Research in Physical Education, Sport and Health
2020, Vol. 9, No. 2, pp.107-110
ISSN(Print):1857-8152; ISSN(Online):1857-8160

PREVENTION OF EYE INJURIES IN SPORTS

DOI: https://doi.org/10.46733/PESH20920107gd
(Original scientific paper)

Emilija Gjoshevska Dashtevska, Maja Ivanova
University Clinic for Eye Diseases,
Faculty of Medicine, Ss.Cyril and Methodius University, Skopje, Republic of North Macedonia

Abstract

In recent decades, sports have become increasingly popular both professionally and as a hobby among the young population, and each year a large part of eye injuries are due to them. In the past, due to lack of protection, many of the eye injuries caused by sports ended in vision loss and blindness. Prevention plays a key role in the severity of the injury and the incidence. More than 90% of sports injuries to the eyes are preventable. Because of the different elements in different sports and different energy transfer at impact, it is impossible to make the same universal protectors for the eyes, which would fitto all kinds of sports. Eye protection for every sport should be considered separately. American Society for Testing and Materials (ASTM) has developed standards for protective eyewear in various sports. Adoption of legislation and legal acts regarding sports protection, as well as the introduction of a register for recording injuries, are some of the key measures that have proven to be effective in improving prevention and improving protective equipment. On the other hand, it is necessary to educate coaches, athletes, children and the population about the incidence of this type of injury and how to protect themselves from it. By using appropriate eye protection, the frequency of this type of medical problemwill be set to minimum, and as a result, people will have lower financial expenditures.

Key words: *prevention, eye injuries, sports, eye protection*

Introduction

Over the years, different types of sports have become very popular, and each year, many eye injuries are caused bythem.Here are the sports among which ocular injuries are most frequent, listed in decreasing order: basketball, water sports, baseball and racket sports. They are divided into: low-risk sports, high-risk and very high-risk sports. There are about 40,000 eye injuries caused in sports in the United States each year, 90 percent of which are thought to be preventable.

Baseball is the most common cause in children aged 5 to 14, while basketball is the most common cause in adults aged 15 to 64. According to the American Medical Association, sports are divided into: conflict sports (American rugby, rugby, hockey), contact sports (football, basketball, wrestling), contactless (cross-running, racing, tennis, swimming) and others (bowling, archery, golf). (Rodrigues et al., 2003).

High-risk sports are considered to be those sports where balls are used, where there is contact, where a racket or a stick is used, and this includes rugby, wrestling, tennis, golf, water polo. Very high risk: boxing, wrestling and martial arts, i.e. those that do not typically wear eye protectors. Swimming, gymnastics and cycling are at low risk. (Jeffers et al., 1990)

The incidence of eye injuries caused by different types of sports varies from country to country. This is due to various factors, primarily - social culture, legislative acts regarding mandatory protection measures, different levels of education of coaches, players and parents, and of course the different popularization of certain sports in different countries. (Dashtevska, 2018)

For example, in a study conducted in Scotland, the incidence of ocular injuries in sports is 12.5% of the total number of injuries, of which 47.5% are from racket sports and as an isolated sport rugby is in first place with 32.5%.

About 90 percent of eye injuries are actually preventable. The mechanism of injury is: blunt trauma, penetrating injury, chemical burns, and radiation exposure. It is most often a blunt trauma to the eye, and the most common clinical sign of these injuries is a hyphema in 87. 5%. (Barr et al., 2000) (Yu et al., 2020)

Types of protective eyewear in sports

The American Society for Testing and Materials (ASTM) has developed standards for goggles in sports that include racket, baseball, basketball, lacrosse, hockey and alpine skiing. Protective glasses are usually made of polycarbonate, a highly resistant plastic that absorbs ultraviolet rays. This plastic is the material of choice because it is eight times more durable than other materials. These glasses can also be made according to a prescription with the appropriate diopter. (Napier et al., 1996)

There are four types of protective glasses. Of these, two types are suitable for risky sports:

