

## Concussions

### Background

Because of the possibility of neurological damage, traumatic brain injuries are particularly serious and warrant attention. In recent years there has been growing attention to the problem of sport related concussions, with much of this deriving from media reports of debilitating conditions arising from traumatic brain injuries (a category that includes but is broader than concussions) among male professional athletes, particularly in football and hockey. There is also growing attention to concussions across all levels of sport and among both male and female athletes in a range of sports.

A concussion is a brain injury induced by forces caused by a direct blow to the head, face, neck or elsewhere on the body wherein force is transmitted to the head. Concussions typically result in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. In some cases, symptoms and signs may evolve over a number of minutes to hours. It is important to note that in some cases symptoms may be prolonged (McCroory, 2012).

Information on concussions is particularly difficult to obtain because of variable definitions, clinical indicators and reporting procedures, including reliance on self-reporting.

### Facts & Research Findings\*

Research on the incidence of concussions generally shows higher rates among female athletes at both the collegiate and high school levels. Particular attention has been given to analyses in soccer and basketball, where men and women play by similar rules and ice hockey, a sport that is largely similar in the men's and women's game with the important difference that intentional body checking is prohibited in the women's game. Data for all three sports show higher rates among females at both the high school and collegiate levels (Hootman, Dick & Agel, 2007; Dick, 2009; Rosenthal et al., 2014).

Even more alarming is that there is emerging evidence that indicates that female soccer players playing elite or select soccer before high school sustained concussions at a rate higher than their high school and college counterparts, most continued to play despite experiencing symptoms, and less than half sought medical attention. Analyzing data collected



over a four-year period from 351 players between the ages of 11 and 14 on elite and travel soccer teams, researchers at the University of Washington found a concussion rate four times higher than the rate in the most recent study of high school soccer players (O'Kane, et al., 2014).

Findings of higher incidence of concussions among women athletes are a subject of debate. Reported gender difference in incidence may be the result of measurement differences, in the form of more frequent self-reporting by females or in injury surveillance and diagnosis, with greater attention among health professionals to identification of injuries in women's sport (Arnold, 2014; Dick, 2009).

There is little evidence on possible reasons for gender differences in the incidence of concussions. The greatest attention has been directed to head and neck size and musculature although there is little evidence on how these figure in the mechanism of the injury. There also has been some discussion of hormonal influences though again, there is little research on the role that hormones may play in the occurrence of the injury (Covassin et al., 2011).

There also is evidence of gender differences in the outcomes of concussions with evidence suggesting that female athletes present more concussion symptoms acutely, take a longer period to recover from concussions and report a greater

number of and more prolonged post-concussion symptoms than male athletes (Dick et al., 2009; Covassin et al., 2011).

As with data on gender differences in incidence, findings on presentation of symptoms and recovery are confounded by difference in measurement and reporting, as well as findings of baseline differences between men and women on a variety of neurological variables (Covassin et al., 2011).

The cornerstone of concussion management is physical and cognitive rest until the acute symptoms resolve and then a graded programme of exertion prior to medical clearance and return to play. Evidence on the need for gender specific protocols in the management of concussions is inconclusive (McCrory et al., 2013).

Among women, the mechanism of concussion is most often contact with a surface or ball, rather than with another player (Dick, 2009).

## Prevention

A variety of strategies to prevent concussions have been identified, including equipment, rule changes and enforcement, refereeing, coaching technique, neck strength, emphasis on fair play, education and legislation (Benson et al., 2013). There is varying evidence on each of these and no conclusive evidence on the effects of any one strategy (Benson et al., 2013; McCrory et al., 2012).

Considerable attention has been focused on the use of protective equipment, including mouth guards and helmets. While there is evidence that this equipment can contribute to reduction of dental and facial injuries and skull fractures, there is limited evidence of their impact on concussions, which are caused by the impact of force transmission (Benson et al., 2013; McCrory et al., 2012).

There is evidence that individuals with a history of concussions have a lower threshold for subsequent concussions, which are also more severe. This risk of "second impact" concussion has prompted heightened attention to the management of initial injury, as a prevention strategy for subsequent injury. These efforts are focused on the importance of identifying the initial injury and proper management to reduce the risk of subsequent injury (Wilson, 2010).

Notwithstanding debates about the accuracy of findings of gender difference in the incidence, experience and outcomes of concussions, there is agreement that concussions are a serious injury, with potentially serious consequence for all athletes and growing awareness and attention to the problem of sport related concussions is an important step addressing this sport-related health concern.

## References

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