Do mouthguards prevent concussion?

One of the most commonly held myths in sports medicine is the premise that wearing a mouthguard will prevent concussion. The origins of this contention are obscure, but an evidence based review of the scientific support for this concept has not been previously published.

Evidence for protective effect of mouthguards in sporting injury

The evidence of injury protection by the use of mouthguards is mostly based on case series and retrospective injury surveys. Many authors quote a self reported history of dental injury before the use of mouthguards as the evidence for a protective effect.21–23

When injury surveys of individual teams are reported, the numbers of injuries are generally too low to draw adequate conclusions from the use of mouthguards. In a large cross sectional study of university rugby, no significant protective effect for any type of injury was shown in mouthguard users.24 Other authors, however, have shown different results. In a questionnaire study of high school basketball, wearers of mouthguards had a 10-fold reduction in dental injuries compared with non-wearers. Most of these injuries were lip lacerations, and no difference was found in relation to brain or spinal injury.25

Evidence for concussion prevention by mouthguards

Although many authors claim that mouthguards offer an effective means of preventing concussion and spinal injuries,22–24 the evidence for this statement is limited. Two papers are usually cited to support this contention, and these deserve particular analysis.25 26

The first is by Stenger et al.,25 who claimed benefit for both head and cervical spinal injuries by mouthguard use. The authors reported their experience of a season of gridiron football by the Notre Dame University team. In this paper, they anecdotally reported five cases of their experience in which mouthguard use had abolished the symptoms of Meniere’s disease, cervical nerve root compression, chronic “burners” (cervical radicular syndrome), dizzy spells/low back pain, and, in one case, repeated concussion. They also noted that there were “six or seven” players within the team who required cervical traction before matches and that the need for such traction was abolished by regular mouthguard use. In the football season, there were a total of 10 cases of concussion and four dental injuries, providing insufficient data for statistical analysis of protective effect.

The authors also showed that with a mouthguard in situ, there was an altered mandibular position on lateral skull radiographs, so that the condyles were distracted from their fossae. On this basis, the authors postulated that forces from mandibular impact applied to the head and neck would be attenuated, resulting in fewer injuries. Their evidence however, is at best speculative.

The second commonly cited paper is by Hickey et al.,26 who showed in a cadaver model that a mouthguard could attenuate the forces applied to the head as the result of a blow on the point of the chin.27 Using an intracranial pressure transducer, a decrease of about 50% was noted in the amplitude of the intracranial pressure wave after impact. There are a number of methodological concerns with this study, such as the difference in skull compliance between a cadaveric skull and a live human skull and the use of a fixed skull in the experimental model, which has previously been shown to alter the nature of the brain injury sustained.27
Although an interesting observation, neither pure linear acceleration nor changes in intracranial pressure after impact is the basis for diffuse brain injuries such as concussion. This has been extensively studied in animal and human models. Intracranial pressure changes are, however, related to focal brain injuries such as contrecoup injury. To give the authors credit, they did not claim a beneficial effect for concussion or other forms of brain injury but simply reported their observations. Subsequent authors, who cite this research, often uncritically, have attributed a significance to these findings that may not have been intended by the original authors.

Conclusions
The ability of mouthguards to protect against head and spinal injuries in sport falls into the realm of “neuro-mythology” rather than hard science. Reading the original studies cited as evidence for this effect reveals anecdotal claims that can best be described as bizarre rather than reflecting established medical principles. It is unlikely that a mouthguard would offer effective protection against brain or spinal cord injury, and the limited published data are not compelling in this regard nor does it accord with the known pathophysiology of such injuries.

At this stage, there is no convincing evidence to support a protective effect against any type of sporting injury. This is largely because studies with sufficient power have not yet been performed. Absence of proof is not proof of absence. It is critical that a randomised controlled trial of sufficient power is performed to answer this question so that sports clinicians can accurately advise athletes of safety issues and the best means of preventing injury.

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