1. Protective sports goggles that meet the standards of the American National Standards Institute (ANSI) standard F803. The ASTM F803 standard includes certain sports: racket, baseball, basketball, women's lacrosse, field hockey and football
2. Sports goggles attached to a helmet or for sports in which ASTM F803 glasses are inappropriate. Standard specifications for such glasses are for young baseball players and base runners (ASTM F910), MacBasket (ASTM 1776), skiing (ASTM 659) and ice hockey (ASTM F513). Also, protectors with specific standards are available for football and men's lacrosse.
3. Protective glasses that are considered inappropriate are:
4. Glasses with ordinary everyday frames that meet the standards of ANSI (American National Standards Institute) Z80.3.
5. Protective goggles that meet the standards of ANSI Z87.1. with specific features, explained in the following text.

The glasses are made of 2 mm thick polycarbonate plastic lenses built into ordinary everyday glasses (for athletes who need refraction correction and belong to the group of low risk sports) or sports frames with 3 mm thick polycarbonate lenses (for athletes participating in medium to high risk sports).

Eye protection should have athletes who wear contact lenses and those that do not require correction of refraction. Athletes with refractive error should wear polycarbonate lenses with a prescribed diopter.

These glasses require a solid sports frame that meets the standards for impact resistance (i.e. ASTM F803-01).

Eye protectors whichdo not have adequate lens donot pass these standards.

Face mask attached to the helmet can be used in sports such as hockey, football, baseball and lacrosse. (Rodrigues et al., 2003) (Classe, 1996)

Seven lenses that meet Z80 (ANSI) standards for everyday glasses have been tested for impact resistance of 5 missiles (air pistols, golf balls, tennis balls, lacrosse balls and baseball), made of high-index plastic, allyl resistant plastic, thermal tempered glass, chemically tempered glass and polycarbonate with a central thickness of 1 to 2.2 mmand 4 lenses that meet ANSI Z87 standards for industrial safety goggles (allyl resistant plastic, thermal tempered glass, chemically tempered glass and polycarbonate with a central thickness of 3 mm). (Vinger et al., 1997)

Recommended types of protective aids for face and eyes in different types of sports

Face masks first appeared in the Canadian Ice Hockey in 1976.With the introduction of protectors and rules against holding the stick high,injuries to the eyes leading to blindness are reducedin the next few years. In contrast, in 1974 and 1975, out of 258 injuries, 43 ended in blindness. From this we can conclude that prevention plays a big role in both the severity of the injury and the incidence. (Yan, 2020) (Black et al., 2017).

Each sport should be considered separately. The introduction of eye protectors requires them to be comfortable, not to compromise the field of view, to be resistant and, of course, to match the outfit of the athletes. (Yan, 2020)

Protective goggles that have a sufficiently large frame and are made of resistant material are needed. On the other hand, they should be with UV protection (according to ISO standards up to 380 nanometers). (Yan, 2020)

Due to the different elements in different sports and the different energy transfer per stroke, it is impossible to make a protector that will suit all sports.

American rugby, basketball, rugby, tennis and other racket sports show attain the best results with polyacrylate glasses. The protection of baseball or softball players depends on their position and contact with the ball.

For example, catchers may use polycarbonate or face protectors made of wire embedded in the helmet, while field players should wear sports glasses with polycarbonate lenses. (Committee on Sports Medicine and Fitness, 2004)

The same goes for outdoor hockey, while ice hockey players must wear helmets with complete face protection. American football requires resilient helmets protectors and glasses should be embedded in the mask which is constructed of wire.

Lacrosse energy is transmitted in the same way as baseball, so it requires complete protection, sports glasses with polycarbonate lenses or wire protection.

Complete protection is also required for a paintball because low-mass but high-speed missiles are used.

Skiers and other winter sports require protection from UV radiation and objects from the environment (wood, stone) because of high speed movement.For water sports, glasses are used that provide both protection and better visualization. (Committee on Sports Medicine and Fitness, 2004)

Table 1. Appropriate protection for different sports according to appropriate standards.

