

**EYE INJURIES IN SPORTS**

UDC: 796:617.7-001

(Original scientific paper)

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**Abstract**

Nowadays participation in sports and recreational activities is an important part of healthy, physical and active lifestyle. Sports have become increasingly popular and account for numerous eye injuries each year. Sports are classified as high risk, moderate risk, low risk and eye safe. Most of sports-related eye injuries are preventable. The use of eye protection has helped to reduce the number and severity of eye injuries. The American Society for Testing and Materials has established performance standards for selected eyewear. Also education for recognition of the risks of eye injury playing sports of athletes, coaches, trainers and parents can help in prevention of this type of injuries.

**Keywords:** eye injuries, sports, eye protection**Introduction**

The eye injuries have extraordinary meaning, because it is a matter of a single organ, whose parts and specific construction are fitting for the eyesight function. Despite the fact that only 0,27% of the total human body surface and 4% of the face area are contributed to the eyes, they represent the third most affected organ by injuries, after hands and feet (Nordber, 2000, Omolase et al., 2011).

With the increase of popularity of sports and the tendency for a healthy way of life throughout the world, the importance of eye traumatism is also increasing. In different countries of the world, especially the developed ones, one of the leading places are occupied by eye injuries caused by different types of sports (Hoskin et al., 2016).

Every year more than 600,000 people suffer eye injuries while participating in sports or recreational activities, out of which roughly 13,500 result in permanent loss of sight (Mishra and Verma, 2012). Thirty percent of eye injuries, among children younger than 16 years, are sports related (Rodriguez et al., 2003).

The prevalence of specific sport activities varies depending on the country, that is, depends on the customs and culture of the country's citizens (Moon et al., 2016). Football, basketball, cricket, boxing, racquet sports and full contact martial arts are very popular and thus most commonly associated with eye injuries (Kim et al., 2011, Leivo et al., 2015).

Tennis, golf, basketball and various other sports can lead to major eye damage, reduction of visual acuity and sometimes even lead to blindness.

Numerous publications have reported that the type of sport in which the most frequent and severe injuries occur is not the same with different populations and nationalities (Goldstein, 2011, Nemet et al., 2016). In the study MacEwen and McLatchie (2010) have concluded that a small number of sports, such as soccer, rugby, hockey and the racquet sports are responsible for the most occurred injuries. Baseball and basketball have been implicated in most sports eye injuries in the United States, soccer in Portugal, Norway and Israel and soccer or racquet sports in Britain (Capão Filipe et al., 2003). The results, presented in the study of Bar et al. (2000), suggest that football was the single most common sport associated with ocular trauma being responsible for 32,5% of cases. In the United States for an example, the most common eye-injured-causing sports are baseball and softball, racquetball, soccer (European football) and American football (Cass, 2012).

**Sports classification**

American Academy of Pediatrics (AAP) and American Academy of Ophthalmology (AAO) have developed a classification of sports according to the risk of eye injuries (table 1) (Vinger, 2000).

Table 1. Classification of Sports According to the Risk of Eye Injuries, if Protective Means are not Used

| High Risk                       | Moderate Risk | Low Risk                | Eye Safe        |
|---------------------------------|---------------|-------------------------|-----------------|
| Small, fast projectiles         | Tennis        | Swimming                | Track and field |
| Air rifle                       | Badminton     | Diving                  | Gymnastics      |
| BB gun                          | Soccer        | Skiing (snow and water) |                 |
| Paintball                       | Volleyball    | Noncontact martial arts |                 |
| Hard projectiles, close contact | Water polo    | Wrestling               |                 |
| Basketball                      | Football      | Bicycling               |                 |
| Baseball/softball               | Fishing       |                         |                 |
| Cricket                         | Golf          |                         |                 |
| Lacrosse                        |               |                         |                 |
| Hockey (field and ice)          |               |                         |                 |
| Squash                          |               |                         |                 |
| Racquetball                     |               |                         |                 |
| Fencing                         |               |                         |                 |
| Intentional Injury              |               |                         |                 |
| Boxing                          |               |                         |                 |
| Full contact martial arts       |               |                         |                 |

### Eye injury risk in sports

Before playing any given sport, the athlete must know the risks of that sport. Loss of sight, even in one eye, involves changes in lifestyle for the individual and serious financial and social consequences both for the individuals and for the society as a whole (International Federation of Sports Medicine -FIMS, 1989).

Eye examination should play an important part in the screening physical examination for every athlete prior to sports participation. The athlete deserves a careful explanation of the risk of eye injury, both with and without various types of eye protectors in the proposed sport. For each athlete, physicians should obtain an ocular history, paying special attention to prior conditions such as a high degree of myopia, retinal detachment, eye surgery and injury or infection. Athletes with any of these conditions may be at a higher risk for serious eye injury (Jeffers, 1990). It is important to assess athletes who have a strong family history of retinal detachment, retinal tears and diabetic retinopathy (Locke et al., 1997). Athletes with such risk factors should be evaluated by an eye care professional before engaging in any high risk or very high risk sport (Christensen, 1997).

