

Dr Patricios and Makdissi both contributed to the content, design and drafting of the paper; Dr Patricios was primarily responsible for drafting the paper whilst Dr Makdissi critically reviewed and revised the manuscript in accordance with ICMJE criteria.

Key words: concussion; head injuries; clinical assessment

Word count: 1026

This work received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Running title: Fifty Shades of Grey Matter

Concussion remains prominent in the medical and scientific literature but its assessment and management remains somewhat “grey” and ill defined. The key issues related to concussion are widely discussed in the public arena. While these discussions should contribute to an improved understanding of concussion in the broader community, confusing messages are being driven by different agendas.

Questions being asked

Quarrie and Murphy [1] question the relevance of current concussion consensus definitions, [2] particularly as they translate to the real world. The authors make pragmatic recommendations. Specifically they suggest that the increasing incidence of concussion may be partly due to the expanded “theoretical” definition and that changes in the manner in which the SCAT3 is implemented and interpreted may more accurately diagnose the condition.

Similarly, a number of recent articles have highlighted the fact that the “theoretical definition” of concussion as outlined in the current Zurich statement, lacks sensitivity and specificity. Furthermore, basic concepts of concussion management, such as a period of absolute rest and graded return to play, lack a strong evidence base. [3,4] Increasingly, concussion in sport appears to have become “a grey area about grey matter” with an increasingly wide net cast to capture more cases, the management of which remains subject to varied opinion and some conjecture.

Concussion is not unique

“Shades of grey” are not unique to the field of concussion. Authors have highlighted conditions such as Raynaud’s disease and fibromyalgia where symptoms, signs and other measures occur along a continuous spectrum of severity and where, in the absence of clearly defined pathology, no satisfactory gold standard exists. [4,5] In these instances, the importance of expert clinical opinion has been highlighted. [6]

Dissociating the public message from a clinical strategy

Concussion has a high public health profile. Sporting communities are increasingly sensitive to both the potential acute effects of concussion and increasingly, the possible long-term sequelae of repetitive traumatic brain injury [7]. In such an environment it is easy for clinicians to be drawn in to appeasing the public's desire for a simplified approach to a complex issue. [8] There is a risk of oversimplifying science for the sake of a dogmatic and politically exploitable public health message. Many of the most alluring concussion-related articles appearing in the lay press conform to this unsophisticated rubric and do a disservice to the clinical complexity of evaluating injured grey matter.

The public mantra....

In concussion management the only unambiguous public message must be that of "Recognise, Remove and Refer". To this end, the Zurich definition and extensive symptom complex are necessarily broad, encompassing some exercise-associated conditions that may not be related to traumatic brain injury. Both screening tools and awareness campaigns need to be simple and sensitive enough to allow paramedical and layperson field side decision-making.

....vs the clinical complexity

Two key aspects of Zurich's "theoretical definition" are the acknowledgement that concussion is "complex" and that the diagnosis is "clinical". The clinical significance and potential sequelae of sports-associated head injuries should remain at the forefront of the clinician's mind when assessing these injuries, namely that concussions may mimic other injuries, be life threatening, cause prolonged symptoms and have the potential for long term compromise.

Such a spectrum of complex clinical issues is not unique to traumatic brain injury and requires astute medical evaluation, often serially. It is the role of medical doctors to evaluate the history, consider

confounding variables (“modifying factors”), perform general, systemic and functional examinations, order and interpret appropriate investigations and repeat this process as necessary to determine the best course of action for the patient. None of this fits into a neat “package” suitably digestible by the public or other key stakeholders (such as politicians or sports administrators).

Long-term perspective

Similarly, the long-term risks of concussion remain incompletely defined and even speculative, leading to heightened public concern.(3, 9) A lack of data leaves a void between the injury itself and the histological changes seen in the cohort of cases described under the umbrella of CTE. [6] Research looking at more clinical (as opposed to pathological) indicators of neurological compromise in repeated concussions may well help us better explain this expanding “grey” area of neuroscience.

Management quandaries

Murphy as well as others’ assertion that return-to-play guidelines are not evidence-based. [1,2] This is true. The Zurich Guidelines are aimed at maximum risk reduction rather than individually appropriate and comprehensive management of cognitive and exercise exposure. The competent clinician is not precluded from customising an appropriate approach.

The role of SCAT3

Quarrie and Murphy make a valid point regarding the appropriate and more consistent use of the SCAT3. We emphasise that the SCAT3 is a screening tool that fits more into the “recognise and remove” ambit rather than serving as a definitive clinical template. Ultimately the office management of concussion requires experience in treating head injuries and experienced clinical judgment. Expert

clinicians must be able to distinguish concussion from its differential diagnoses that include organic brain pathology and many other causes. As much as they convey the message “concussion is serious and I suggest the following exercise and cognitive rest strategy”, clinicians need to be able to say “I really don’t think that you are concussed, let’s look elsewhere for a cause of your symptoms”. Sifting through shades of grey is our responsibility.

Constructive conclusions

Quarrie and Murphy add to recent work that is constructively critical of current consensus definitions and practices and calls for a more pragmatic definition, greater emphasis on excluding differential diagnoses and a more flexible management algorithm. Divorcing the public awareness message of “if you suspect it, refer it” from the integrated clinical assessment and management strategy that should follow, might require clarification in future consensus frameworks and has been successfully employed in sports such as Rugby. Future consensus documents may well target a broader spectrum of clinicians likely to encounter concussion such as ER specialists and family practitioners. Once at the doctor, fifty cases of injured grey matter may require fifty different approaches that benefit from experienced clinical input. Concussion is not the only conundrum doctors have faced that requires intuition, insight and individualisation. Public opinion may be black-and-white but clinical neuroscience isn’t. We deal in shades of grey matter.

References

1. Quarrie KL and Murphy IR. Towards an operational definition of sports concussion: identifying a limitation in the 2012 Zurich consensus statement and suggesting solutions. *Br J Sports Med* doi:10.1136/bjsports-2014-094112 [published Online First: 25 September 2014]

2. McCrory P, Meeuwisse WH, Aubry M et al. Consensus statement on concussion in sport: the 4th International Conference on Concussion in Sport held in Zurich, November 2012. *Br J Sports Med.* 2013 Apr;47(5):250-8.
3. Kirkwood MW, Randolph C and Yeates KO. Sport-Related Concussion: A Call for Evidence and Perspective Amidst the Alarms. *Clin J Sport Med* 2012;22(5):383-4
4. Craton N and Leslie O. Time to Re-think the Zurich Guidelines? A Critique on the Consensus Statement on Concussion in Sport: The 4th International Conference on Concussion in Sport, Held in Zurich, November 2012. *Clin J Sport Med* 2014;24(2):93-5
5. Coggon D, Martyn C, Palmer KT and Evanoff BA. Assessing case definitions in the absence of a diagnostic gold standard. *Intl J of Epidemiol* 2005;34:949–952
6. Katz JN, Stock SR, Evanoff BA et al. Classification criteria and severity assessment in work-associated upper extremity disorders: Methods matter. *Am J Ind Med* 2000;38:369–72.
7. McKee AC, Cantu RC, Nowinski CJ et al. Chronic traumatic encephalopathy in athletes: progressive tauopathy after repetitive head injury. *J Neuropathol Exp Neurol.* 2009;68(7):709-35
8. Shades of grey. It is risky to oversimplify science for the sake of a clear public-health message. *Nature* 2013;497:410.
9. Gardner A¹, Iverson GL and McCrory P. Chronic traumatic encephalopathy in sport: a systematic review. *Br J Sports Med.* 2014 Jan;48(2):84-90.