Basketball	Eye protection that meets ASTM F803
Hockey	Outdoor hockey: eye protection that meetsASTM 2713. Ice hockey: eye protection with ASTM F513, Goaltenders ASTM F1587
American rugby	Helmet with face mask, polycarbonate shell and sports glasses
Skiing	Glasses that meetsASTM * F659. 12801.
Baseball	Grippers: helmet and face protector that meets NOCSAE ** ND 024.
Sports with racket (tennis, squash, rocketball)	Eye protection that meets ASTM F3 164

* American Society for Testing and Materials

** National Operating Committee on Standards for Athletic Equipment (Yan, 2020)

Preventive measures for sports eye injuries

Measures aimed at preventing eye injuries are regulated differently in different countries around the world. Adoption of legislations for sports protection should be one of the measures that has proven to be very successful over the years. On the other hand, it is necessary to educate coaches, athletes, children and the population about the incidence of injuries and ways to protect themselves, because appropriate eye protection lowers the frequency of ocular trauma. (Yan, 2020)

An interesting example that highlights the importance of legislation and the imposition of the use of goggles is shown in a study of the Scandinavian sports florbol. Similar to hockey, it is played with a small plastic ball and plastic sticks, with a ball speed of up to 200 km per hour. In Sweden, it is recommended, but not mandatory, to wear goggles for adults who play florbol, unlike Finland, where it is mandatory for adults to wear glasses. Between 2008 and 2011, the estimated incidence of eye injuries related to florbol in Sweden was double that of Finland. Similarly in the United States, the incidence of eye injuries associated with the field hockey has been reduced by 84% after glasses were introduced as a charge in 2010. (Bro, Chost, 2016) (Dain, 2017) (Helmy, Hamza, 2016)

The effectiveness of polycarbonate protectors has been provenin the past in combat.Although eye injuries have declined since the 19th century (when they were 1.76 percent in the Crimean War and 6.8 percent in the war in Lebanon), there has been no eye damage in the Israeli war because soldiers have provided adequate protection. The experience is the same today in sports such as ice hockey, rocketball and squash, as well as paintball and war games. (Kuhn, Piearamici, 2002)

There are different types of effective and appropriate glasses that are available to the public, which do not get foggy when used and do not affect peripheral vision. Ordinary glasses are not only not a good protection, but can also be a bigger problem due to the breaking of the glass under impact. (Kuhn, Piearamici, 2002)

The United States Eye Injury Registry (USEIR) says injuries are probably the most unrecognized health problem facing the nation. The study of injuries presents the incomparable possibilities for reducing morbidity and thus realizing savings both financially and humanly. According to them, such a systematic collection and publication of data can help primarily ophthalmologists who play a key role, on the other

hand to help other countries by demonstrating the effectiveness of legal legislation in the countries in which it operates. (Kuhn, Piearamici, 2002)

United State Eye Injury Register (USEIR) is the largest database for eye injuries. In our country there is no national register of eye injuries. The need for such a register of injuries is necessary. It would help us not only in terms of epidemiology, such as the incidence and types of injuries, but also in terms of prevention, whether and to what extent protection is used in sports and what measures and new aids could be introduced further. Special attention in terms of protection should be given to the athletes who already have reduced vision in one eye. If the visual acuity is less than 20/40 in the weaker eye, it is considered a monocular vision.

According to the American Society for Testing and Materials (ASTM), all monocular athletes should wear protectors in all games of medium and high risk. These athletes, especially children, must undergo an ophthalmological examination before sports activity. It is also recommended to avoid high-risk sports, such as boxing and martial arts, where eye protectors cannot be worn. The ophthalmologist should also inform parents and coaches about the potential risk of that sport. (Wichmann et al., 1992)

Conclusion

Sports eye injuries are common. It is most often a blunt trauma to the eye with bleeding in the anterior chamber, which occurs due to a direct hit with a ball or a collision between the players. Most of the eye injuries that occur during sports, according to studies, are preventable. What is missing in some countries, including ours, is the introduction of legal legislation and a register of eye injuries, which will be very important for epidemiological data. Education should be directed towards trainers and professional athletes, towards children who are starting to engage in a particular sport, to their parents and to recreational athletes. The role of prevention in all levels of health care is indisputable, especially in the field of ophthalmology, where it is a very sensitive organ and where a seemingly insignificant injury can end in permanent vision reduction and complete blindness.

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