

Brain injury and heading in soccer

Head to ball contact is unlikely to cause injury but head to head contact might

Whether repeated concussive or subconcussive blows cause permanent or cumulative brain injury is a complex and controversial question. Press coverage highlighted the case of Jeff Astle, a former England international football player, where the coroner ruled the cause of his death as an “industrial disease”—suggesting that repeated heading of balls during his professional career was the cause of his subsequent neurological decline.¹ This case was at odds with that of Billy MacPhail, a former Glasgow Celtic player, who in 1998 lost a legal battle to claim benefits for dementia that he said was due to heading the old style leather footballs. Concern has been raised over whether heading in soccer may be the basis for injury and cognitive impairment, and in the United States this has led to calls advocating the use of protective headgear for soccer players.

Soccer players don't just head the ball; their heads can collide with each other, and players in positions where heading is common are also more likely to have head to head collisions more often. Although uncommon, most concussive injuries seen in soccer derive from such head to head rather than ball to head contact.²

Heading a soccer ball results in head accelerations of less than 10 g (or less than 1000 rad/s²) whereas the minimum values for the development of sport related concussion are 40-60 g (or 3500-5000 rad/s²).^{3,4} In contrast, head to head contact can generate enough of the forces required to cause brain injury as in any conventional head injury. Recent biomechanical research has found that commercially available soft helmets fail to reduce even this degree of head trauma to a safe level, which implies that these helmets have only a limited protective role in this setting.⁵

There is no evidence that sustaining several concussions over a sporting career will necessarily result in permanent damage.⁶ Research on experimental animals provides some supporting evidence against the concept that recurrent concussive injuries alone cause permanent damage. In studies of experimental concussion, animals have been subjected to repeated concussion 20-35 times in a two hour period. Despite the unusually high number of injuries no residual or cumulative effect was shown.⁷

Can repeated subconcussive trauma such as might be seen in heading the ball cause a cumulative neurological injury in this setting? Although this was indicated by early retrospective studies, more recent studies have not supported this idea.⁸⁻¹⁰



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In a series of retrospective studies including retired Scandinavian soccer players, cognitive deficits were noted.^{11,12} The results of these studies are flawed, with appreciable methodological problems. These problems include the lack of pre-injury data, selection bias, failure to control for acute head injuries, lack of blinding of observers, and inadequate controls. The authors conclude that the deficits noted in these former soccer players were explained by repetitive trauma such as heading the ball. However, the pattern of deficits seen is equally consistent with alcohol related brain impairment—a confounding variable that was not controlled for.

Matser et al from the Netherlands have also implicated both concussive injury and heading as a cause of neuropsychological impairment in both amateur and professional soccer players.^{2,13} Reanalysis of the data from these papers, however, indicates that purposeful heading may not be a risk factor for cognitive impairment.¹⁴

Prospective controlled studies using clinical examination, neuroimaging, or neuropsychological testing have failed to find any evidence of cognitive impairment in soccer players.⁸⁻¹⁰

We do not know for certain whether heading the ball in soccer may result in chronic cognitive impairment. It seems unlikely that subconcussive impacts such as seen in head to ball contact will cause chronic neurological injury. Although head to head contact may cause concussive injury, it is both uncommon and unlikely to result in cumulative brain injury. It has been speculated from other sports that particular genotypes may place athletes at heightened risk in

association with head trauma, although this is yet to be validated in other studies.¹⁵

For football players the avoidance of exposure to brain injury is important, although currently there are few means by which this may be achieved. Most head to head contact is inadvertent, and coaching techniques and visual perception training may help in a few cases but are unlikely to eliminate this problem entirely. Soft shell helmets or head protectors currently do not have the biomechanical capability to prevent concussive trauma and hence cannot be recommended.

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Self reports in research with non-English speakers

The challenge of language and culture is yet to be met

Assessment of the health and healthcare needs of ethnic minority populations, often relying on self reported data, is important in health and social services.¹ Major problems exist with the reliability of such information, particularly among recent and older immigrants and refugees who may have little or no competency in English and may be at high risk of health problems. Approximately 23% of immigrants to Britain born in China, Bangladesh, India, and Pakistan have no functional skill in English, and 70% cannot function fully in an English speaking social environment.²

When a measure is probing differences within a group it must be appropriate, valid, and reliable for the group concerned. However, if the data are to be used to make comparisons between groups as in clinical trials and most epidemiological studies, then the questions must be conceptually and functionally equivalent and appropriate for all the groups compared. Non-English speakers are often excluded from clinical trials and epidemiological studies, for reasons including the lack of valid and reliable cross cultural measurements.³

In clinical and epidemiological studies questions developed for native English speakers are usually translated into other languages. It is assumed that the modes of inquiry appropriate for native English speakers are applicable to other linguistic groups. These assumptions may reflect pragmatic issues relating to time and finance or lack of understanding of the complexities of language and culture. Translations, even by experts, may fail to achieve questions that are comparable to the original English in terms of appropriateness and meaning.⁴ It is therefore important to consider conceptual matters, cultural relevance, and the subtle connotations of words and phrases.

In multilingual studies, if each language is translated and compared to the English, each may

resemble the English version, but the different non-English languages may differ in important ways, sometimes because it is impossible to find equivalent translations. For example the term “feeling blue,” used in the original American version of the short form questionnaire 36 (SF-36), has different connotations in different languages⁵ whereas the terms “check up” and “Pap smear” have no conceptual equivalent in any Chinese language.⁶

Research in our department, analysing the translation of local and national health surveys, has uncovered numerous potential problems—for example, asking Muslims whether they drink more at Christmas, and the use of terms such as “weekend” and “hangover” with questionable relevance to some ethnic groups.⁷ Detailed examination of translations of the Rose angina questionnaire into Punjabi and Cantonese has highlighted subtle issues potentially explaining the recently shown lesser validity of this instrument in South Asian populations.⁸

In face to face interviews complications arise where different forms of the same language are used—for example, Bengali and the Sylheti variant of Bengali, the latter having no written form. For some languages the written and spoken forms are not the same—for example, Arabic or Cantonese. At interview the questions asked will not be the same as the questions written on the questionnaire or interview schedule, with unknown effects on data quality.

An alternative to seeking cross cultural equivalence is to define issues as, firstly, salient and meaningful within a culture, for example, chewing paan, and, secondly, concerns of salience between cultures, for example, smoking tobacco. This strategy requires a participatory approach whereby monolingual and bilingual representatives of the target group(s) are