

The prevention of traumatic brain injury

Prevención del traumatismo craneoencefálico

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Introduction

Although in sports in general, and in contact sports and speed sports in particular, there is a risk of sustaining traumatic brain injuries either due to sport-specific mechanisms or to other accidental mechanisms, prevention strategies can considerably reduce their occurrence, intensity and structural and functional injury. These measures span a broad spectrum, ranging from an education in values directed at athletes up to changes in the sports regulations, the use of protections and the materials used in sports^{1,2}.

Use of protections

The concept of sports protection includes the use by athletes of protective items such as a helmet or mouthguard, as well as safety guards, padding and coverings for static equipment on the playing field, such as the basketball base and the goalpost bases on the rugby pitch.

Sports regulations for numerous contact and speed sports require the use of specific helmets for each type of sport (boxing, martial arts, American football, ice hockey, Alpine skiing, cycling, etc.) given the evidence on their preventive and protective effect against traumatic brain injury, although not all studies have demonstrated their protective effect against structural brain damage^{3,4}. Over the last decade, the use of new sports helmet designs and materials has successfully increased protective performance against different impact intensities and linear acceleration (establishing for example the risk of fracture at impacts greater than 200-300 g.). However, there is a need to consider other factors such as rotational acceleration and the Gadd Severity Index (which relates the duration of the impact producing cerebral motion with the magnitude of the cerebral translation) in order to achieve more specific protection with regard to isolated intense trauma cases and to repetitive cases of a lower magnitude^{3,4}.

Changes in the regulations

Another important prevention strategy is the adaptation of the sports rules and regulations in order to reduce trauma injuries by direct contact between players, as well as to optimise medical assistance in those cases in which an accident occurs.

In some sports, such as American football, the change in the regulations prohibiting direct head contact among players is a good example of the repercussion that regulation changes can have on a reduction in injuries and repercussions on the health of the athletes⁵.

In this same regard, it would also be of interest to introduce regulatory changes that would permit a speedier medical intervention in traumatic events in which treating the athlete is a race against time.

On the other hand, in the case of football, the regulatory change in the size and weight of the ball could be a good strategy in reducing the repercussions of impact during ball-heading, particularly for junior players and women's football⁶.

Preventing violence in sport

Competitiveness and aggressiveness are two positive qualities for athletic performance, providing that they do not lead to non-sporting or violent attitudes against the adversary. Violence in sport is frequently manifested in aggressive behaviour towards the opponent, thereby increasing the risk of sports injuries and, in particular, the risk of more serious injuries such as the case of traumatic brain injury.

While the promotion of fair play is important as a positive and educational strategy, of equal importance is the adoption of strict sanctioning measures against violent attitudes of this nature, including such measures in the rules and regulations of the sports in which actions of this type may occur. These measures should not only be directed at athletes but

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also at any team members who encourage this type of violent attitudes and actions⁷.

The transfer of knowledge

The implementation of educational schemes to educate athletes, trainers, fitness coaches and healthcare person in the basic concepts and coordination in emergency situations in the event of a traumatic brain injury is of the utmost importance for the correct care of injured athletes¹.

Likewise, the conveyance of ethical values, values of respect for opponents and fair play, is a key factor in the prevention of sports injuries in general, and for traumatic brain injuries in particular^{1,8}. Furthermore, this educational and formative strategy should not only be directed at athletes but also at their family and social environments. Along these lines, informative videos, supportive websites, dissemination strategies through the social media, can all be very useful and effective tools to achieve this purpose.

Visual-motor-sensory training

One of the most innovative preventive strategies is virtual visual-motor-sensory training. These techniques, which were initially designed for the rehabilitation of patients with brain injuries, are now being implemented for the improvement of athletic performance, having been proven to be effective in traumatic brain injury prevention.

Visual-motor-sensory training is performed through virtual exercises that positively stimulate the neuroplasticity of the brain through vestibular exercises, ocular motor activities, cervical control, and coordination and postural balance movements. The results have shown improve-

ments in movement and balance control, with an effect on an improvement in performance and on traumatic brain injury prevention^{9,10}.

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