The one-eyed athletes should be checked by an ophthalmologist before participating in any sport.

One-eyed athletes should never participate in a very high risk sports such as boxing, wrestling and full-contact martial arts, because there is no adequate eye protection available for these types of sports.

### Other risk factors

Beginners are more prone to injuries in comparison to intermediate or advance players because beginners still have not learned or refined the necessary skills to master the sport. On the other hand, highly qualified athletes play faster, play with greater aggressiveness and therefore may be at greater risk of sustaining a serious injuries of the eye.

### Basic mechanisms for the occurrence of eye trauma

The basic mechanisms for the occurrence of eye injury during participation in sports are the following:

- The eye can be injured by something sharp – the most common causes are fragments from personal glasses (Herzum et al., 2001), which are not protective glasses designed for sports and are the most probable reason for occurrence of perforative injury,
- An impact from a blunt object, smaller than the opening of the orbit – golf ball, hockey stick, ping-pong ball, golf stick (Jayasundera, 2003), which can even lead to a rupture of the eyeball due to high energy impact on a small area, with a possibly harmful functional result,
- An impact from a blunt object, bigger than the opening of the orbit, such as tennis ball, elbow etc. In the course of impact, a part of the energy is transferred to the soft tissue, bones or the orbit floor, which can become fractured,
- An impact to the skull can be a cause for direct or indirect trauma of the eyeball or sight pathways

with transient or permanent loss of sight. The frontal bone is very sturdy and resistant to blows, three times more in comparison to the zygomatic bone and mandibula. These injuries usually occur during sports such as football (Leivo et al., 2015) and hockey.

In the course of baseball and golf (Jayasundera et al., 2003, Mishra et al., 2014), the density and velocity of the ball can become a reason for severe orbital, ocular or facial trauma (Zagelbaum et al., 1994). The situation is also similar in tennis, where the ball moves at a very high speed, which is why, in some cases, the protective glasses cannot protect the eye.

The most common eye injuries in sports involve closed globe, open globe and radiation injuries.

Closed globe injuries account for most sports related eye injuries. According to Napier et al. (1996), the sport-related eye injuries, although frequent in occurrence, they are rarely serious injuries. In large number of cases, it is related to corneal erosions, lighter contusions and hyphemas. In rare cases, with closed globe injuries, serious results can occur, such as vitreous hemorrhage and retinal ablation, traumatic macular hole or traumatic optic neuropathy (TON) which refers to an acute injury of the optic nerve secondary to trauma.

Open globe injuries are relatively uncommon. This type of injuries are very serious, must be treated quickly because they can lead to total loss of vision and blindness.

Radiation eye injuries occur as a result of prolonged exposure to ultraviolet rays of the sun in snow skiing, water skiing and other water sports.

### **Eye protection**

Up to 90% of sports related eye injuries are preventable by using adequate eye protection equipment (Mishra and Verma, 2012, FIMS, 1989). Eye protection has reduced the number and severity of eye injuries and it is strongly recommended that protective eyewear be worn by all participants in sports which have a risk of eye injury. Athletes should be educated by team physicians about proper eye and facial protection and encouraged to use protective devices.

The American Society for Testing and Materials (ASTM, 2003) has established performance standards for selected eyewear. Each sport has a certain type of recommended protective eyewear, as determined by the ASTM (2003). Protective eyewear is made of polycarbonate, a highly impact-resistant plastic which is now easily available as prescription and non-prescription eyewear and all players should be encouraged to use them (FIMS, 1989). Protective eyewear should also sit comfortably on the face. Poorly fitted equipment may be uncomfortable, and may not offer the best eye protection.

Wearing a helmet or faceguard cannot protect the eyes, because the eyes are still exposed to the opponents fingers or other sport equipment. The face mask may consist of metal wire, coated wire or a transparent polycarbonated shields.

Face masks attached to a helmet should be used in sports such as hockey, football, baseball and lacrosse. In these sports, athletes must wear eye protectors under the face mask.

Athletes who are functionally one-eyed must have their status diagnosed and wear appropriate eye protection. If a one-eyed person decides to participate in a particular sport, then they should wear maximum protection for all trainings and competitions.

### **Conclusion**

Sports and recreational activities have become increasingly popular and an important part of healthy, physical and active lifestyle.

Eye injuries in sports can cause severe and permanent visual loss. Because up to 90% of sports related eye injuries are preventable. All participants in sport activities must wear adequate eye protection equipment.

Education for recognition of the risks of eye injury, while playing sports, for athletes, coaches, trainers and parents, can also help in prevention of this type of injury.

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